Smart Metering in Latin America

A Decade of Opportunities

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Introduction: The Case for Modern Smart Electricity Metering in Latin America

Solving the energy challenges

Over the past two decades, smart meter deployments around the world have delivered sizeable benefits for the electricity supply chain and the wider power system, including consumers. Among other things, smart metering has enabled:

Improvements in the quality and reliability of supply through better visibility and more effective monitoring of the LV grid, leading to more efficient network management and quicker outage detection and response

Better overall efficiency of supply through more effective load profiling, better visibility of technical losses, automation of and error reduction in the meter-to-cash process

Fairer access to electricity by limiting losses, particularly non-technical, which inflate the cost of energy for all paying consumers, for example through consumption analytics and tamper detection

Enabling tomorrow's power system

The push toward greater energy efficiency, decarbonization, and electrification, along with climate change, are leading to a paradigm change in power systems — one where grids must actively contribute to system stability and flexibility, orchestrating more intermittent supply, distributed generation, and more active consumption.

Modern smart metering technology enables utilities to leapfrog the traditional "meter-to-cash" model in favor of a new-generation approach. In this new paradigm, smart meters become intelligent grid-edge devices and work as gateways to behind-the-meter resources, enabling active market participation of consumers and prosumers.

Modern smart meters also enable new real-time business and operating models for utilities, enabling:

- **Product (e.g., prepayment, dynamic tariffs) and service innovation**, from overload management to net-metering and behind-the-meter optimization for prosumers and multitariff customers
- **Better customer experience and control** with real-time tariff transparency, usage tracking, load disaggregation and customer engagement (e.g., high-bill alerts, personalized saving advice)
- **Improved network planning**, enabling up-to-the-minute load profiling and demand forecasting, load and DER detection, understanding of grid asset loading and hosting capacity
- **Access to, aggregation of behind-the-meter flexibility** for load and demand management, from demand response to direct load control

Finally, as bidirectional flows of data and energy become prevalent, it is imperative for utilities to leverage smart grid technology that provides the highest cybersecurity standards as well as system redundancy.

Future-proofing Latin American systems

The characteristics and projected evolution of LAC power systems make smart grids and smart meters both a necessity and an opportunity for the region. As they start larger-scale deployments, LAC utilities stand to fully capture the benefits described above, enabling more reliable and fairer energy supply while accelerating the energy transition by going beyond traditional metering.

This IDC InfoBrief analyzes the case for modern smart metering in the region by:

- Providing a **snapshot of the LAC electricity system**, its challenges, and future evolution
- Outlining the **drivers and opportunities for smart grids and meters** in the region, including an overview of major pilots and deployments with a focus on Argentina, Brazil, Chile, and Colombia
- **Considering the Meters and More standard** and more generally PLC-based smart metering as a valuable element of the smart grid technology mix for LAC electric utilities

SECTION **1**

Snapshot of Power System Trends in Latin America and the Caribbean

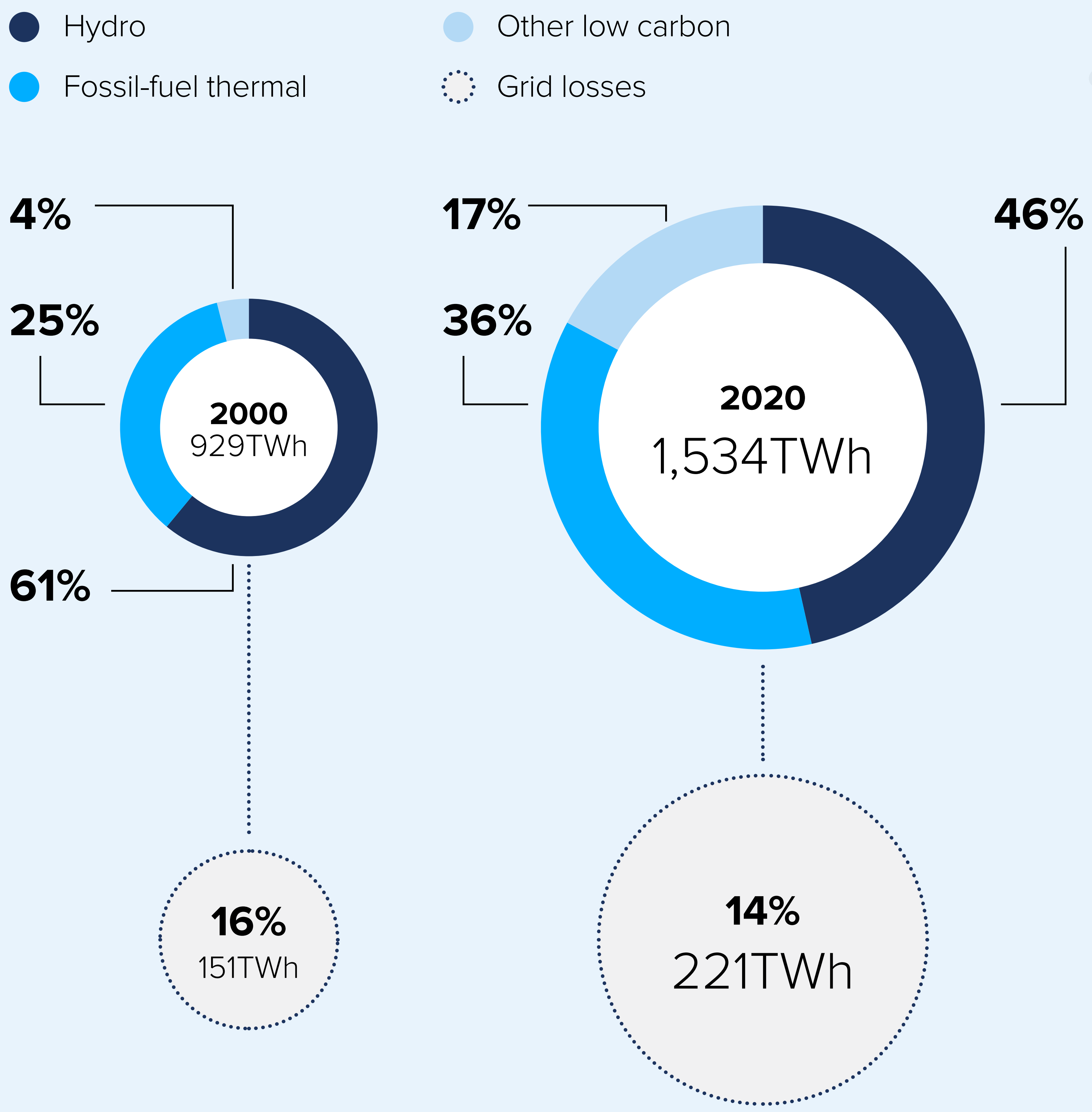
An Evolving Energy System

A region in transition supported by a stable renewable mix

Despite two decades of volatile economic growth and slowing demography, electricity consumption grew by more than 68% in LAC between 2000 and 2020, reaching 1,312TWh, or 6% of the world's total. At 2,029kWh, annual per capita electricity consumption is lower than in other emerging regions and has headroom for growth.

Extensive natural resources, coupled with relatively lower demand growth, have helped LAC avoid the fossil-fuel dependency of other emerging regions. LAC's hydroelectric tradition, use of biomass and wind, and solar energy potential have helped the region keep its green generation mix relatively stable since 2000, and in fact improve it over the past decade, despite growing gas-fired generation. In 2020, low-carbon sources accounted for 64% of LAC's generation mix (61% excluding nuclear), the second cleanest power mix in the world after Europe. This, however, hides considerable differences among subregions and countries, with fossil thermal generation accounting for as low as 14% of the mix in Brazil and as high as 72% in Mexico, LAC's two largest power markets.

Evolution of power generation by source and grid losses in LAC



Long plagued by inefficiencies

Despite substantial improvements since 2000, LAC still faces challenges in ensuring basic energy access for the entire population, as well as meeting energy demand with affordable prices and quality of supply. This is being exacerbated by the climate challenges some countries are facing.

Electricity access has leapt from 89% in 2000 to 97% of the population in 2020, but the figure masks profound differences among subregions, countries, and social groups.

The energy intensity of GDP is decreasing, a sign of improving energy efficiency. At 780 BOE/$M GDP in 2019, LAC is one of the world's least intensive regions by final energy consumption. At the same time, despite efforts by governments and utilities, LAC has suffered from persistently large power transmission and distribution losses since the 1990s. At 14% in 2020, grid losses in LAC were higher than in most emerging regions and enough to power an estimated 3.2 million households. Once again, profound differences hide behind the regional average, from Brazil's 17% to Chile's 5%.

As per capita consumption increases, it is imperative utilities provide access to affordable electricity by reducing losses, which inflate the cost of energy for paying consumers.

An Energy Transition Powerhouse

Working toward sustainable growth

Emerging markets will account for the bulk of global electricity demand growth in coming decades. LAC is no exception, fueled by demand for cooling, cleaner cooking, electrification of transportation and industrial loads, and growing ownership of electric appliances.

While LAC only accounts for around 5% of world emissions, many countries have committed to achieving carbon neutrality by 2050. In a net-zero scenario, LAC electricity demand is projected to grow by more than 84% through 2040 with generation capacity to almost double, to 868GW.

Supported by an energy transition powerhouse

With its abundant natural resources, LAC is positioned to take full advantage of the energy transition. Renewables are the cheapest source of new electricity in most of the region and non-conventional sources have great potential for further development. Argentina, Bolivia, Chile, Mexico, and Peru enjoy some of the world's highest levels of solar radiation, while certain regions of Argentina, Chile, and Uruguay boast significant wind speeds.

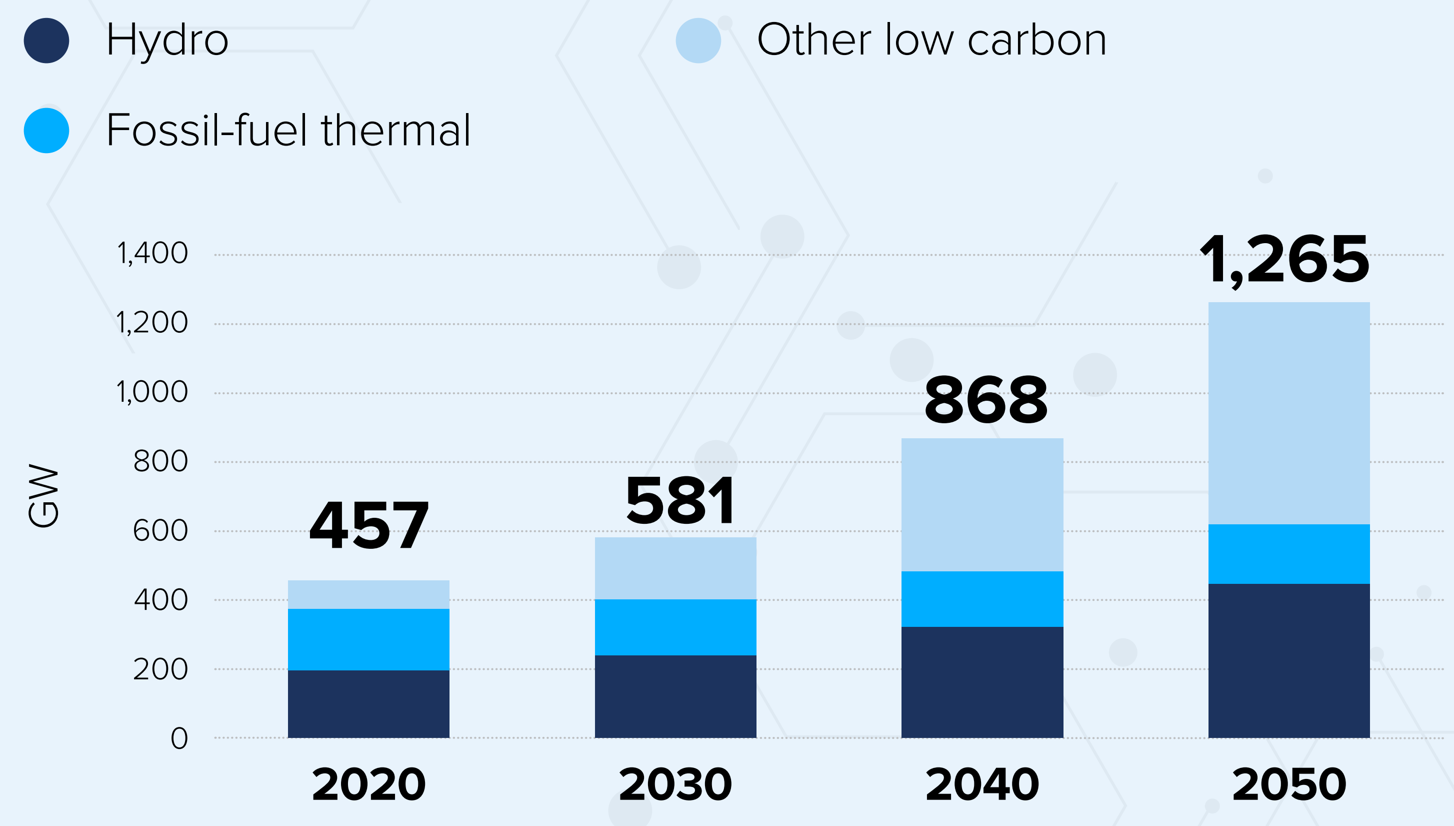
Many countries in the region are actively decarbonizing their energy sectors. Governments in Latin America were among the first to run capacity auctions to provide incentives for renewable deployment, led by Brazil in 2005.

RELAC (a government initiative launched in 2019 by 15 LAC countries) has set a target of at least 70% renewables in the region's electricity mix by 2030.

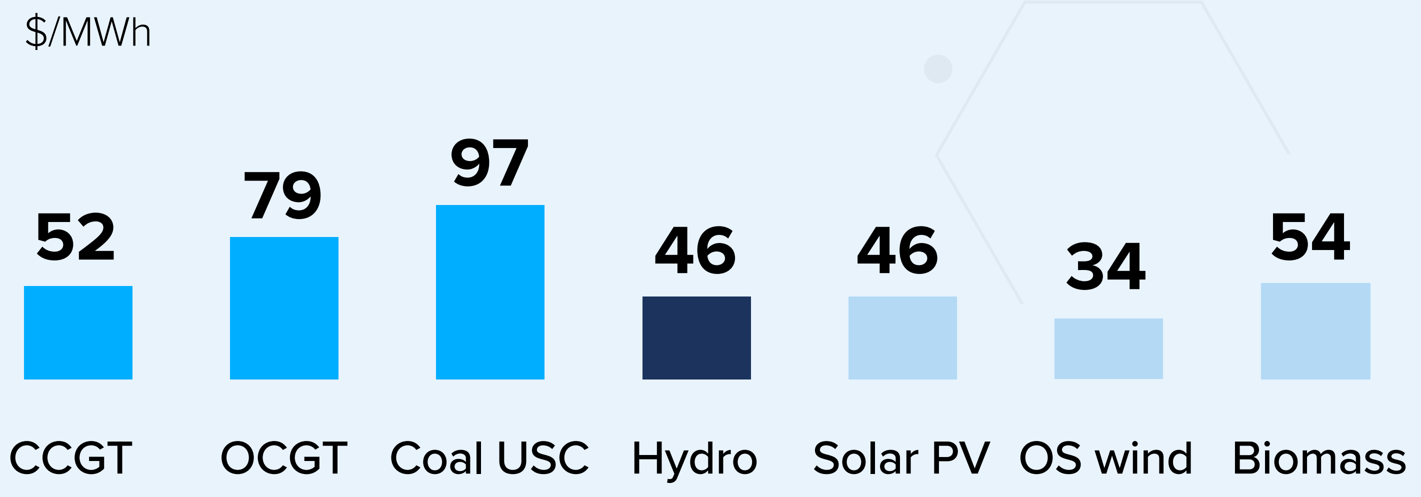
This transition is advancing at good pace. Over the past decade, more than 64GW of non-conventional renewables were installed (99% of which were solar PV, wind, and biomass). More than 11GW was installed in 2020 alone, while 18GW of net conventional thermal capacity was retired, confirming the strong decarbonization drive.

LAC is also home to the world's largest copper and lithium reserves, critical elements for emobility and battery storage. Green hydrogen is also a significant opportunity for the region, with Mexico, Colombia, Chile, and Brazil all potential large-scale producers in the future.

Generation capacity by source in LAC in a net-zero scenario

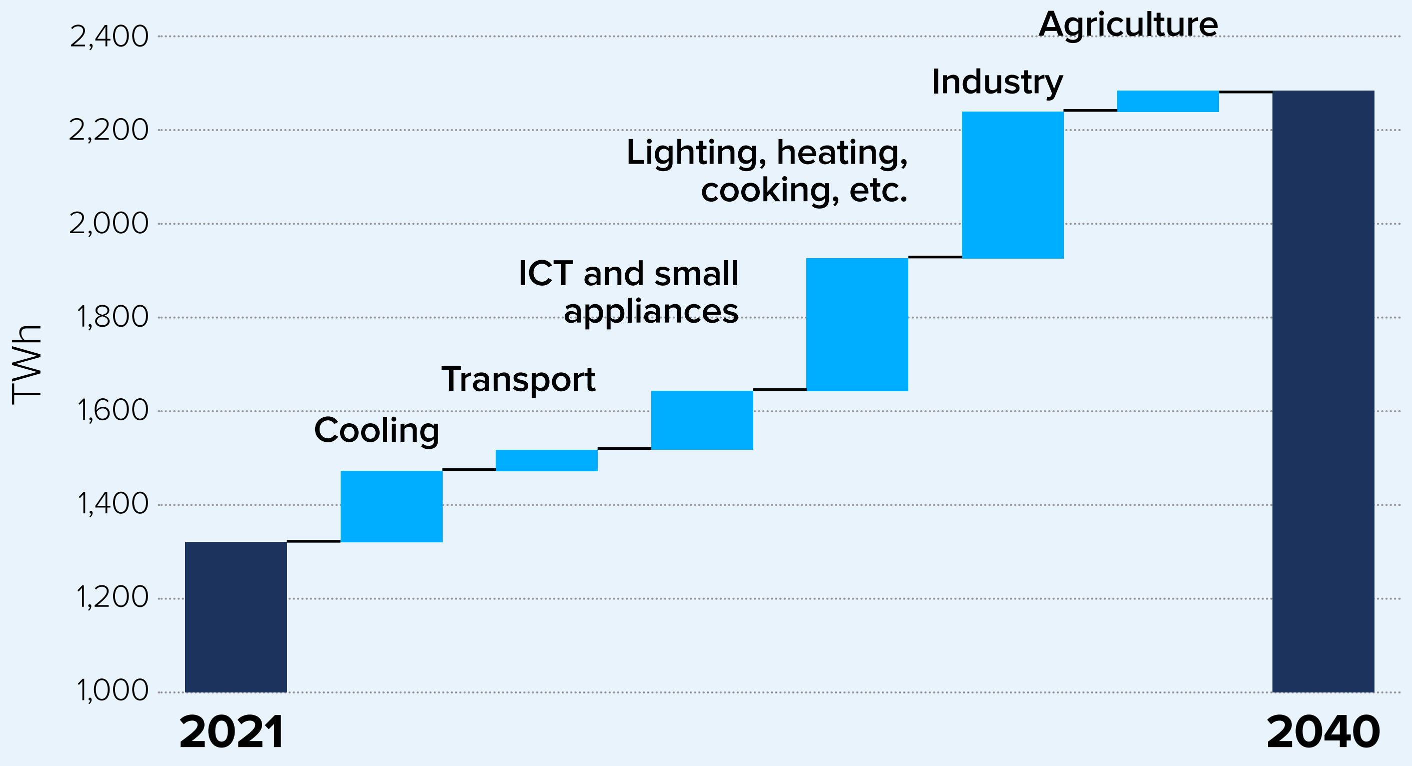


Levelized cost of electricity for different generation technologies in Brazil



Old and New Challenges on the Horizon

Contribution to projected electricity demand growth in LAC



Keeping up with electrification and DERs

LAC's distribution grids will need to keep up with new sources of electricity demand and growing distributed resources. New non-industrial loads alone — including for heating, cooling, lighting, new appliances, and EVs — will expand electricity demand by 45% through 2040. For cooling, AC units are projected to grow by 7% per year, from 90 million in 2020 to 320 million in 2040.

As demand picks up, so will consumer interest in distributed generation. Since 2015, spurred by the shrinking cost of solar PV, small-scale distributed generation has also taken its first steps in LAC and now net-metering and net-billing schemes are available in major markets. While definitions vary by country, there was an estimated 9GW of distributed generation capacity in LAC at the end of 2020, with Brazil, Mexico, and Chile leading growth.

Grid digitization, energy efficient technologies, customer engagement, and demand management can help ensure a reliable and affordable electrification process that doesn't strain the system, while maximizing the potential for distributed generation.

And a more stochastic generation mix

With wind and solar accounting for up to 70% of net capacity additions until 2030 in the RELAC scenario, LAC power systems need to become more flexible and integrated in the next few years.

Power grids need to keep pace with the generation mix evolving away from traditional dispatchable resources and toward more intermittent ones. New transmission capacity and interconnectors must be deployed to balance subregional systems with an increasingly diverse generation mix. Argentina, Chile, and Colombia, among others, are facing transmission bottlenecks and must invest in capacity to expand renewable generation.

Fending off the climate threat

Diversification, system flexibility, and integration can also help LAC deal with climate change. Changing rainfall patterns are worsening the impact of periodic droughts that dry up reservoirs in LAC's hydro-based power systems. In 2021, the Southern Cone faced the worst drought in a century, forcing an increase in thermal power output, with an impact on prices and emissions.

Attracting investment

According to LAC's energy leaders, the energy transition will require three to five times the current level of investment. RELAC alone requires investment in renewables to grow by an estimated 47% compared with the business-as-usual scenario.

To be successful, LAC needs regulatory stability and convergence to attract private capital by reducing uncertainty and perceived risk. It also needs support from international agencies as well as technology and expertise from countries that are further ahead in the energy transition journey.

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SECTION **2**

Drivers and Opportunities for Smart Electricity Grids and Smart Metering in Latin America and the Caribbean

Smart Grids as a Platform for the Energy Transition

Energy transition and the smart grid

The energy transition is changing the way electricity is produced and consumed across LAC. Making this transition efficient requires the system to become more reliable, flexible, and resilient.

With smart meters as their cornerstone, modern, smart distribution grids are the backbone of this transformation. They enable more reliable supply, more efficient consumption, and deeper electrification, integrating most new renewable capacity and supporting the creation of new services for consumers. This means recording consumption in short-term intervals, enabling remote measurement and remote control of equipment, dealing with bidirectional electricity flows, and managing DERs.

In its broadest sense, a modern smart grid is:

- **Decarbonized:** able to host growing amounts of variable renewables in the system
- **Distributed:** able to manage new loads and DERs, including electrified transportation, heat, and industrial loads
- **Digital:** leveraging smart technologies for measurement, control, settlement, and billing, as well as marketing and customer engagement
- **Democratized:** enabling active consumers to participate in the market and exchange energy

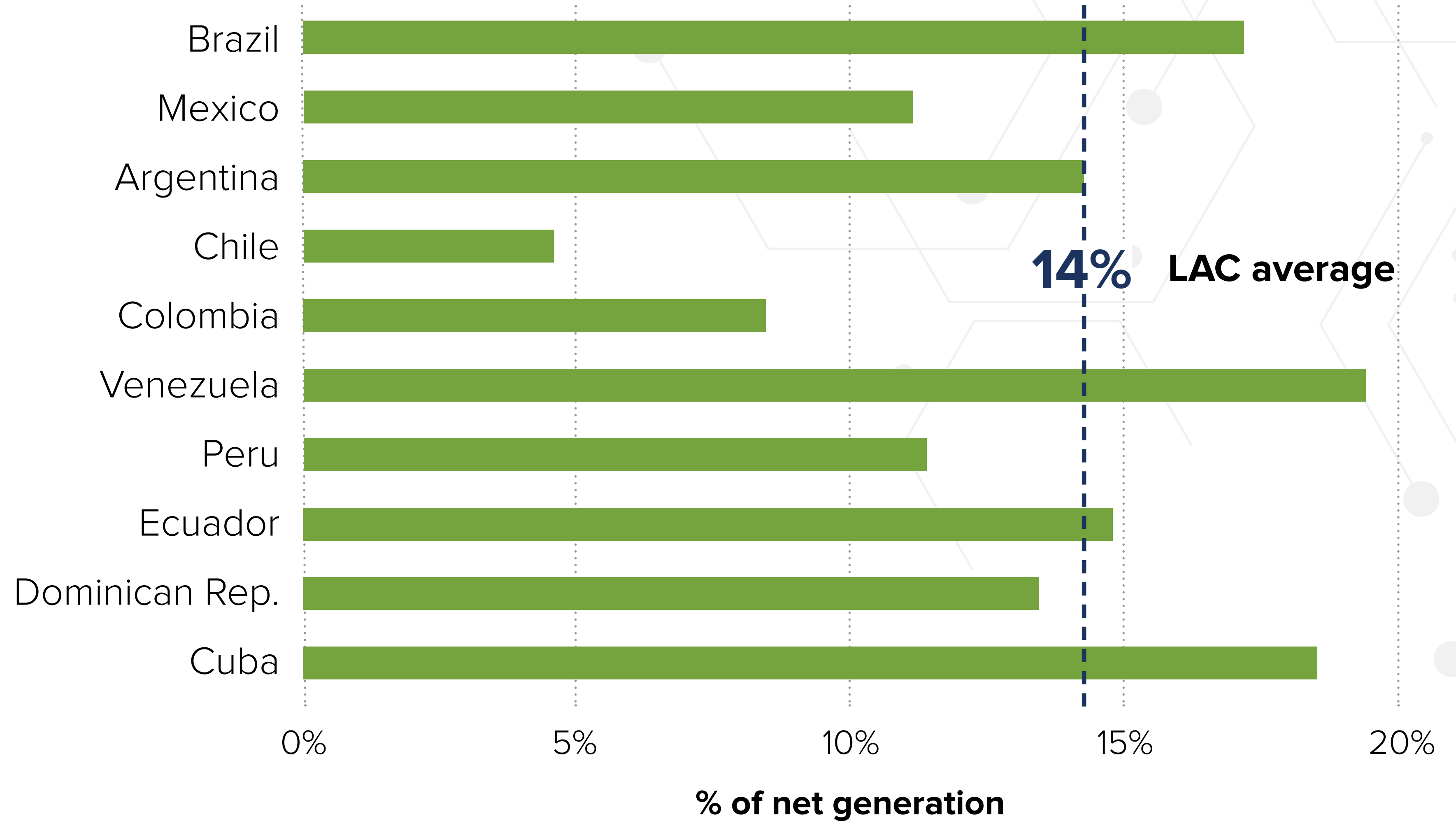
As the entity responsible for delivering such a grid cost effectively, the DSO of the future in LAC is no longer a mere infrastructure operator or regulated supplier, but a platform for the energy transition and facilitator of emerging business models.

Meeting demand reliably and affordably

As mentioned in Section 1, LAC still struggles to meet energy demand reliably and affordably. With investment lagging for many years, several distributors in the region need to improve technical and commercial energy losses and enhance service quality and reliability. While most countries have seen improvements after the market reforms of the 1990s, these have in some cases stagnated or even been reversed after the early 2000s, sometimes as a result of expanded electricity access in rural areas.

The answer to meeting these challenges lies not only in generating more energy, but also in more effective grid control and more efficient energy management. The smart grid is the go-to paradigm for this, enabling real-time monitoring of grid conditions. Smart meters improve visibility into the LV network, helping detect outages and triangulate root cause quicker, limiting the impact on affected customers, improving reliability indicators (e.g., SAIDI, SAIFI) and customer satisfaction, and minimizing losses.

Total grid losses in LAC's top 10 electricity markets by final consumption in 2020



Supporting Better Reliability, Affordability, and Efficiency ...

The potential impact of smart meters and network automation on grid losses and service quality alone is a formidable driver of smart grid deployment in LAC. In São Paulo, for example, Neoenergia expects to improve service quality by 40%, with smart meters helping it to cut fault response times from hours to minutes.

SAIDI (hours/year) and SAIFI (number/year) indicators for best and worst performing markets in LAC in 2020

Best performers	SAIDI	SAIFI
Costa Rica	0.5	0.2
Santa Lucia	0.2	0.3
Dominica	0.6	0.3
Mexico — Monterrey	0.4	0.4
Mexico — Mexico City	0.6	0.9
Chile	2.9	1.5
Peru	6.4	1.7
Worst performers		
Jamaica	27.1	10.7
Belize	14.2	13.8
Argentina	4.5	14.4
Paraguay	21.9	22.8
Honduras	32.5	23.4
Nicaragua	93.6	45.7
Guyana	113	106

Energy conservation, efficiency, demand response, and other DERs can further reduce technical losses and defer or replace infrastructure investments, further reducing the overall system cost of electrification and therefore consumer bills.

Modern smart meters can also help improve customer experience and monitoring loads and help consumers better understand usage and spending. This enables utilities to foster cost-efficient consumption, through TOU tariffs, price signals, or prepayment. It also enables real-time digital customer engagement, e.g., through load disaggregation, proactive alerts, and personalized usage and savings advice.

Operating more efficiently

Smart meters also make distribution and customer operations more efficient. They automate and reduce errors in the meter-to-cash process and reduce or eliminate the need for utility personnel to manually read meters, find faults, or connect and disconnect customers. In some disadvantaged urban areas of LAC, this also represents a significant safety improvement, reducing staff exposure to conflict situations. Also, with the region's significant rural and semi-urban population, remote metering can help cut windshield time substantially for field technicians.

Meeting growing demand sustainably

As mentioned, the need to decarbonize power generation and deal with climate change means LAC power systems must diversify and become increasingly flexible and integrated. With wind and solar PV projected to account for three-quarters of the generation capacity expansion until 2040 in a net-zero scenario, balancing the intermittency of such resources will be crucial. Similarly crucial will be mitigating the fluctuations in energy cost caused on one hand by the periodic scarcity of LAC's main hydro resources and on the other by fuel price volatility in more thermal-intensive systems.

Beyond metering: enabling active customer participation

Modern smart meters are intelligent grid-edge devices and gateways to behind-the-meter resources. They can help consumers automatically optimize usage based on tariff and self-generation, and system operators rely on consumers to reduce or shift demand and contribute to system flexibility. Besides the obvious impact on LAC's emissions, this can pay significant dividends in terms of lower energy cost and better security.

… While Boosting Sustainability and Market Participation

Brazil has used extraordinary energy efficiency and demand flexibility programs since 2001 to help its power system cope with periods of low hydro reservoir levels. In 2016, Colombia implemented a two-month program to reduce demand during an El Niño event. In both cases, penalties and rewards were used to curb demand across sectors.

While some efficiencies can be sustained, such emergency programs are blunt instruments rather than structural solutions and can carry significant economic costs. The ability to industrialize and deploy these measures more rapidly and cheaply through modern smart meter technology is very attractive for LAC in the context of its changing climate patterns and diversifying generation mix.

Additionally, smart meters enable efficiency and flexibility programs to focus on measured rather than estimated savings, which is important where data on time and locational consumption patterns are aggregated to provide measurable and predictable resources to the system.

Managing prosumers and DERs

As mentioned, smart metering technology and policies can be used to convert immediate energy savings into structural improvements that benefit LAC consumers, improving energy affordability, in addition to reducing the system's carbon intensity. This is especially relevant considering some of the longer-term trends highlighted in Section 1, including accelerating distributed generation, growing electrification of energy loads, and take-up of DERs beyond demand response.

Brazil has become the largest distributed generation market over the past five years, streaming past the 10GW mark in 2022, thanks to an appealing regulatory framework. Regulator Aneel expects this total to reach between 27GW and 47GW (depending on the size of incentives) by 2031. Mexico and Chile are also growing at pace, with more than 3GW of combined distributed capacity in 2021. Overall, the top 3 markets grew by almost 80% per year over the past five years. Among the obstacles holding back the rest of the market are a lack of solid regulation, difficult access to financing, inflexible grids, and inadequate investment cases (e.g., prosumer payment, renewable communities).

Growing penetration of distributed generation in the largest markets and eventually in the rest of LAC will lead to greater complexity, which could translate into higher costs if not addressed.

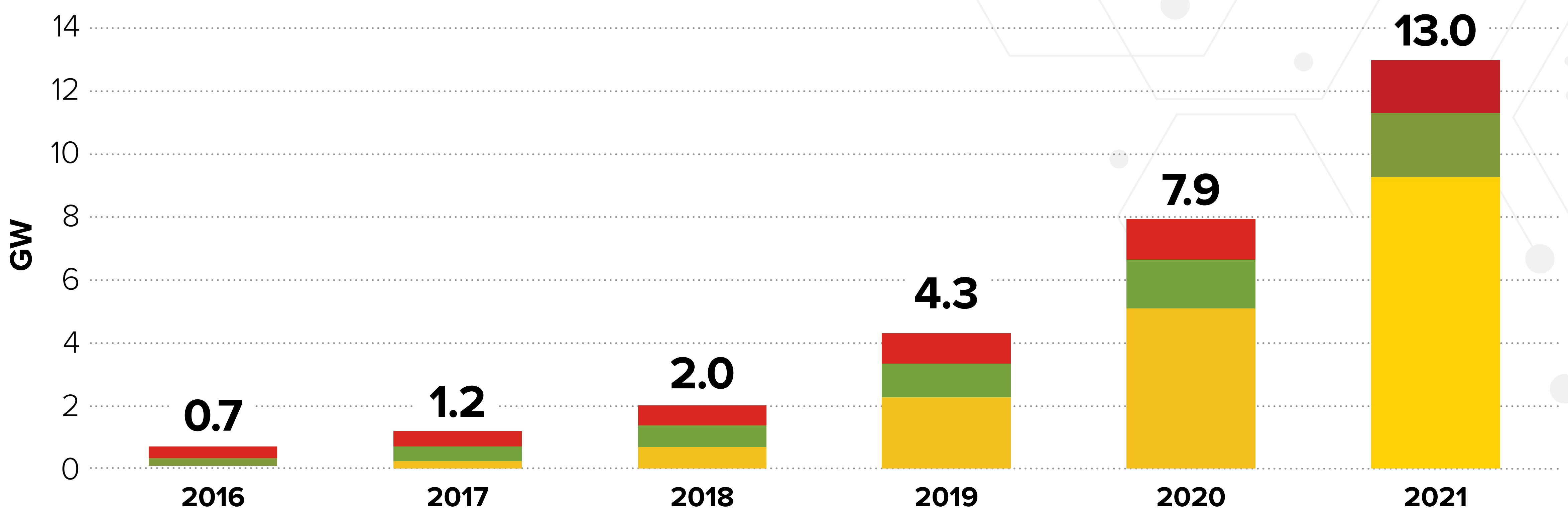
LAC distributors are looking at three alternatives to cope with growing prosumer penetration:

- Development of a comprehensive **demand response** market
- Use of **battery storage** systems and other DERs
- Expansion of distributor responsibility to the operation of **new markets for DERs**

Grid sensing, automation, and smart meter data are structural elements of all these models, helping to improve profiling, understand hosting capacity, and improve network planning, besides controlling voltage and monitoring asset loading.

Distributed generation in LAC's top 3 markets

- Chile
- Mexico
- Brazil



Progress Toward Smarter Grids: Smart Metering 1/3

In Brazil's Minas Gerais, for example, CEMIG is using smart meter data and weather data to forecast prosumer production to deal with asset loading and anticipate congestion problems.

Helping to secure the grid

As bidirectional flows of data and energy become prevalent, modern smart meter technology provides vital endpoint security and data encryption to help secure the expanding IT perimeter of the smart grid. With PLC-based technology standards, this adds to complete DSO ownership of the communication medium, as well as a systemic, redundant security and backup channel for the system.

Smart meter targets, pilots, and rollouts

Long considered too expensive by DSOs, the investment case for smart meters has significantly improved in LAC over the past decade. This is driven by use case maturity and operators refocusing on service quality and efficiency after years of underinvestment, as well as billing accuracy and customer satisfaction. The new and emerging trends outlined in previous sections (e.g., evolving generation mix, growing distributed generation, climate change, prospective electrification) are further improving the investment case for LAC DSOs. Additionally, after years of political instability, some LAC regulators have reached a degree of alignment on minimum smart meter requirements, making the region more appealing for device manufacturers.

Brazil, for example, started its first pilots around a decade ago, enabling utilities and regulators to accumulate experience. Others, such as Argentina and Uruguay, activated smart grid pilots around 2014. Overall, the first full-scale deployments started to appear 6–7 years ago.

While several pilots and rollout projects are underway, less than 10% of customers were estimated to be equipped with AMI in several of the LAC's major markets as of 2020. Estimates published the same year projected the investment of LAC distributors in smart metering at more than $18 billion for the current decade. More recent projections put total smart meters deployed in LAC by 2029 at more than 85 million, with Brazil, Mexico, Argentina, Colombia, Chile, Ecuador, and Peru the leading markets.

Brazil

Brazil is currently not pursuing a mandated mass market smart meter rollout, opting instead for a flexible approach where distributors are entirely funding their rollouts and can't pass the cost onto consumers. This means it can be difficult for utilities to recoup the cost for smaller consumers.

Selected LAC countries by maturity of smart meter rollout

Progress Toward Smarter Grids: Smart Metering 2/3

Distributors have started replacing the meters of customers who opted into the TOU tariff scheme rolled out by the regulator starting in 2012. Enel Distribuição São Paulo was a first mover, having been the first distributor to obtain metrology certification for its smart meters in 2016. After a successful 300,000 smart meter pilot launched in 2021, the distributor is now starting a full-scale rollout to its **8 million** customers in the region. In São Paulo, EDP Energias do Brasil also expects to equip 50% of its customers with smart meters by 2023. In the Paraná region, Copel is concluding the first stage of its large-scale deployment, with **462,000** smart meters installed and a further **1 million** being rolled out as part of the second stage. Since 2018, Iberdrola's Neoenergia has also replaced **75,000** meters in the state of São Paulo as part of its Future Energy project. In Belo Horizonte, Copel had deployed **100,000** smart meters as of June 2022 as part of a large-scale rollout of **250,000** devices.

Mexico

A reported **2 million** smart meters were in operation in Mexico as of the end of 2018, representing 4.5% of the country's total metering points. Rollout plans have been updated frequently over the past few years, with smart meters playing a critical role in the government's strategy to control non-technical losses (estimated at 7.6% of all power dispatched by state-owned electric utility CFE in 2018). In 2019, CFE's stated goal was to deploy around **6 million** smart meters by the end of 2022 and **25 million** smart or digital meters by 2025, a target it is expected to struggle with.

Most installations in Mexico are being driven by C&I customers' need to comply with the network code and their desire to access the competitive wholesale energy market.

Uruguay

Uruguay is one of LAC's top performers, with around **800,000** smart meters in operation as of July 2022 thanks to a meter swap program that is free for consumers. State-owned utility company UTE is targeting 100% coverage of its **1.5 million** customers in the next two years, just over four years after the start of the mass market program.

Argentina

A 2019 resolution by the Argentinian government established the mandatory installation of smart meters for new connections beginning in 2020. While some pilots and small-scale projects are underway, no large-scale plan was adopted to encourage existing consumers (especially those on older technology) to switch to smart meters.

In a 2022 report, Enel Argentina proposed a mass market smart meter rollout to be carried out over 8–10 years and financed through a dedicated fee.

Costa Rica

Costa Rica is also a smart meter pioneer in LAC with state-run electricity and telecommunications service provider Grupo ICE having installed its first smart devices in 2012. The group is expected to end the year having installed **600,000** smart meters, covering about 41% of electricity consumers, and is on track to reach full coverage by 2024. In 2021, Costa Rica published its national smart grid strategy. Framed within its national decarbonization plan, the strategy seeks to generate a flexible, smart, and low-cost electricity system that takes advantage of technological innovation.

Progress Toward Smarter Grids: Smart Metering 3/3

Chile

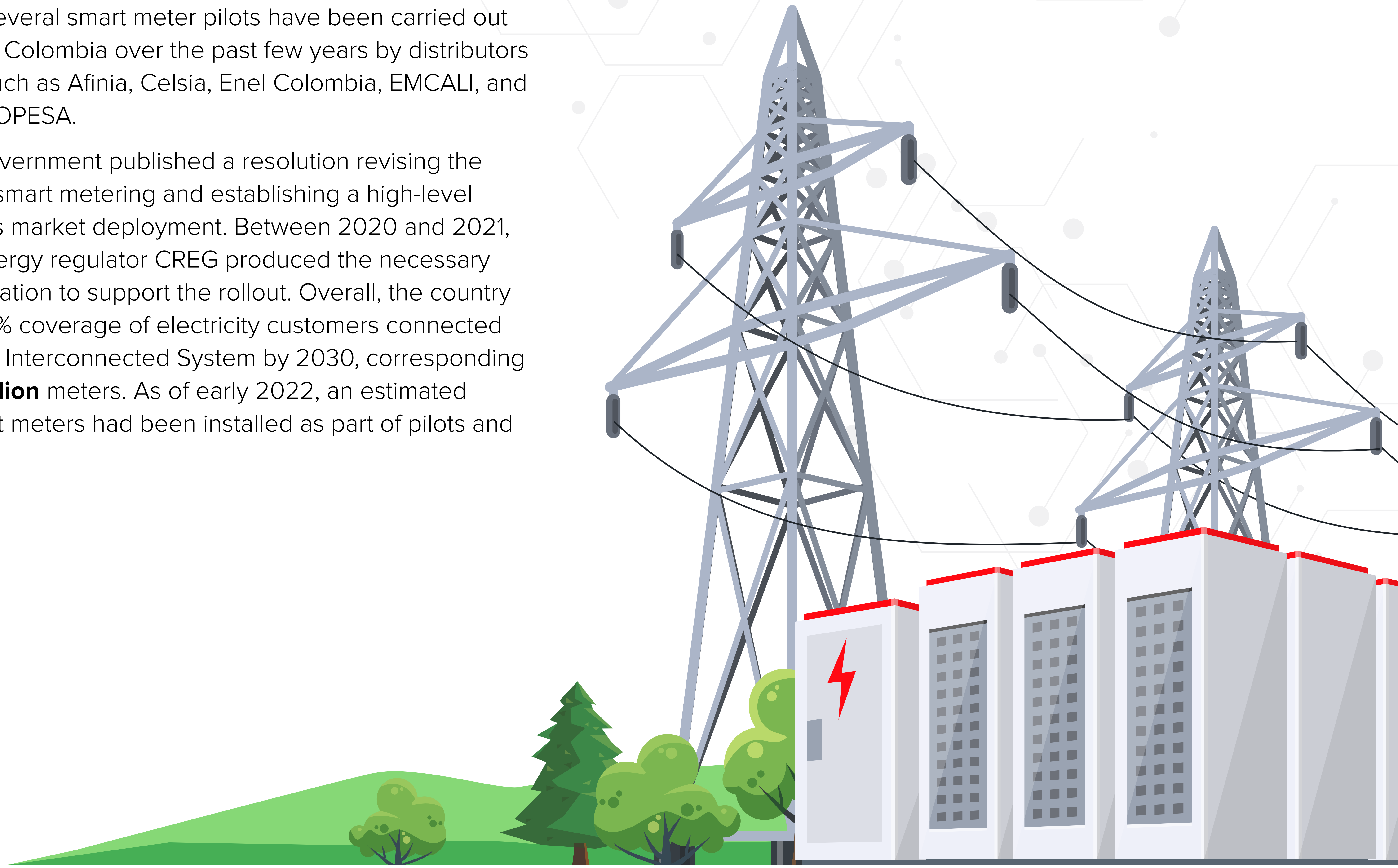
Chile's initial plan to swap most electricity meters with smart devices starting 2018 suffered a major blow the year after when the news that new devices would be paid for by consumers led to major objections. In response, the government backtracked and adopted an opt-in approach, which resulted in a slower deployment rate.

As of mid-2020, two of the country's largest distributors had implemented smart meter pilots in their service areas. Enel Distribución Chile, which serves Santiago, had installed more than **500,000** smart meters, covering about a quarter of its customers. Grupo Saesa, serving the south of Chile, had deployed intelligent equipment at more than **25,000** metering points.

Colombia

Several smart meter pilots have been carried out in Colombia over the past few years by distributors such as Afinia, Celsia, Enel Colombia, EMCALI, and SOPESA.

In 2019, the government published a resolution revising the guidelines on smart metering and establishing a high-level plan for a mass market deployment. Between 2020 and 2021, Colombia's energy regulator CREG produced the necessary technical regulation to support the rollout. Overall, the country is targeting 75% coverage of electricity customers connected to the National Interconnected System by 2030, corresponding to about **11 million** meters. As of early 2022, an estimated **450,000** smart meters had been installed as part of pilots and early rollout.



Developing a Vision for the DSO of the Future

Creating critical mass around technical and regulatory needs

As mentioned, the investment case for smart grid technology is becoming increasingly apparent for both LAC utilities and regulators. This has led several countries to establish basic requirements and adopt strategies and road maps for smart meter deployments over the next decade. At the same time, several DSOs have started piloting smart meter technologies and use cases.

However, LAC countries are far from uniform when it comes to their market structure, energy mix, development maturity, technological needs, and investment plans. As LAC's energy systems integrate, a growing degree of technical alignment and a maturing of regulatory frameworks are necessary to help build critical mass around smarter grids.

In 2021, the non-profit association ADELAT was created, grouping 15 distributors across Brazil, Peru, Chile, Colombia, and Argentina, to exchange best practices and promote innovation across all areas of power distribution.

Among other things, the association is emphasizing the rollout of smart meters and smart grid technology to optimize operations, distributed generation, electric mobility, and regulatory design.

ADELAT's list of 21 challenges for the DSO offers a view of the drivers and opportunities enabled by smart grids and new operating and business models in LAC. It also shows the scale and the complexity of the challenges ahead

21 challenges for the DSO of the future in LAC

Technical · Environmental · Financial · Social · Regulatory and business model

Support the implementation of new technologies	Technical
Implement transport electrification	Technical
Increase service reliability through improvements in distribution, particularly in rural areas	Technical
Integrate urban microgrids	Technical
Offer complementary services and demand flexibility	Regulatory and business model
Study the role of the energy retailer as a provider of a quality service	Regulatory and business model
Rethink the role of distribution-level storage in urban and rural contexts	Technical
Implement smart metering	Technical
Develop a business model for distributed generation	Regulatory and business model
Achieve electricity market liberalization	Regulatory and business model
Address technical and non-technical losses	Technical
Deepen TSO-DSO cooperation to improve flexibility	Technical
Improve the security and quality of supply	Social
Reduce greenhouse gas emissions	Environmental
Generate cost efficiencies	Financial
Achieve just and equitable energy access	Social
Develop regulatory sandboxes	Regulatory and business model
Consider a customer-centric offering model	Regulatory and business model
Design resilience remuneration schemes	Regulatory and business model
Implement grid digitization	Technical
Enhance business model sustainability and circularity	Environmental

SECTION **3**

Country Deep-Dives

ARGENTINA

Electricity System Structure, Trends, and Key Stakeholders

Snapshot 2020

Population: **45.4 million**	Low-carbon share of generation: **35%**
Per capita electricity consumption: **2,755kWh**	Distributed generation capacity: **4,290MW**
Per capita CO_2 emissions: **3.4tCO_2**	Carbon intensity of generation: **336gCO_2e/kWh**
Electricity generation: **131.1TWh**	Electricity access: **98.79%**
Installed electrical generation capacity: **41.95GW**	Rate of T&D power losses: **14%**

Electricity system

In 1991, following the 1988–1989 crisis, during which 50% of the nation's thermal power plants were unusable due to a lack of maintenance, the Argentinian government unbundled the energy market and opened all segments to privatization. It also separated the regulatory and policy-making functions.

This overhaul brought substantial investments from the private sector, which in addition to public investments, have made Argentina's energy market more reliable and stable.

In the generation segment, about 75% of the installed generation capacity is privately owned, while the state continues to own all nuclear generation capacity and co-owns two binational hydroelectric plants in Paraguay and Uruguay.

Argentina's transmission assets are managed by Compañía Nacional de Transporte Energético en Alta Tension (Transener). Distribution assets are largely managed by three private companies, Edesur, Edenor, and Edelap, which account for 75% of the private company market. The remainder of public electricity distribution service is provided by cooperatives that operate in small towns with rural and semi-urban demographics.

Main regulators and institutions

MME: The Ministry of Energy and Mines has the overall responsibility for policy setting in the electricity sector.

ENRE: The National Electricity Regulatory Entity regulates electrical activity and monitors that companies comply with their obligations under the regulatory framework and concession contracts.

SE: The Secretariat of Energy is responsible for environmental issues in power generation, transmission and distribution, oil and gas production and transportation, and fuel storage, distribution, and retail.

CAMMESA: The Argentine Wholesale Electricity Market Clearing Company is tasked with managing Argentina's interconnection system, planning the necessary power generation and managing the dispatch of power from generators, and to regulate the wholesale spot and forward power markets.

FCEE: The Federal Council of Electric Energy is the administrator of specific funds for the electric industry and is the advisor to the National Executive Power and Provincial Governments regarding the electric industry, public or private energy services, priorities in the execution of studies and works, concessions and authorizations, and electric industry prices and tariffs. It also advises on changes needed to the legislation.

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Energy Transition State of the Art

Troubling times

Argentina is the third-largest energy market in Latin America and currently meets its electricity supply mainly with natural gas, which accounted for 65% of installed capacity in 2020. Hydropower accounts for 18%, followed by nuclear (8%), wind (7%), and solar (1%).

A set of public policies boosted utility-scale projects in variable renewables between 2016 and 2019, taking advantage of its rich solar and wind resources. This is critical as extreme weather events, namely heat waves, have caused significant power outages in the country over the past few years, which have also demonstrated that existing infrastructure is far from resilient.

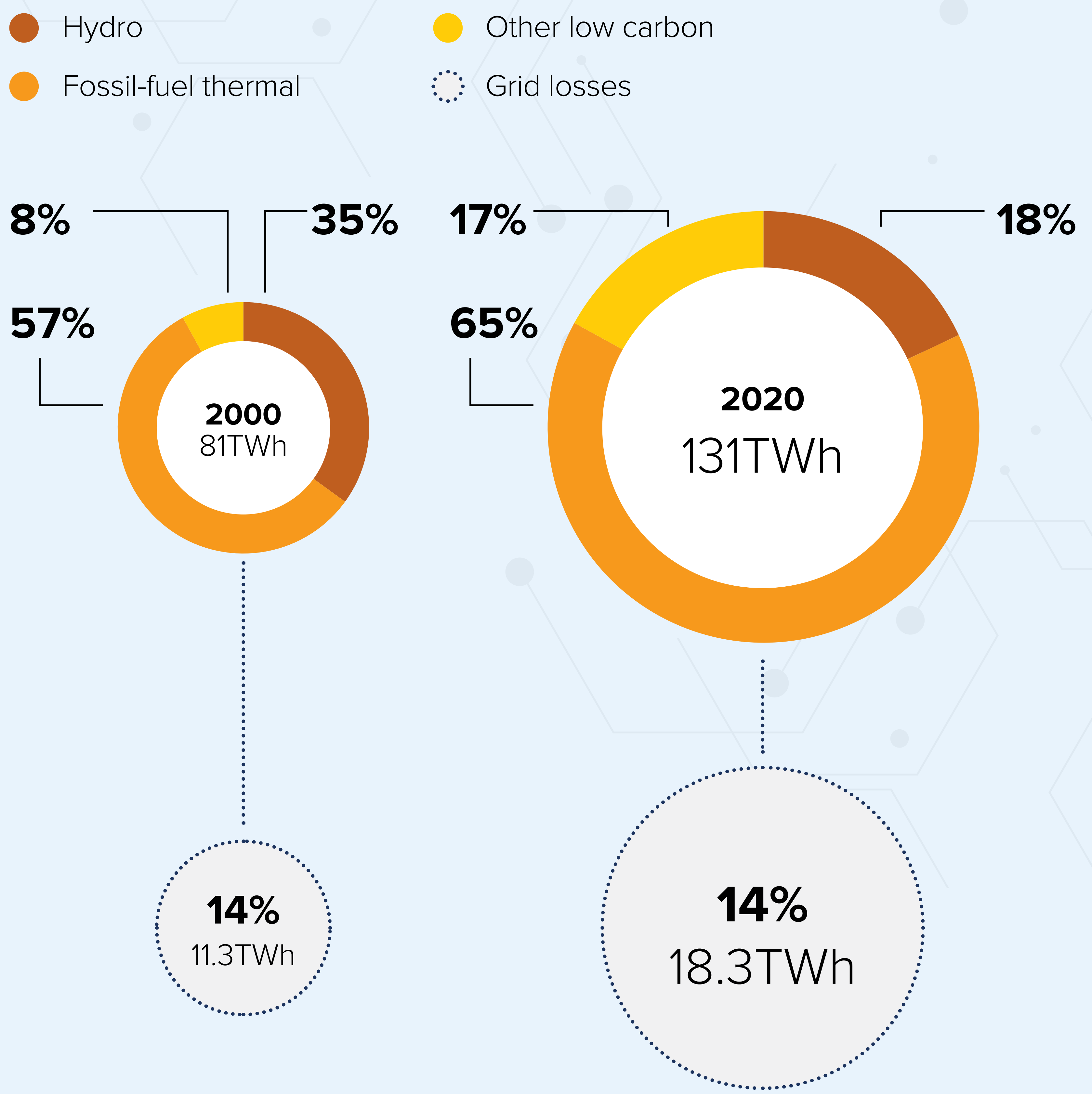
The country set a goal (Renewable Energy Act of 2015) for non-hydro renewables to reach 20% of the power mix by 2025. Hydropower is expected to account for nearly half of Argentina's installed capacity by 2030.

However, the recent macroeconomic crisis and the pandemic have been a major obstacle to clean energy development. Only a half of the wind and solar PV projects awarded in previous auctions were operational by mid-2021. In addition, almost a quarter of the auctioned projects missed their commissioning deadlines and were at risk of losing their power purchase contracts, which spurred the government to extend the deadlines. This has all contributed to a dramatic decline in investments since 2018, as it is expected that a significant share of awarded projects be cancelled due to financing challenges.

Per capita energy consumption in Argentina is the second highest in South America after Chile, mainly caused by space heating needs.

Electricity demand per capita is around 2,700kWh/cap (2020). Electricity consumption has been declining since 2015 to 124TWh in 2020. The residential sector is the largest electricity consumer (38%) and has been growing, ahead of industry (37%), which has been declining, and services (24%).

Evolution of power generation by source



Energy Transition Policies and Legislation

2021: Energy transition plan

In October 2021, Argentina approved the "Guidelines for an Energy Transition Plan to 2030," through Resolution 1036/2021. The plan entails significant investments for increasing renewable energy-based generation capacity, electricity transmission works and the gas pipeline network, among others. The 2030 plan also establishes a growth path of renewable energy in the electricity generation matrix. The lines of action formulated to meet policy goals include promoting energy efficiency; the generation of clean energy to reduce greenhouse gas emissions; increased gasification by implementing measures to gasify energy consumption; developing national technological capabilities; increasing the resilience of the energy system through adaptation of the HV and MV transmission and distribution networks; federalizing energy development with active participation of the provinces in the planning and development of productive energy generation conglomerates; and formulating a national strategy for the development of hydrogen as a new energy vector.

Sustainable mobility

In October 2021, the Argentinian government put forward a law promoting electric vehicles and sustainable mobility. The draft law foresees: the creation of a 20-year support scheme for electromobility, both for consumers and manufacturers; a ban on the sale of new ICE vehicles from 2041, procurement of large EV fleets, both for the Argentinian administration and for public transports; and the establishment of a National Agency for Sustainable Mobility.

Green energy development plan

In 2021, Argentina announced a National Green Productive Development Plan. It focuses on sustainable mobility, green hydrogen production, "green industrialization," energy transition, guidelines for small businesses and SMEs, circular economy, sustainable construction, and sustainable mining.

It aims to promote domestic production of solar water heaters through technical assistance, financing, and product certification, and promote the demand for domestic solar water heaters by including them in tender documents for urban development and social housing, both by the national government and provinces.

The attention to space heaters is driven by Argentina having the second highest per capita energy consumption in South America, mainly caused by space heating needs.

2020: Energy efficiency label for new social housing

The Undersecretariat for Renewable Energy and Energy Efficiency will provide technical advice to the Ministry of Housing of the Nation on incorporating energy efficiency criteria and setting minimum standards in social housing built with state funds. Buildings will be required to submit energy performance index calculations according to IRAM Regulation 11,900/2017.

2017: National program for DG

Law 27424 establishes a national framework for promoting distributed renewable energy generation connected to the grid. As electricity distribution services are regulated at the provincial level, individual provinces must join the framework or develop their own. As of March 2020, 13 provinces had joined the national framework, 8 had developed their own, and 3 were yet to decide. The law establishes conditions and measures for renewable power generation by users of the distribution grid, for self consumption, feed-in of energy surpluses, as well as the obligation of utilities to facilitate such feed-in.

ARGENTINA

Smart Metering Overview

Not mandated

So far, smart meters have not been a top focus in Argentina, which has not nationally mandated for their deployment or developed a rollout road map. Any progress made has been by independent and not coordinated pilot projects spread across the nation (shown in a subsequent slide).

Apart from the deployments carried out by utilities (shown in a subsequent slide), Argentina's electric cooperatives have carried out numerous smart meter deployments to facilitate consumption reading across large service areas and amounts to around 30,000 smart meters.

Regulatory support

In 2019, the government began promoting the transition to smart meters by passing a series of resolutions. This included Resolution 247, which specifies the requirements that electricity meters subject to metrology must meet (Technical and Metrological Regulations for AC Electricity Meters). Resolution 247 also mentions data communication and transmission technologies such as PLC and defines their consumption limits.

The certification of smart meters is tasked to the national metrology agency, Instituto Nacional de Tecnología Industrial (INTI). Any smart meters deployed in Argentina must have been certified by this entity.

From December 31, 2022, all smart meters deployed in Argentina will need to meet all the criteria established in Resolution 247 of 2019 (transitional period will have terminated).

ARGENTINA

Smart Metering Projects

Armstrong

In 2012, the town of Armstrong, in the province of Santa Fe, launched Argentina's first integral smart grid pilot project. The project included the installation of 1,000 smart meters, the generation of 500kW from renewable sources (PV panels and small wind generators), and systems for automation and monitoring of MV substations.

Salta

Between 2015 and 2018, in a neighborhood in the city of Salta, 1,800 smart meters were deployed.

General San Martín

By 2017, one of the largest smart metering projects in Argentina (5,000 smart meters) was implemented in the province of Mendoza by the local utility Empresa Distribuidora de Electricidad del Este SA (EDESTE). The project was funded by UTN and FONARSEC (60%) and was valued around $5 million.

Centenario

By 2018, the Neuquén Provincial Energy Entity (EPEN) had installed 5,240 electricity smart meters across Centenario, Aluminé, and San Martín de los Andes. The total investment in equipment acquisition, labor cost for replacement and management of equipment, systems, and facilities was around $3 million. EPEN planned to extend the rollout to some 14,300 additional devices across the three locations and then further extend to other parts of the province. The smart meters are enabling the deployment of PV panels as a step toward an expanded distributed generation scheme.

Buenos Aires

Two distribution utilities (Edenor and Edesur, part of Enel Argentina) operating in Argentina's capital, Buenos Aires, have carried out smart meter installation projects.

In early 2018, Edesur installed 5,000 smart meters for residential customers in Buenos Aires and ran the project for 6 months before presenting results and findings to the country's energy sector regulator, ENRE. Following the pilot project, toward the end of 2018, Edesur had planned to roll out smart meters to over 2.5 million of its customers in Buenos Aires. However, the COVID-19 pandemic brought the mass rollout to a halt, with only 15,000 deployed.

Following Edesur's pilot project, Edenor also began rolling out smart meters. It deployed 1,900 smart meters, using advanced metering infrastructure (AMI) technology in the Buenos Aires neighborhoods of General Rodríguez, José C. Paz, Merlo, and San Miguel.

It aimed to deploy smart meters to half of its 2.5 million customer base in Buenos Aires, but the plan was also interrupted by pandemic.

Status Quo

Smart meter rollouts in Argentina have ceased, not only due to the negative impact of the pandemic, but most importantly due to the financial instability and volatility Argentina is currently facing.

It is unlikely that implementation projects will resume until the current financial woes of the nation subside.

IDC

BRAZIL

Electricity System Structure, Trends, and Key Stakeholders

Snapshot 2020

Population: **214 million**	Low-carbon share of generation: **86%**
Per capita electricity consumption: **2,392kWh**	Distributed generation capacity: **5,094MW**
Per capita CO_2 emissions: **1.80tCO_2**	Carbon intensity of generation: **113gCO_2e/kWh**
Electricity generation: **621.2TWh**	Electricity access: **99.77%**
Installed electrical generation capacity: **179.5GW**	Rate of T&D power losses: **17%**

Electricity system

Brazil's electricity generation sector was exclusively run by the government until 1996 when it was liberalized. Today, it is still dominated by large government-controlled companies. Specifically, about 40% of generation capacity is controlled by federally owned companies, and a further 20% is controlled by state-owned companies such as Copel, CESP, and Cemig. The remaining 27% of generation capacity is privately owned.

Brazil's transmission grids (HV) are almost exclusively managed by state-owned companies (e.g., Minas Gerais-Cemig, CTEEP, Paraná-Copel, and São Paulo) and federal companies (e.g., Eletrobras). To date, there are about 40 transmission concessions in Brazil, most of which are controlled by the government.

Brazil's electricity distribution grids (MV and LV) are managed and operated by 102 different companies, most of which are owned by foreign private investors (these include Spain's Iberdrola, Italy's Enel, China's SGCC, and Portugal's EDP). Annual investments of around $2.2 billion are needed for network expansion (69%), improvement (19%), and renewal (12%).

Main regulators and institutions

MME: The Ministry of Energy and Mines has the overall responsibility for policy setting in the electricity sector.

ANEEL: The Brazilian Electricity Regulatory Agency oversees and regulates the generation, transmission, and distribution of power in compliance with the existing legislation and with the directives and policies dictated by the central government.

CNPE: The National Council for Energy Policies is responsible for proposing the national energy policy to the president; proposing generation supply reliability criterion (risk of rationing); and approving the auction of certain power projects that are not competitive in economic terms but are considered "strategic."

CMSE: The Electricity Industry Monitoring Committee monitors supply continuity and security.

ONS: The Operator of the National Electricity System is a non-profit private entity responsible for the coordination and control of the generation and transmission installations in the National Interconnected System (SIN).

CCEE: The Chamber of Electric Energy Commercialization enables the commercialization of electricity in Brazil and supports the evolution of the market.

EPE: The Energy Research Office is a government agency that supports the Ministry of Mines and Energy with studies and research that guide the development of Brazil's energy sector.

Energy Transition State of the Art

A clean, renewable energy mix

Between 2000 and 2020, Brazil's electricity consumption grew 1.6 times to 540.3TWh, thanks to strong economic growth, an expanding wealthier middle class, and a push toward electrification.

Brazil has one of the cleanest electricity mixes in the world, with 86% of the electricity generated in 2020 coming from low-carbon sources.

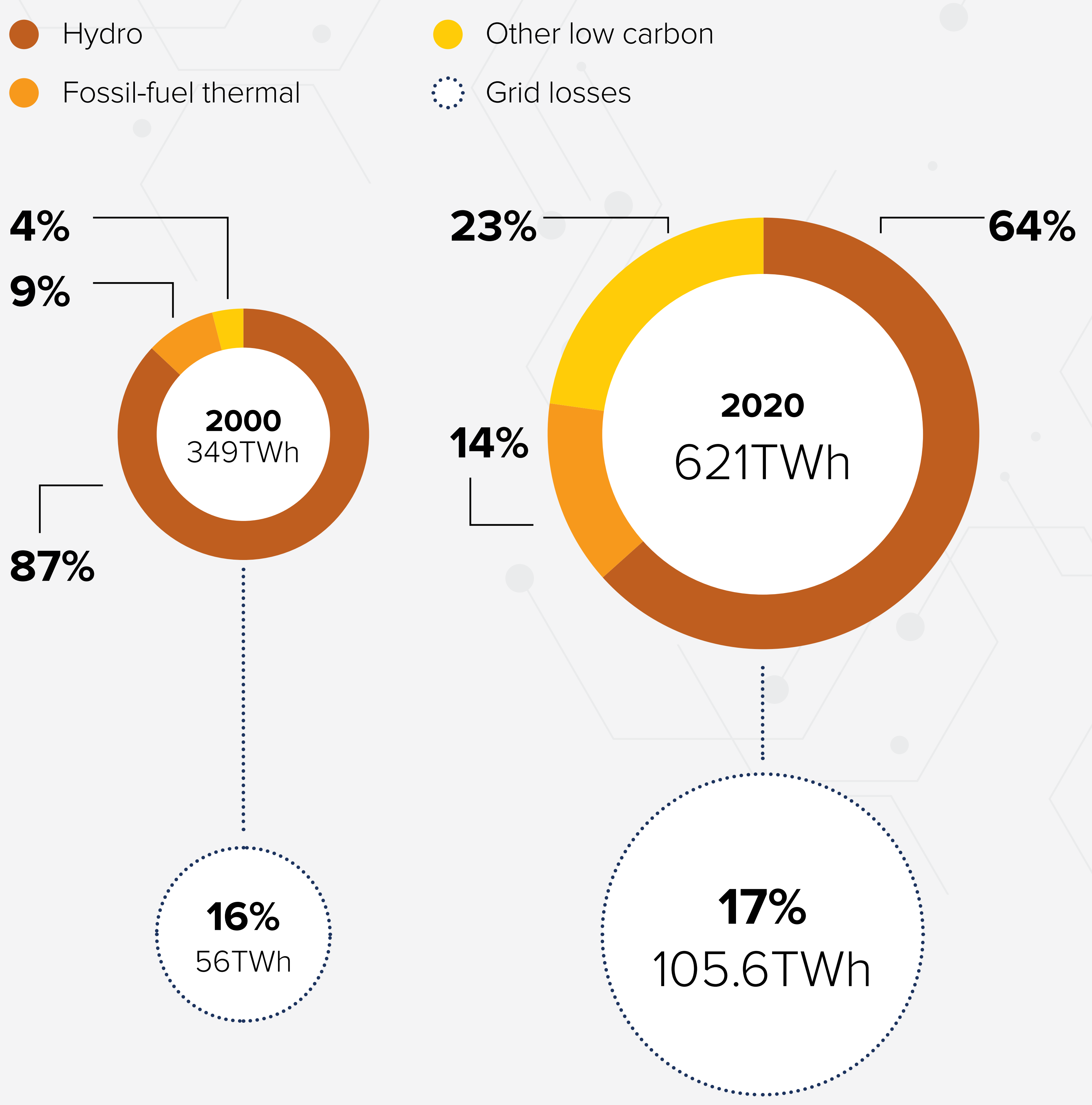
While Brazil's hydropower installed capacity has grown in recent years, the energy source has become less important in the overall energy mix. This trend is expected to further as reliance on hydropower is reduced to mitigate the impact from severe climate events, such as the 2021 drought, and PV and wind power continue to surge.

As Brazil continues to push for a more diversified energy mix, investments in wind, bioenergy, and natural gas are all expected to pick up. Adoption of rooftop PV is also expected to grow as consumers look to self-generation technologies to meet their growing electricity demands. Local distribution utilities will need to invest in smart meters and other smart grid technologies to support this more distributed and intermittent energy system.

Investments in these technologies will also enable utilities operating grids to continue to tackle their non-technical losses challenge. Brazilian transmission and distribution networks lose about 17% of electricity that runs through the networks. This is above the region's average of 14% and is much higher than the average for Europe and North America, which is around 8%. A lot of work has already been done to limit these losses in densely populated centers, but much more work is needed to provide fair access to affordable electricity by avoiding having to inflate the cost of energy for all paying users. Tackling non-technical losses will also enable Brazilian companies to become more competitive by eliminating unnecessary extra costs.

Despite its potential, Brazil still lags when it comes to facilitating the energy transition. Regarding smart meters, the government does not impose DSOs to install them and does not impose any standard requirements but only minimum requirements. Only if an end customer opts for a smart meter, then the DSO is by law obliged to install one at the premises and required to finance it with its own revenues.

Evolution of power generation by source



Energy Transition Policies and Legislation

2022: Law 14,300 for distributed microgeneration and mini-generation

Federal Law No. 14,300/2022 introduced substantial changes to the Energy Compensation System (SCEE) applicable to consumers with small distributed generation in Brazil. The SCEE enables consumer units participating in any of the compensation modalities to reduce the amount of energy consumed with energy injected into the distribution network. It was reformed under the new law to update the requirements applicable to consumers to frame the categories of micro (up to 75kW) and mini (75kW to 3MW or 5MW) distributed generators and potential beneficiaries. It also updated energy surplus compensation schemes, the legal framework for energy credits, and the methodology for compensation for electricity consumed. It created transition regimes for the incidence of new tariff components on compensated energy and changes in the application of the availability tariff on the consumer unit that is part of the SCEE and of the contracted demand on the consumer unit with micro or mini distributed generation. Law 14,300/2022 now allows behind-the-meter solar-plus-storage, and reforms net metering. It also creates the Social Renewable Energy Program (PERS) as a way to explore the potential use of distributed renewable generation instead of the social tariff for low-income consumers.

2021: Changes in contracts for distributed generation

A series of changes to implement a different model for the contracting of distributed generation. The shift is from the possibility of contracting only to meet energy demand to the possibility of contracting to address power system problems, such as deferral, investment management, and other ancillary services.

Procel — Energy efficiency program (2021)

Created in 1985, Procel aims to promote energy efficiency in several sectors. In 2016, Law 13,280/2016 defined the elaboration of the Resources Allocation Plans (PAR) to orient the use of the financial resources to be destined for energy efficiency projects, under Procel's administration. Currently, $13 million is budgeted for energy efficiency projects in existing public buildings.

Ongoing since 2000: PEE — Energy efficiency program

This mandates that electricity suppliers spend 0.5% of their annual net operating income on energy efficiency projects, making it a large ($13 million a year) source of funding for energy efficiency projects. To date, the program has funded 172 projects, worth around $280 million. A high share of the projects (62%) developed between 2008 and 2012 impacted low-income households. In a recent study, ANEEL highlighted the decline in returns on resources invested through PEE and the need for changes in the regulation.

BRAZIL

Smart Metering Overview

Not mandated

Brazil does not currently mandate the rollout of smart meters for any customer (large enterprise, SME, or residential). The adoption of smart meters is by customer request and the related costs are covered by the DSO and are not directly passed on to the customer.

Regulatory support

ANEEL, the Brazilian Electricity Regulatory Agency, sponsors numerous R&D smart metering pilot projects. These projects have been testing various communications technologies, including Prime PLC, Meters & More SMITP, and Wi-SUN on the RF front. The projects are key to modernizing electricity grids and furthering the energy transition.

Standards and road maps

When a DSO is requested to supply a smart meter, customers are divided into two main groups: group A, classified as high-voltage (above 2.3kV or below 2.3 kV through underground distribution system), and group B, classified as low-voltage (residential, rural, public lighting, etc.).

The smart meters provided by the DSOs must be certified by INMETRO (the National Metrology Institute under the Economy Ministry) or an authorized lab.

To be certified by INMETRO, smart meters must have the following technical requirements:

RTM586/2012: implements metrological control of the software/firmware to distributed electricity metering systems and electronic electricity meters

RTM587/2012: Metrological Technical Regulation (RTM) for electronic meters of active and/or reactive electrical energy, single-phase and polyphase, including reconditioned

RTM520/2014: Metrological Technical Regulation defining the tests criteria for multitariff (White Tariff) energy meters and energy quality indicators

Smart metering communication

ANEEL does not define remote communication systems such as media type or application protocols. DSOs can select and adopt the technology they wish, as long as they can ensure the security of the data transferred and the personal information collected from the consumer units.

In case of a remote communication system the related national agency will regulate the application, for example, systems based on radio frequency must follow the rules defined by ANATEL, the Telecom National Agency.

BRAZIL

Smart Metering Projects

Copel — Rede Elétrica Inteligente

In a multiphase project, Rede Elétrica Inteligente (REI), Copel plans to roll out smart meters across its service area. The first phase (3 years) is intended to reach 4.5 million users in 151 municipalities in the state of Paraná.

For phase 1, an investment of about $150 million is needed to deploy 462,000 smart meters. In May 2022, Copel had deployed 350,000 smart meters in 73 municipalities in the west, southwest, and south-central regions of Paraná.

For phase 2, in which a tender will take place, an additional 1 million smart meters are planned to be deployed.

REI's new smart meters will communicate directly with Copel's Integrated Distribution Operation Center, sending signals about energy consumption every 15 minutes, with additional information about the quality of the energy that is reaching the consumer unit. In case of interruptions, the smart meter automatically notifies Copel's control center, enabling maintenance to take place more quickly and without the consumer having to warn about the occurrence of the problem.

EDP — Inovcity

The EDP Group, which operates in two states (São Paulo and Espirito Santo), and serves over 3.6 million customers, plans to install smart meters for half of its customers by 2023.

About 15,000 smart meters were first deployed in the city of Aparecida. In Espírito Santo, 5,500 smart meters were installed in the municipalities of Domingos Martins and Marechal Floriano.

Enel Distribuição São Paulo

Enel Distribuição São Paulo has installed 300,000 smart meters based on Meters and More technology in the São Paulo metropolitan region. The project was carried out in two phases that included the installation of 150,000 devices each. The pilot project is being carried out within the R&D program of Brazil's ANEEL, costing $45 million, of which $23 million was funded by ANEEL.

After completing the pilot project, Enel Distribuição São Paulo decided it would proceed with a full-scale rollout to replace about 8 million analog devices in the country's largest and densest concession area. It plans to install about 1 million meters per year, ending in 2030.

Neoenergia

Since 2018, Iberdrola's Neoenergia has replaced 75,000 meters in the state of São Paulo as part of its Future Energy project. An important part of the project was the implementation of a 4G cellular telecommunications network to connect, in real time, power grid automation equipment and smart meters to the Elektro Operations Center. The investment in technology led Neoenergia to have the first 4G LTE (Long Term Evolution) broadband smart grid project in Latin America and the first such private network in Brazil.

CHILE

Electricity System Structure, Trends, and Key Stakeholders

Snapshot 2020

Population: **19.3 million**

Low-carbon share of generation: **48%**

Per capita electricity consumption: **3.731kWh**

Distributed generation capacity: **1,282MW**

Per capita CO_2 emissions: **4.1tCO_2**

Carbon intensity of generation: **369gCO_2/kWh**

Electricity generation: **77.6TWh**

Electricity access: **99.77%**

Installed electrical generation capacity: **26.31GW**

Rate of T&D power losses: **5%**

Electricity system

The Chilean electricity system, SEN (Sistema Eléctrico Nacional), is legally unbundled into generation, transmission, and distribution. Entities in these segments are managed by private companies, which invest in construction, maintenance, and operation of the infrastructure following the respective regulatory scheme.

More than 100 companies own power generation assets. Many of these operate directly or indirectly through partnerships, and the majority are independent power producers.

The transmission and distribution segments also include operators from the private sector, which are subject to a stricter legislative regime. In transmission there are 38 companies, including Tanselec and Interchile. The distribution segment, which has 30 operators, is dominated by four operators that account for about 98% of distributed energy. These are Enel Distribución, CGE, Chilquinta, and SAESA. The rest of the market is covered by 19 regional distributors.

Main regulators and institutions

ME: The Ministry of Energy has overall responsibility for policy making in the electricity sector.

CNE: The National Energy Commission is the regulator for energy systems. It ensures effective competition and objectivity and transparency of its operation.

CEN: The National Electric Coordinator is Chile's Independent System Operator (ISO), which is responsible for the reliable, secure, and efficient operation of the national electric system.

SEC: The Superintendence for Energy is Chile's regulatory body for the production, promotion, and sale of fuels and electricity.

ACERA: The Chilean Association for Renewable Energies is a 140-member association including developers, generators, and suppliers of products and services throughout the value chain of the renewable energy industry.

CAPG: The Chilean Association of Power Generation represents power generator companies operating in the country.

CONAMA: The National Environment Commission is the state institution whose mission is to guarantee the right of citizens to live in an unpolluted environment, to protect the environment, preserve nature, and conserve environmental heritage.

CDEC: The Economic Load Dispatch Center coordinates and determines the operation of the Central Interconnected System (SIC) facilities, including generating plants, transmission system lines and substations, and free customer consumption busbars.

ACEN: The Chilean Energy Traders Association promotes electricity commercialization with public policies and best practices, fostering competition in the electricity supply market and promoting energy efficiency.

CHILE

Energy Transition State of the Art

Heading in the right direction with RES

With its wealth of resources such as copper and lithium and the presence of the Atacama Desert (high solar radiation), Chile has a strategic role in the region's energy transition. It is also the only country in South America that is a member of the Organization for Economic Cooperation and Development (OECD). Between 2000 and 2019, Chile's electricity consumption more than doubled, making it the fifth-largest energy consumer on the continent. Due to this rapid growth in consumption, Chile is heavily dependent on energy imports and fossil fuels, particularly coal.

However, thanks to Chile's favorable legislation it is significantly reshaping its energy mix, moving away from coal in favor of renewables. In 2021, it was the second most attractive market for investments in the world, despite experiencing a drop from 2020.

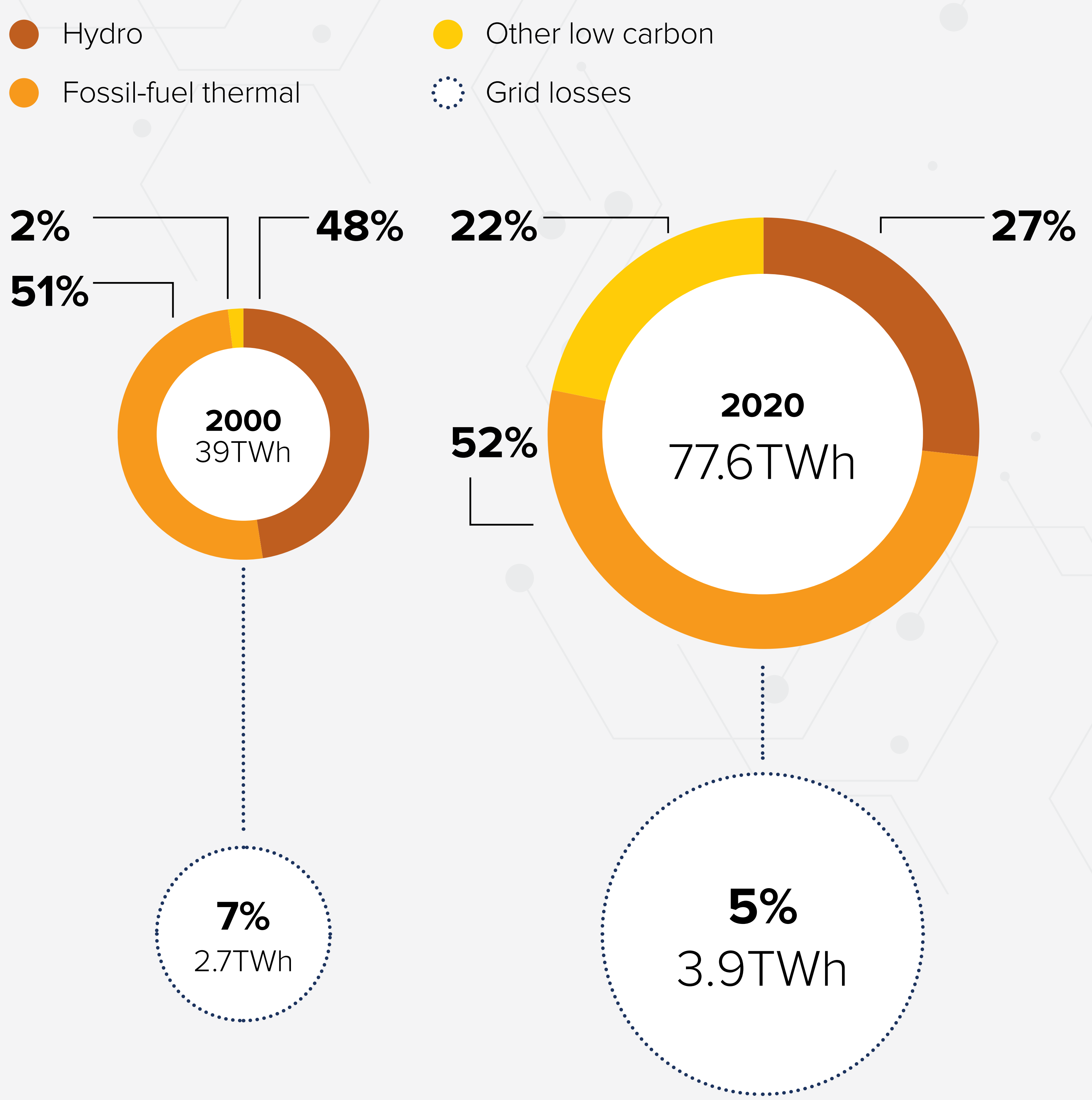
The Chilean government is actively expanding its role in energy planning, continuing to stimulate project development. By the end of 2022, solar is expected to be Chile's main source of electricity generation.

By 2030, the total share of intermittent renewables generation, such as solar and wind power, will reach about 85%, with peaks of 100% in some areas.

Despite the many steps forward Chile has taken toward a cleaner energy mix, the country is plagued by inefficiencies in its grids. A lack of adequate infrastructure and various operational problems led to 160GWh being "lost" in January 2022 alone, which was more than the total recorded in all of 2019.

To enable more distributed generation (specifically PV) to be fed into the grid, Chile will need to invest significantly in its infrastructure. Only by transforming them into smart grids will the country be able to really reap the benefits of its distributed renewable energy sources investments and be a key player in energy transition in the region.

Evolution of power generation by source



CHILE

Energy Transition Policies and Legislation

2022: Long-term energy policy

In 2022, Chile's Ministry of Energy published an update to its Long-Term Energy Policy (PELP, first published in 2015), which re-emphasizes the pledge to net zero, laying out a clear decarbonization path that addresses all sectors of the national economy.

In its "Estrategia Nacional de Energía 2030" document, Chile outlines a road map for the adoption of clean energy and push toward energy efficiency. From a technological perspective it describes Chile's goal of developing smart grids made up of distributed generation and smart meters.

National electromobility strategy resolution No.8/2022

The National Electromobility Strategy outlines the actions that Chile must take in the short and medium term to ensure that 40% of private vehicles and 100% of public transport vehicles are electric by 2050. One of the key objectives is that all light and medium vehicles sold, all public transport (buses, cabs, and shared cabs), and heavy equipment sales will be zero-emission by 2035.

Energy storage bill

The bill will allow standalone energy storage systems to receive income by dispatching their energy and power in the country's National Electric System market. The bill seeks to increase the use of energy storage to get around grid congestion, which currently means that the bulk of renewable energy is dumped. Some 748GWh of renewable energy has already been dumped in 2022, for example.

The bill will exempt owners of EV and hybrid vehicles from the "circulation permit" for two years, followed by six years of a reduced charge before users pay the full permit during year nine. EVs will also be able to participate in electricity markets as distributed energy resources (DERs).

2021: Energy efficiency law

This initially targets a 10% reduction in energy intensity by 2030 compared to 2019. The 10% reduction in energy intensity targeted for 2030 should lead to cumulative savings of $15.2 billion and a reduction of 28.6Mt of CO^2. It addresses energy efficiency in three primary energy consumption sectors: residential, public, and commercial, accounting for almost a quarter; transportation, at just over a third; and industry and mining, at about 40%. The law also declares hydrogen a fuel and gives the Ministry of Energy power to regulate it as an energy resource.

"Put Energy to Your SME" program

This government program provides funds of up to $15 million to SMEs to improve energy efficiency and install renewable energy capacity for self-consumption. SMEs represent 98% of Chilean companies, and this project aims to increase the amount of energy available behind the meter.

Solar House Program

A government program to promote the use of solar PV systems by allowing their purchase at a lower price and variable state co-financing for homes with a tax assessment of up to $100,000.

Smart Metering Overview

CHILE

Background

In 2017, for the first time, Chile's CNE set a quality-of-service technical standard, Diario Official Exempt Resolution Number 706.

Meanwhile, a 2018 law dictated the splice and the meter to be property and responsibility of the concessionary DSO, as they are part of the distribution network.

In 2018, however, smart meter rollout suffered a setback when news broke that the new smart meters would be paid for by users, which led to a huge backlash. The government then changed its plans, making deployment of smart meters voluntary.

Technical quality standard of services for distribution systems

In 2019, CNE published an updated norm (from 2017) to establish, among other things, that distribution companies were obliged to implement MMCS (measuring, monitoring, and control system) to measure the consumption, monitor the supply status, and control the remote operation.

A complementary norm includes specifications of the device and some system-performance indicators, particularly in relation to communication protocols.

Communication protocols

The 2019 norm refers to a Technical Annex, a complementary norm, which includes specifications of the device and some system-performance indicators, particularly in relation to communication protocols.

The Technical Annex of the MMCS specifies that the smart metering data must follow IEC 62056-6-1:2017. However, in areas of low concentration of customers, defined by the superintendence, the data provided by the meter must be identified in accordance with IEC 62056-6-1:2017 or ANSI C12.19:2008.

Road map

The decision to make smart meter rollout voluntary contradicts the set obligation of the distribution companies to start with the installation of the meters.

The following deadlines had been set for DSOs to implement MMCS:

By January 1, 2023, the distribution company should have implemented 30%.

By January 1, 2024, the distribution company should have implemented 60%.

By January 1, 2025, the distribution company should have implemented 100%.

CHILE

Smart Metering Projects

After the 2018 setback to smart meter deployments, the government changed its plans to make the deployment of smart meters voluntary.

In the meantime, two different approaches were followed. Some utilities (Enel, Chilquinta, and Saesa) started deploying smart meters that met all the general demands of the 2017 Technical Norm. Other utilities decided to wait until the 2019 Technical Annex (specifications of the device and some system performance indicators, particularly in relation to communication protocols) was issued.

Enel Distribución

In 2016, Enel Distribución launched the first phase of a smart metering program in Santiago, installing over 50,000 smart meters. Since then, the company has installed around 514,689 smart meters, about 26% of its almost 2 million customers.

Santiago is also home to the Smartcity Santiago initiative focused on the use of sustainable energy and digital technologies to improve the quality of life and urban environments.

SAESA Group

The SAESA Group — which includes FRONTEL, EDELAYSEN, and SAESA — supplies electricity to more than 900,000 clients in southern Chile, mainly in La Araucanía and Los Lagos. The SAESA Group has implemented more than 25,000 smart meters, 22,600 of which are for customers and 2,400 to monitor the behavior of distribution transformers.

Since 2020, five research projects have been carried out with electrical engineering students and PhD students who have used the information registered in the databases since 2018. The results enabled it to identify eight different profiles for residential customers, helping the company to consider these new scenarios with different customer profiles in its infrastructure investment plans. Likewise, work continues to monitor, analyze, and estimate projections for distribution transformers that have connected measurement equipment.

COLOMBIA

Electricity System Structure, Trends, and Key Stakeholders

Snapshot 2020

Population: **51.6 million**	Low-carbon share of generation: **73%**
Per capita electricity consumption: **1,311kWh**	Carbon intensity of generation: **193gCO_2/kWh**
Per capita CO_2 emissions: **1.4tCO_2**	Electricity access: **96.81%**
Electricity generation: **69.3TWh**	Rate of T&D power losses: **8%**
Installed electrical generation capacity: **17.76GW**	

Electricity system

In 1995, Colombia liberalized its energy market. The Colombian government only deregulated the market and did not introduce privatization, allowing a mixed ownership structure (private 60% and public 40%) — public in the context of central and regional governments. The Colombian energy system was only partly unbundled. The incumbents were allowed to remain both generators and distributors, but through separate subsidiaries. At the same time, some restrictions were introduced on how much electricity a distribution company can buy from a generation company within the same group (60% at present, the remaining 40% having to be bought from other suppliers whether cheaper or not).

There are two clearly differentiated areas: the non-interconnected areas (ZNI) and the national interconnected system (SIN). SIN accounts for most of the country's (electricity) demand.

ISA operates the high-voltage grid in Colombia. It is also responsible for operating the Colombian Pool.

There are six major utilities in the country: Grupo EPM, Enel Colombia, Celsia, ISAGEN (independent government-owned generation company), Vanti, and Emcali.

Main regulators and institutions

MME: The Ministry of Mines and Energy oversees the regulation of the mining and minerals industry and the electricity sector in Colombia.

CREG: The Regulatory Commission for Electricity and Gas oversees both the electricity and the gas sector. CREG is an independent office but is organized as part of the Ministry of Energy and Mines.

UPME: The Energy and Mines Planning Unit carries out sustainable planning and development for the mines and energy sectors in Colombia, for formulating state policies and decision making for the benefit of the whole country, and by performing information processing and analysis.

SSPD: The Public Utilities Superintendence is a technical entity created by the Constitution of Colombia to exercise the control, inspection, and monitoring of the entities that provide domiciliary public utility services.

SIC: The Superintendence of Industry and Commerce is a public authority and a technical agency attached to the Ministry of Trade, Industry, and Tourism. It is the statutory body of the government of Colombia in charge of regulating fair business practices, promoting competitiveness, and acting as the Colombian patent and registration office.

CNO: The Operation National Council is a private body whose main function is to agree on the technical aspects to ensure that the operation of the National Interconnected System (SIN) is safe, reliable, and economical, and to be the executor of the operating regulations.

COLOMBIA

Energy Transition State of the Art

Clean but in need of diversification

Colombia's installed power generation capacity is currently just under 18GW, with 69% from hydroelectric power plants, 30% from coal- and gas-fired power plants, and the remaining 1% from renewable sources such as solar and wind.

In general, Colombia's power generation is clean, thanks to its high hydropower contribution. However, this also makes it increasingly dependent on hydro and at risk of extreme weather conditions.

In response, Colombia has embarked on a substantial energy transition journey, one of the most ambitious across Latin America.

In 2021, it reaffirmed its intention to fulfill its Paris Agreement commitments and revised its 2030 emissions reduction target from 20% to 51% (and black carbon emissions by 40% in 2030 compared to 2014 levels).

Colombia has one of the most ambitious commitments in the Latin America and Caribbean region and aims to achieve carbon neutrality by 2050.

Between 2021 and 2026, Colombia aims to expand its renewable capacity by almost 50% (close to 7GW). This growth will be driven by the competitive solar PV and wind auctions as well as the commissioning of the 2.4GW Hidroituango hydropower project.

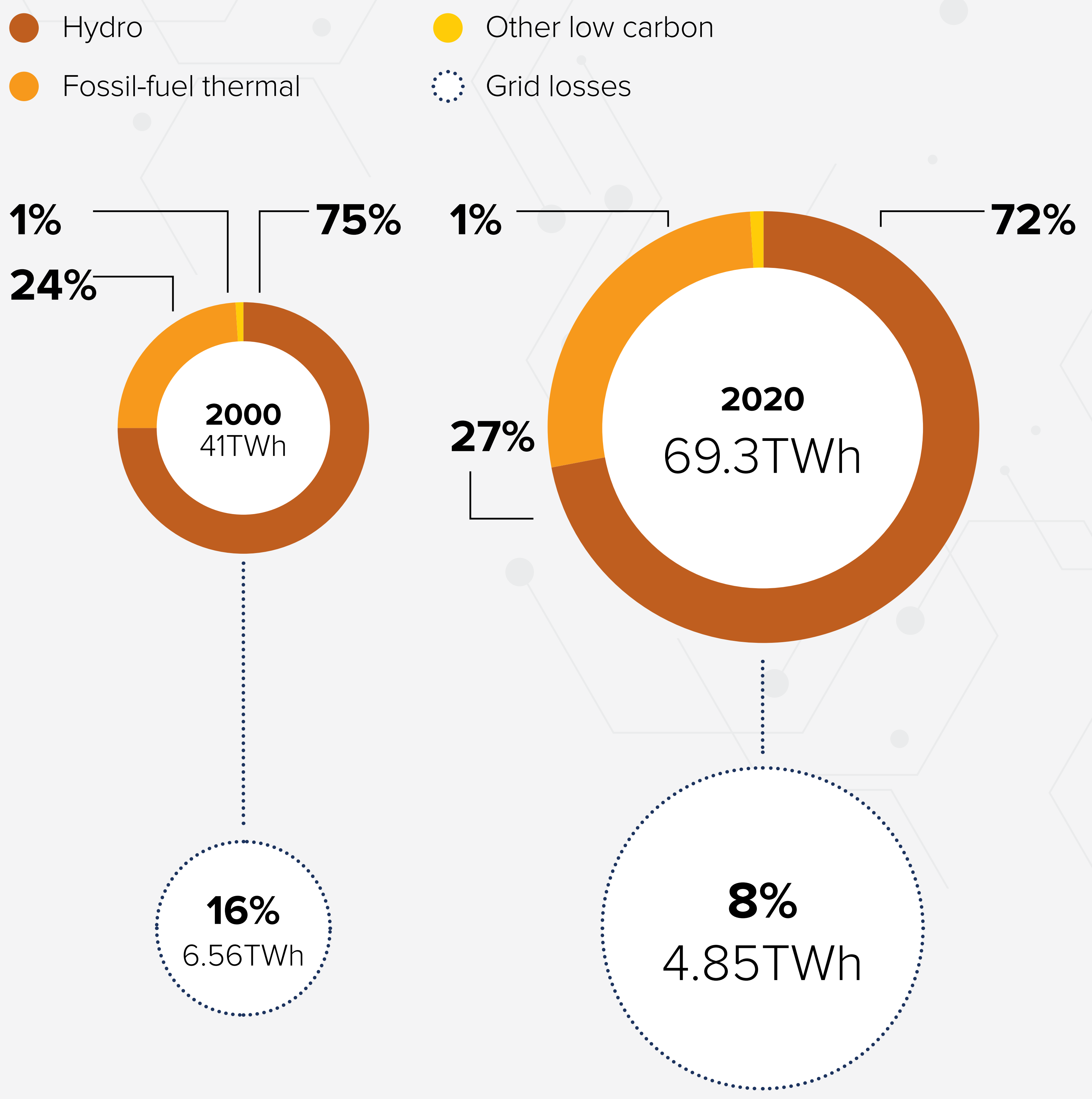
With its very favorable solar and wind conditions, in 2019, the Colombian government led a series of auctions to support the buildout of related capacity. Since 2019, wind and solar PV developers have secured over 2.6GW of capacity from energy, reliability, and private auctions.

Colombia's ongoing commitments are driven not only by its vulnerability to climate change impacts, including drought and sea-level rises, but also by its aim to reduce premature deaths attributable to outdoor fine particulate matter air pollution.

As the penetration of distributed generation increases, Colombia will also need to prioritize improving grid efficiency and reliability, especially in large cities and densely populated areas. The country has spent significant efforts to establish mandates, directives, regulations, and standards to support the deployment of smart meters.

After a few tumultuous years of setbacks, mainly due to the COVID-19 pandemic, the Colombian government in 2022 established a regulatory framework for AMI, planning to achieve 75% coverage by 2030 (in the National Interconnected System/NIS area).

Evolution of power generation by source



Energy Transition Policies and Legislation

2022: Net-zero carbon buildings

In June 2022, Colombia launched its Road Map for Net-Zero Carbon Buildings, which aims to achieve net zero in all new buildings by 2030 and all buildings by 2050. It provides a framework for how the country can decarbonize buildings.

2021: DSOs imposed with RES quota

Resolution 40715 stipulates that, starting in 2023, companies operating in the wholesale energy market must have at least 10% of the power they distribute to end users coming from renewables, through long-term contracts.

Energy transformation mission road map

Colombia has prioritized 39 proposals to modernize and transform the electricity sector. One of these promotes active participation of users in the electricity markets and the redesigning of rates to encourage efficient energy consumption. Changes in the rate structure will go hand in hand with AMI implementations. Another prioritized proposal is the unification of electricity funds to make more efficient use of resources and focus them on financing strategic projects aimed at closing wealth gaps.

Renewable energy auction

Colombia passed a resolution determining a new auction of Non-Conventional Renewable Energy Sources in October 2021. The start date of the electricity supply obligations contained in the contracts awarded will be December 1, 2022, and the supply period for the long-term energy is 15 years. 11 solar projects were awarded, which are expected to meet their energy supply commitments by January 2023. Colombia also awarded the first-ever battery storage tender for a large-scale battery-powered energy storage system. The project is expected to be operational by June 2023.

Connecting commercial-scale DG

Resolution 148 of 2021 defines the characteristics that distributed generation plants of commercial size (above 5MW) must have to be connected to the distribution grid.

Power for grid-isolated homes

Colombia has activated a new mechanism for National Interconnected System (SIN) Grid Operators to continue to bring electricity to more Colombian homes through isolated solutions. Currently, there is a potential of about 338,000 households in Colombia that could have access to electricity through this mechanism, about 170,000 households could be served with isolated micro-grids, and 168,000 with individual isolated distributed generation and battery combined solutions.

Electric and sustainable mobility

Colombia launched its National Strategy for Electric and Sustainable Mobility in 2019, with a goal of incorporating 600,000 electric vehicles by 2030 and 100% of vehicles sold after 2035 to be electric or zero emissions. Law 1964 introduced promotion schemes for the use of electric and zero-emission vehicles and capped the taxation of EVs to 1% of their commercial value. In 2021 Colombia created incentives for each municipality to have public charging electric stations, standardization, and firm market conditions for electric chargers. As of October 2022, Colombia is readying new regulations for electromobility and battery storage.

2018: Prosumers (less than 5MW)

With Resolution CREG 030 users who generate electricity for their own consumption can connect to the public network and sell their surpluses.

Smart Metering Overview

Resolution 101001/2022

In October 2022, Colombia's Energy and Gas Regulatory Commission (CREG) issued Resolution 101001 establishing the regulatory framework for AMI. It confirmed plans made in 2019 (Resolution 40459) to achieve 75% coverage, corresponding to about 11.8 million of the 15.7 million electric power service users, connected to the National Interconnected System (NIS) by 2030.

Bearing of AMI costs

In 2022, Colombia's Constitutional Court annulled a provision of Law 2099/2021, which stipulated that utilities had to bear the costs associated with the acquisition, installation, maintenance, and repair of smart meters and that these costs could not be passed on to the end user in billing or any other way. Following this verdict, the installation, maintenance, and repair costs of an AMI implementation can be passed on to the final consumer by the utility company.

AMI directives and requirements

In 2020, CREG's Resolution 219 outlined the requirements for AMI. Smart meters must comply with the Colombian technical standard NTC 6079 issued by the Colombian Institute of Technical Standards and Certification (ICONTEC) and must enable 15-minute interval meter data reading and storage, as well as voltage and current channels for a minimum of 60 consecutive days. NTC 6079 references international IEC, ANSI, and CLC/TS standards. It also considers requirements for data identification and connection and disconnection requirements referencing IEC, ANSI, and CLC/TS standards. NTC 6079 also covers the concentration Unit (when this is included in the OR's selected solution), and Management and Operation System. NTC 6079 also includes requirements the AMI communication systems must comply with, including referencing IEC, ANSI, and CLC/TS standards for the application layer. Data models considered standards in NTC 6079 also reference IEC, ANSI, and CLC/TS standards. The maximum-security specifications must be adopted, so that they meet the integrity, confidentiality, and non-repudiation requirements (again referencing IEC, ANSI, and CLC/TS standards). Regarding NTC 6079, the network operator is responsible for the interoperability of all the equipment used to collect the data and, in general, of the AMI deployed in its area.

Resolution 219 also included the study of the "General design of the agent that would carry out the independent data and information management activity, GIDI." It resulted in 2021 in the definition of the "Independent Data and Information Management" activity — GIDI — and the general design of the agent that will carry out the activity (Circular CREG 11-2021).

The GIDI will be responsible for defining the mechanisms and methodologies under internationally recognized standards for integration and data exchange. Both the GIDI and utilities rolling out smart meters must implement and maintain an information security management system for the processes involved in the management of measurements, and the CREG can request the demonstration of conformity.

Finally, through the provisions of CREG resolution 096 of 2004, operators can offer the prepaid smart meter option.

Cost benefit analysis

CREG requires network operators to submit deployment plans for the implementation of AMI by:

- Preparing a CBA
- Performing a public information program to inform customers about the service and enable them to make better consumption decisions
- Specifying the yearly and total target up to December 31, 2030
- Carrying out a pilot project (minimum 6 months)

Smart Metering Projects

Emcali

In September 2022, Emcali (Empresas Municipales de Cali, the state-owned company providing water, telecommunications, and electricity services in Cali), awarded a contract to supply and install smart meters. This followed a period of nine months during which various bidders were evaluated. The costs of these meters will be borne entirely by Emcali, which plans to install 100,000 smart meters by the end of 2023. The main objective is to reduce energy losses.

Enel Colombia

During 2021, 1,028 smart meters were installed, for a cumulative total of 73,406. Most of the smart meters were deployed by 2017, in the districts of Puente Aranda, Suba, Fontibón, and Engativá in Bogotá, and in the municipalities of Zipaquirá and Cogua.

Celsia

Celsia, a subsidiary of Grupo Argos with operations in Valle del Cauca and Tolima, has been rolling out smart meters. By July 2020, Celsia had installed 187,000 meters and was advancing rollouts to 2,545 households in Buenaventura. By the end of 2022, the company should have installed over 5,000 smart meters in Buenaventura (around 90,000 customers in 2020).

Air-e

To date, Air-e has installed almost 50,000 smart meters in the Atlántico, Magdalena, and La Guajira departments. Air-e, formerly Caribe Sol, is one of two new electricity operators serving Colombia's Caribbean coastal region, with approximately 1.2 million customers. Air-e is the result of a previous utility company, Electricaribe, being liquidated and sold off into two.

In 2021, in Tolima, a total of 3,993 smart meters were installed in municipalities such as El Espinal, Honda, Guamo, Melgar, and Ibagué.

Afinia

Afinia is the subsidiary of Grupo EPM, which since October 2020 has been providing electric power services in Bolívar, Cesar, Córdoba, Sucre, and 11 municipalities of Magdalena. It has approximately 1.6 million customers. The company, which has installed 28,000 meters, aims to have installed 100,000 meters by the end of 2022. Afinia has set a new goal of 1 million smart meters installed by 2030. It is also installing prepayment smart meters.

SECTION **4**

Considering Meters and More

SMITP Technology 1/2

The Meters and More technology

The Smart Metering Information and Telecommunication Protocol (SMITP), the Meters and More technology, consists of a set of protocols aimed at secure end-to-end communication for smart meter and smart grid applications, providing an identical message protocol for all communication interfaces between the different components of a modern smart metering or AMI architecture.

Technical features

SMITP offers a holistic smart grid communication technology covering the entire protocol stack, from the physical layer through to the application and data model layers. It leverages open industry standards and neutral certification process and can be deployed with multiple communication technologies.

SMITP's main technical features include optimization for low bit rate and noisy channels leveraging B-PSK modulation; optimized power consumption; phase detection; master-slave model; end-to-end security; plug-and-play capabilities (automatic network configuration and management); and retransmission management.

The standard is defined in two CENELEC technical specification documents:

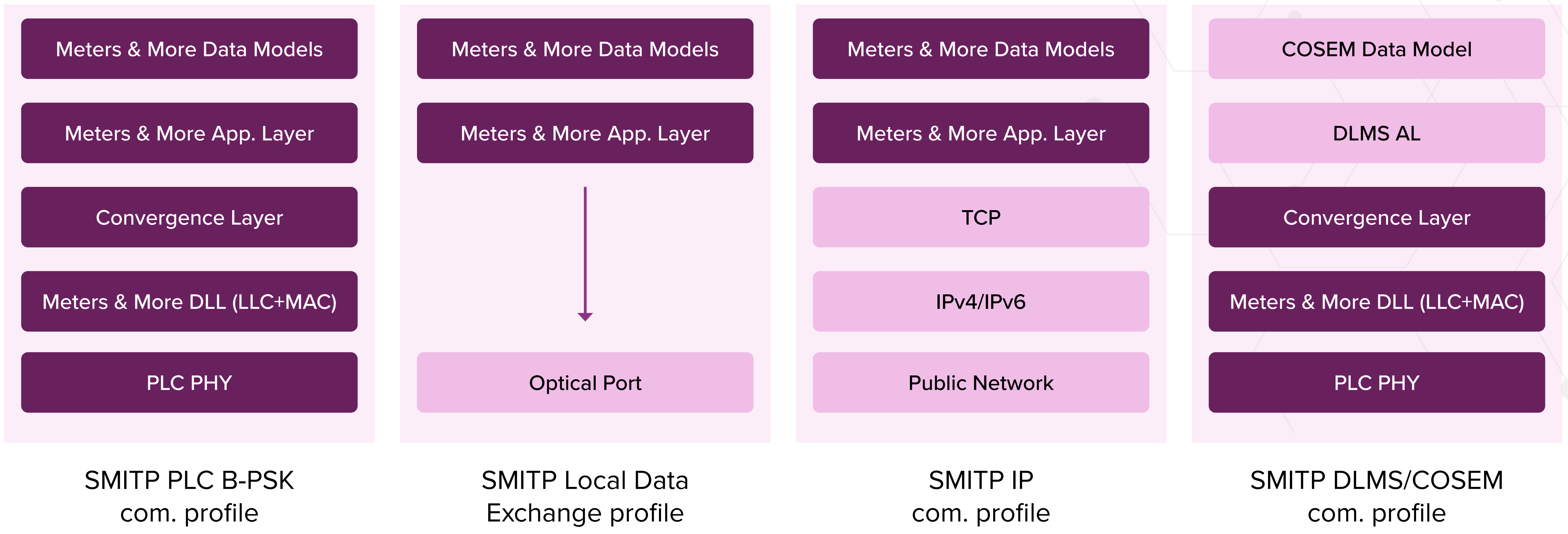
50568-4

CLC/TS 50568-4: specifies the B-PSK physical and data link layers for communications on LV distribution networks between a data concentrator (master node) and one or more smart meters or customer devices (slave nodes)

50568-8

CLC/TS 50568-8: specifies the four communication profiles supported by the standard, including the three original SMITP profiles over B-PSK PLC, IP, and IEC 62056-21 for local data exchange; the fourth is the SMITP evolution to include a DLMS/COSEM profile over the SMITP B-PSK modulation

SMITP communication profiles as defined in CLC/prTS 50568-8



SMITP Technology 2/2

Communication options

SMITP offers multiple communication options and can be deployed with multiple technologies, including (multifrequency, multimode) PLC, public cellular networks, and local optical links.

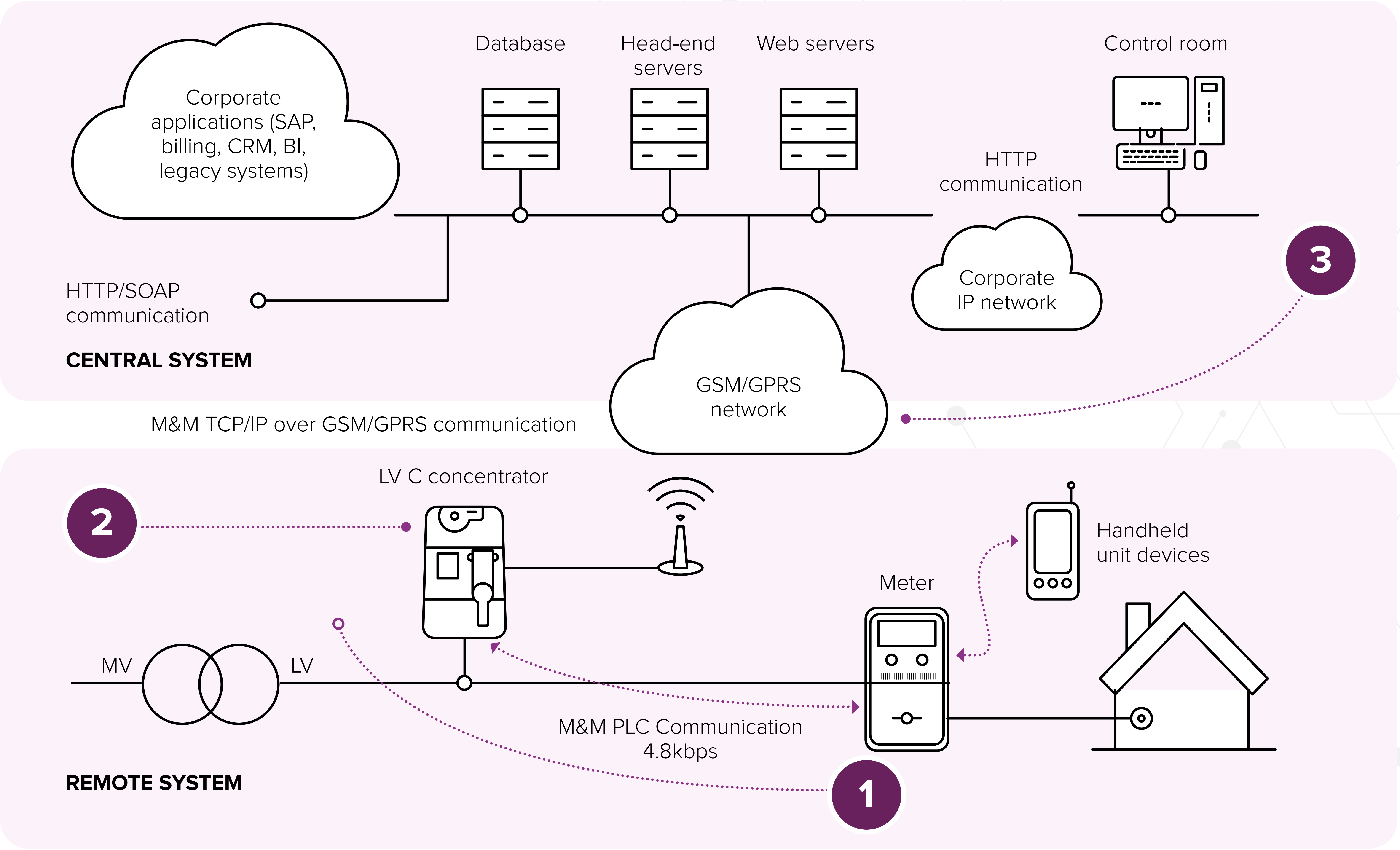
Meters and More is currently extending SMITP communication profiles to include an RF 169MHz option as well as a local data exchange profile (Chain 2) based on PLC C band for data exchange for communication with in-home smart devices. This is based on proprietary Meters and More physical and data layers and in-home communication interface and DLMS/COSEM compact frame for the application layer.

Communication process overview

A summary of SMITP communications across the metering system includes:

1. **Integrated smart meters** (i.e., equipped with breaker) provide metering, contract, and operational data.
2. **Data concentrators installed in every MV/LV substation** manage downstream communication toward smart meters via private DLC-PLC using B-PSK communication at 4800bit/s.
3. **Data concentrators** also manage upstream communication toward an advanced meter management (AMM) or head-end system via public WAN (e.g., GSM, PSTN, satellite) using TCP/IP support.

SMITP communication overview



Typical Challenges for PLC Technology and Large-Scale Smart Meter Rollouts

Channel disturbance

The main distortion factor in PLC communication is noise, which is produced by power electronic devices. This can include background noise, narrowband interference, and impulsive noise.

If the noise level is high, as can happen on old network infrastructure, it can be difficult to detect the signal at the receiving end. The signal gets hidden by noise, which may cause false triggering at the receiver's end.

While trials carried out with old PLC technology have led to some reluctance among LAC DSOs, SMITP is optimized for communication over noisy channels by employing B-PSK modulation and through retransmission features.

Business case sensitivity to deployment context

The business case for PLC communication is typically best in urban settings, where a relatively high number of users are connected under the same transformer and therefore a high number of smart meters can be connected to each data concentrator. As the number of users per substation decreases, the business case for point-to-multipoint communication over PLC degrades because of the higher capex per meter due to the presence of the data concentrator, which is significantly more expensive than a simple gateway. This typically happens in semi-urban or rural settings. In these setups RF technology or mesh networks tend to be preferred, in addition to point-to-point options over traditional cellular (for larger consumers) or LPWA technologies.

Additionally, in areas where poorly meshed power networks might put a strain on the PLC technology, performances are negatively impacted. To improve performance, adaptive hybrid RF bridging options can be deployed to reduce the number of data concentrators needed.

Regulatory fragmentation

While some degree of regulatory alignment is being achieved on minimum smart meter requirements, few regulators in LAC are imposing specific smart metering standards or protocols (Colombia's CREG being an exception), opting instead for looser minimum requirements.

In Brazil, for example, Aneel is imposing minimum requirements, with digital meters for instance being able to record interval consumption data and that data being visible to the consumer. Additionally, meters should support multiple tariffs to enable customers to opt-in to TOU tariffs.

This provides flexibility for distributors to deploy their preferred technology and manufacturer (provided it is certified by INMETRO). But it also makes it difficult for economies of scale and creates a steeper learning curve for particular technology options. This in turn slows the pace of rollouts and reduces the potential benefits highlighted in Section 2 that could be obtained both in front and behind the meter.

High upfront investments

A similar reasoning applies to those markets where smart meters are entirely financed by distributors (e.g., Brazil, Uruguay) and then amortized over the technical life of the device. This tends to be an obstacle to mass market rollout, especially for more capex-intensive technology.

The Case for Meters and More in Latin America 1/2

Global proven track record

SMITP leverages over 20 years of field deployment experience in some of Europe's most demanding regulatory environments and competitive markets. It was published on the back of the European Commission's Mandate 441, it is one of the technologies recommended by the European Open Meter Project, and it has been a CENELEC standard since 2014.

SMITP originated from the Telegestore system, Enel's homegrown smart metering solution, and is used in over 45 million deployed smart meters globally (half a million of which are in LAC), making it one of the most field-proven PLC technologies.

Complete ownership

PLC communication standards, including SMITP, provide distributors with complete ownership and control of the medium. PLC can also represent a systemic security channel of the system, as it is always functional and can provide backup and redundancy.

A holistic technology

SMITP offers a more comprehensive standard than other PLC technologies. It covers the entire protocol stack and defines all communication interfaces of a metering system, offering robustness and functional coverage.

SMITP fosters open specifications and industry standards (including a DLMS/COSEM profile), helping DSOs alleviate vendor lock-in, in addition to providing a growing range of communication options to boost meter reach rates and for behind-the-meter, in-home applications.

SMITP also provides comprehensive security features (128-bit AES encryption, authentication, playback protection, message integrity, etc.). It offers an end-to-end design without needing translation in intermediate components.

Partner ecosystem and end-to-end certification process

The Meters and More Association includes more than 30 organizations, including distributors, silicon vendors, smart grid equipment manufacturers, service providers and systems integrators, R&D and certification labs, and academia. This provides a large ecosystem of interoperable devices, applications, and services.

Meters and More also supports vendors by managing the end-to-end certification process directly, from product definition through test cases, tooling, and access to third-party labs.

Pilot project success in LAC

Despite poor performance in earlier PLC trials in Mexico, existing pilot projects leveraging SMITP in LAC have shown promising results for the successful adoption of the technology, including in Colombia (by Codensa) and Peru (by Enel).

As mentioned in Section 2, after a successful 300,000 smart meter pilot launched in 2021, Enel Distribuição São Paulo is now starting a full-scale rollout to its 8 million customers in the region using SMITP, adding significant weight behind the technology and potentially changing the perception for PLC across LAC.

In Colombia, technical standards already include the Meters and More standard among choices. This gives the SMITP protocol the opportunity to further demonstrate its viability.

The Case for Meters and More in Latin America 2/2

Behind-the-meter applications

Meters and More has taken a further step toward supporting the energy transition by enabling in-home applications beyond metering. It does so by leveraging its newly designed Meters and More Smart Energy Gateway and the Chain 2 profile for meter-gateway communication.

The Smart Energy Gateway — with its hardware specifications and source code available to the Meters and More community — supports several use cases aligned with some of the new energy scenarios outlined in Section 2. They include:

- **Customer awareness and engagement**, enabling consumers and prosumers to track and manage electricity production and consumption from the grid and associated revenues/cost, as well as that of individual smart devices in the home
- **Overload management (residential)**, enabling consumers to optimize power use to avoid home domain overloads by setting load shedding priorities and strategies for individual appliances
- **Active demand and load shifting**, enabling consumers to participate in demand response events and react to price signals
- **Behind-the-meter optimization** of generation and usage, enabling users to time appliance usage based on current and forecast self-generation
- **Multitariff energy use optimization**, enabling consumers to define specific home rules for energy cost optimization based on TOU tariffs

The Meters and More Smart Energy Gateway leverages PLC, providing direct communication to the home. This avoids the need for further intermediate devices to communicate between the smart meters and customers' in-home devices (e.g., in home displays, smart thermostats, smart appliances), to enable beyond-the-meter applications.

The Meters and More Smart Energy Gateway:

- Is based on an extension to the existing protocol (Chain 2 profile) that enables the interchange of energy consumption information with the meter as well as enabling the inclusion of new services
- Offers multifrequency and multimode PLC communication and a flexible data model
- Can connect with other in-the-house smart devices that may be using other standard and widespread communication technologies such as WiFi, ZigBee, and Bluetooth

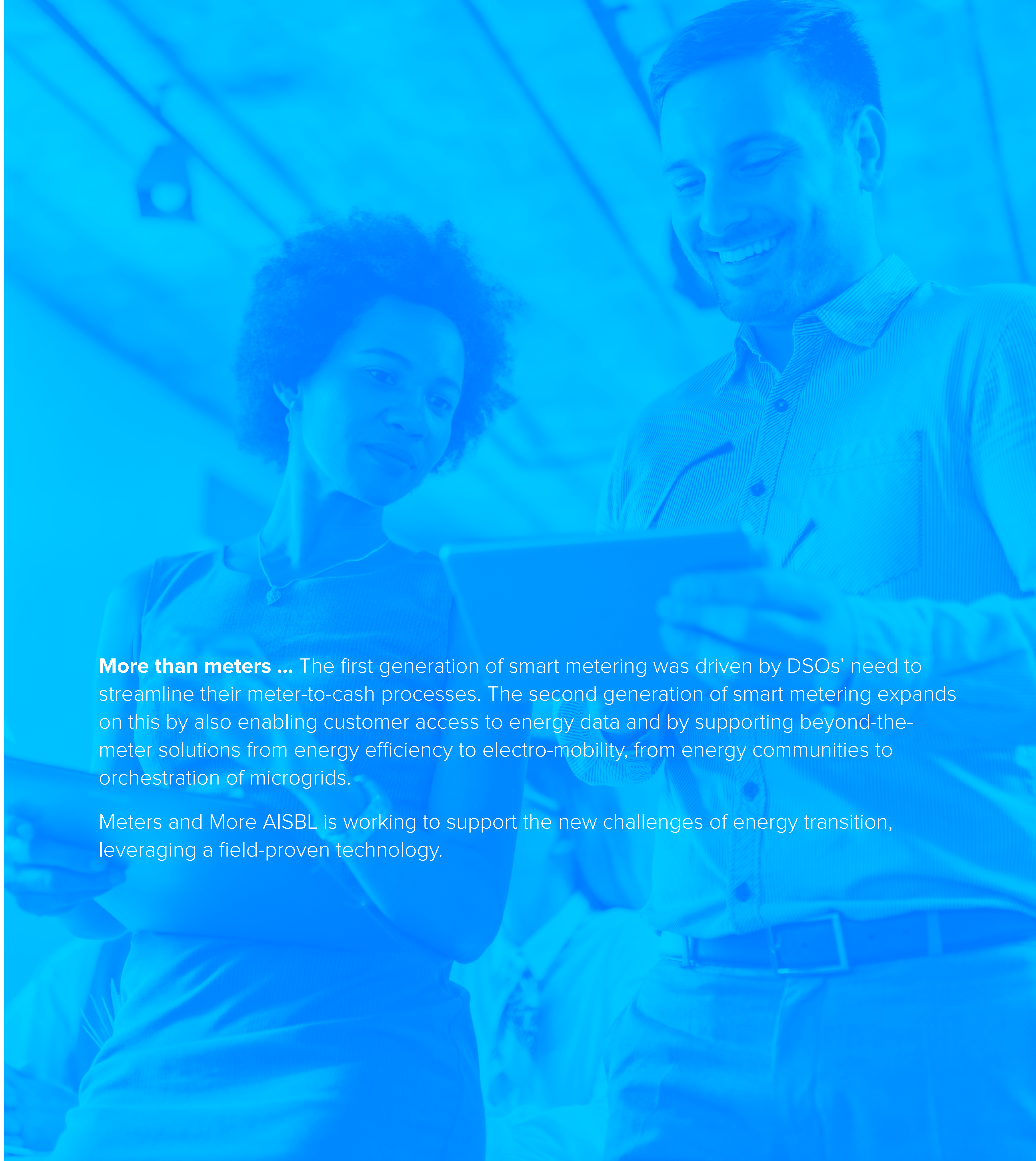
About the Sponsor

Meters and More AISBL, a not-for-profit association based in Brussels since 2010, was established to promote the Meters and More protocol for smart metering, assuring **product interoperability**, a **neutral certification process**, **standardization** at European and international levels, and the continuous integration of **technological evolutions**.

The **Meters and More technology**, also known as SMITP (Smart Metering Information and Telecommunication Protocol), **consists of a set of protocols aimed at secure end-to-end communication of energy data mainly for smart metering solutions**, providing an identical message protocol for all communication interfaces among the different components of a modern AMI architecture.

- Over **45 million meters** managed
- Strong **industry support** from suppliers and utilities
- **Easily accessible (membership) standards-based** and **independently certified** technology
- Optimized and field proven for **high performance**
- **Scalable**, **upgradable**, and **open** to extensions

Please visit our website **www.metersandmore.com** for more information on how to become a member.



More than meters ... The first generation of smart metering was driven by DSOs' need to streamline their meter-to-cash processes. The second generation of smart metering expands on this by also enabling customer access to energy data and by supporting beyond-the-meter solutions from energy efficiency to electro-mobility, from energy communities to orchestration of microgrids.

Meters and More AISBL is working to support the new challenges of energy transition, leveraging a field-proven technology.

References

Interviews were carried out with the following industry subject matter experts:

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