PATHWAYS TO **TARIFF JUSTICE** IN THE BRAZILIAN ELECTRICITY SECTOR

MAY 2025

PSR

Global Energy Alliance for People and Planet
GEAPP

CONTENT

INTRODUCTION

Tariff justice in the electricity sector is an essential pillar to ensure an inclusive and sustainable energy transition. Although Brazil has achieved high levels of universal access to electricity supply, economic affordability remains a challenge, especially for low-income consumers who have a lower capacity to pay. Electricity tariffs incorporate the costs of maintaining and improving the sector, and the way this burden is distributed defines the degree of fairness in energy access.

Currently, the trajectory of electricity tariffs in Brazil undermines the objectives of justice. Among the factors that have led to the undesirable increase in tariffs for smaller consumers are: the expansion of unnecessary subsidies to specific sources, the allocation of inefficient or unrelated costs to the tariffs, and asymmetries in the distribution of system costs among different types of consumers, among others.

As a consequence, this scenario of tariff pressure, coupled with the deterioration of the country's socioeconomic conditions, has increased the burden of electricity bills on household budgets, thereby raising the propensity for electricity theft, which has led to an increase in inefficient non-technical losses, part of which is passed on to the tariffs, creating a vicious cycle. Furthermore, considering the growing need to reinforce infrastructure to deal with the effects of extreme weather events, due to climate change, there is an inevitable rising pressure on tariffs.

For these reasons, the debate on tariff justice becomes even more relevant, highlighting the need for policy interventions that match the challenges of a just energy transition.

In the context of the global energy transition, Brazil positions itself as a key actor in climate discussions, hosting COP30 in 2025 and participating in the G20. These events offer a strategic opportunity for the country to consolidate its leadership in the sustainability and energy justice agenda. The **Global Energy Alliance for People and Planet (GEAPP)**, recognizing the importance of this transition, has been coordinating efforts to develop a **roadmap for a just energy transition**.

Against this backdrop, this study aims to deepen the discussion on tariff justice in Brazil, analyzing its main challenges and proposing policies aimed at building a more rational and efficient electricity sector. To this end, **eleven interviews were conducted with representatives from government institutions, the private sector, civil society, and experts from the electricity sector**. These interviews provided inputs for PSR's analysis, resulting in this technical report, which offers a comprehensive view of the complexities of the issue and potential solutions for Brazil to advance in decarbonization without widening social inequalities.

The document is structured around five central analytical pillars:

1. **the impact of tariffs on household budgets.**
2. **the distribution of subsidies and sectoral charges.**
3. **non-technical losses and tariff discount mechanisms.**
4. **the costs of adaptation to climate change.**

5. **challenges of institutional governance in the Brazilian electricity sector.**

Thus, the objective is to provide a detailed diagnosis to support public policies that reconcile economic efficiency, social justice, and sustainability for the future of the Brazilian Electricity Sector (SEB).

This report was prepared by PSR, a global energy solutions and consultancy company with extensive experience in energy transition and public policies across multiple dimensions.

EXECUTIVE SUMMARY

Tariff justice is defined as *"the condition in which the composition and distribution of electricity sector costs ensure universal access to energy at affordable and equitable prices."* Embedded within the broader debate on energy justice, this perspective acknowledges socioeconomic inequalities and seeks to ensure that vulnerable consumers are not disproportionately burdened, aligning with the concepts of material equality and contributive capacity. Despite the progress made in universalizing electricity access in Brazil, notably through the Luz Para Todos (LpT) Program and the country's predominantly renewable energy matrix, challenges regarding the financial affordability of electricity persist. This is because (i) tariffs are increasingly burdened by inefficiencies or now-unnecessary subsidies; and (ii) public policies aimed at low-income consumers, such as the Social Electricity Tariff (TSEE), require improvements.

Indeed, the burden of electricity tariffs on household budgets has been exacerbated by the accelerated growth of sectoral charges and taxes, which accounted for about 37% of consumer bills in 2023. The Energy Development Account (CDE), the main sectoral charge, has more than doubled over the past decade, driven by the expansion of subsidies — even for incentivized sources that have already become competitive. When adding to the CDE other subsidies, such as the Energy Reserve Charge, the PROINFA program, and incentives for Micro and Mini Distributed Generation (MMGD), the total amount surpassed R$ 60 billion in 2024, further pressuring tariffs. This increase disproportionately affects low-income families, for whom the cost of electricity can represent up to 18% of monthly income and more than 23% of the final price of the basic food basket. Beyond the direct effects, high energy costs also impact the competitiveness of Brazilian industry and the economy as a whole, making the revision of charges and subsidies urgent to ensure fairer and more sustainable tariffs.

In this context, it is important to mention that the tariff structure of the Brazilian Electricity Sector (SEB) presents significant distortions in cost allocation, penalizing captive consumers, especially those in low voltage. The way that migration of large consumers to the free market (ACL) is happening and the growth of MMGD have overloaded the regulated market (ACR), resulting in higher and less efficient tariffs. The CDE charge, which will exceed R$ 40 billion in 2025, follows an allocation criterion that disproportionately burdens low-voltage consumers, while subsidies to MMGD and self-production continue to grow, shifting costs onto other consumers, mainly smaller ones. Overcontracting imposed on distributors due to migrations exacerbates this scenario.

Moreover, the lower the population's ability to pay electricity bills, the higher the propensity for electricity theft and default. In other words, the increase in non-technical losses, mainly due to energy theft, emerges as a consequence of tariff injustice. Conversely, as losses rise, the cost of providing services increases, leading to higher tariffs. Thus, non-technical losses, particularly high in regions of greater socioeconomic

vulnerability, also become a cause of tariff injustice, creating a self-reinforcing “cause and effect” vicious cycle.

In 2023, the cost of non-technical losses totaled around R$ 10 billion, with part of this amount being passed onto tariffs and the rest absorbed by concessionaires, impacting their financial sustainability. It is important to note that the problem is expected to worsen in the future due to factors external to the electricity sector, mainly the growing expansion of areas dominated by organized crime, increased urban informality, and the worsening impacts of climate change, which intensify heatwaves and sharply increase the need for air conditioning in socioeconomically complex regions.

In this context, the Social Electricity Tariff (TSEE) remains the main mechanism to combat energy poverty in Brazil, offering graduated discounts on electricity bills for low-income families enrolled in the Cadastro Único (CadÚnico), the federal government’s registry for selecting and including low-income families in social programs. However, the policy presents limitations that reduce its effectiveness. First, millions of eligible families do not access the benefit due to bureaucratic barriers and registration difficulties. Moreover, the TSEE does not adequately consider regional heterogeneities and consumption patterns. Given this scenario, there is room to expand the program’s coverage by adjusting discounts to reflect the country’s socioeconomic and regional diversity. Recently, regulatory innovations such as those established by Decree No. 12.068/2024 have complemented the TSEE, allowing tariff differentiation in regions where non-technical losses are high, often the areas with greater socioeconomic deficiencies.

Additionally, besides rising temperatures, the effects of climate change pose concrete challenges to the electricity sector, making extreme weather events increasingly frequent and severe. To ensure the resilience of the electricity system while mitigating impacts on tariff affordability, a balanced planning approach between structural, complementary, and resilience investments is essential. The rising costs associated with climate adaptation affect the entire sector’s supply chain, making it necessary to strengthen infrastructure with innovative technologies and advanced monitoring models.

Finally, a closer analysis reveals that the escalation of tariff costs in Brazil is not only the result of technical and economic factors but also of growing political and institutional interference in the electricity sector. The proliferation of subsidies without clear technical criteria, the inefficient allocation of costs, and the asymmetry among consumers overload tariffs, deepening tariff injustice. It is essential that all consumers share the same costs and system benefits within the sector. Currently, the most vulnerable consumers bear costs not paid by others and do not benefit from advantages such as the right to electricity bill portability.

Moreover, this environment is compounded by the encroachment of the Legislature into competences traditionally reserved for the Executive, imposing decisions regarding energy planning and the contracting of specific sources, which compromises regulatory

predictability and economic efficiency. Recent examples, such as the expanded subsidies to MMGD and the attempts to include "pork-barrel amendments" (“jabutis”) into legislative bills, illustrate this worrying trend.

Given the challenges presented, we recommend the following guidelines to mitigate tariff injustice in the Brazilian Electricity Sector. These examples are not exhaustive, as many measures are needed to bring SEB closer to economic rationality, seize new development opportunities, and better adapt the sector to the impacts of climate change — consequently reducing the tariff injustices that burden Brazilian consumers.

We propose the following actions to mitigate tariff injustice:

1. **Strengthen the institutions of the Brazilian Electricity Sector.**
2. **Improve and disseminate indicators to diagnose energy injustices.**
3. **Increase transparency in electricity bills.**
4. **Reduce tariffs and rationalize overcharges.**
5. **Improve the allocation of electricity sector costs.**
6. **Modernize the tariff structure and enhance economic signals.**
7. **Reform the Social Electricity Tariff (TSEE).**
8. **Enable the economically sustainable opening of the free market to low-voltage consumers.**
9. **Combat electricity theft with a holistic approach.**
10. **Adapt the electricity sector to the effects of climate change.**

The implementation of the recommendations proposed in this report becomes even more critical in the current global context, in which Brazil assumes a central role in discussions on energy transition and social justice. With the upcoming COP30 and its recent leadership role within the G20, the country has the opportunity to consolidate an agenda that not only promotes the decarbonization of the global energy matrix but also ensures that the benefits of this transition reach the entire population, especially the most socioeconomically vulnerable. For this to happen, tariff justice must be recognized as a fundamental pillar of this transformation.

CONCEPTUAL FOUNDATIONS

Tariff Justice:

"the condition in which the composition and distribution of electricity sector costs ensure universal access to energy at affordable and equitable prices."

Given that this document addresses a topic still little explored in Brazil, except for a few recent exceptions, there is a risk that key concepts may not provide the necessary clarity for the discussion. Therefore, the aim here is to establish a solid conceptual foundation, underpinning the analyses presented throughout the text. These definitions are the result of an extensive literature review and the interviews conducted as part of this study.

Firstly, **energy justice**—the broader concept encompassing **tariff justice**—refers to guaranteeing universal access to energy at affordable and equitable prices. This perspective is embedded in the United Nations (UN) Sustainable Development Goals (SDGs), particularly Goal 7, which commits to *"ensure access to affordable, reliable, sustainable, and modern energy for all."*

To achieve this goal, it is essential to adopt an approach that acknowledges socioeconomic inequalities, prioritizing efforts towards families and communities in situations of greater vulnerability. This strategy takes into account the principle of **material equality**, which seeks to treat unequal individuals unequally, to the extent of their inequalities, as emphasized by Aristotelian philosophy and reiterated by important Brazilian thinkers such as Ruy Barbosa. Similarly, the concept of **contributive capacity**, often used in Tax Law, can be applied: vulnerable energy consumers should not bear a disproportionate burden relative to their available income, jeopardizing their basic needs.

In the direction of energy justice, **universalization**—typically measured by the percentage of the population with access to electricity—has made significant progress in Brazil over recent decades. The **Luz Para Todos (LpT)** Program, created in 2003, was a critical initiative in this respect. According to the Ministry of Mines and Energy (MME), in fifteen years, 16 million people gained access to electricity, and currently, about **99.8%** of Brazilian families (IBGE, 2019) have electricity service, making it the most universalized public service in the country.

However, it is well known that access alone does not guarantee sustainability, as many consumers struggle to afford their electricity bills. Access to energy at prices compatible with the population's economic conditions—known as **affordability**—remains an

energy justice (and in this case, tariff justice) objective to be pursued both in Brazil and globally.

To illustrate, a common indicator relates to the proportion of family income spent on energy. This measure is connected to **distributive justice**. A violation of this principle occurs when energy costs significantly compromise the household budget to the point of restricting access to other essential goods and services, such as food. A family may be considered in a situation of **energy poverty** if it spends more than a certain percentage of its income on energy services, often set at 10%, a threshold inspired by Brenda Boardman's work for the United Kingdom[1]. This approach offers a direct and easily understandable measure for guiding public policies. However, it is a unidimensional measure and may not capture the full extent of energy poverty, as it overlooks important aspects like the quality and adequacy of energy services.

Thus, there is a need to deepen this concept to grasp its multidimensionality. In Brazil, the topic is advancing under the guidance of the Energy Research Company (EPE) and the MME, through the development of the Observatory for the Eradication of Energy Poverty (OBEPE), inspired by similar initiatives in the United States, France, and the United Kingdom. The technical note "Analysis of International State Experiences on Poverty and Energy Justice: Definitions, Indicators, Measures, and Governance," published in 2024 by EPE, drew from international, especially European, references to study and address both phenomena in Brazil, aiming to create and enhance public policies such as the TSEE and the Gas Assistance Program.

Using the same methodology proposed by Boardman, the share of energy expenses in the median Brazilian household budget was approximately 6%[2] in 2009, suggesting a national cut-off criterion around 12%. Since then, however, tariffs have been increasingly pressured—mainly due to the expansion of subsidies—making the current situation more critical. Additionally, other indicators will compose the Observatory, enabling a multidimensional and updated view of energy poverty.

Equity, closely related to distributive justice and energy poverty, refers to reducing cost and benefit asymmetries among different socioeconomic classes, regions, and territories, also considering factors such as gender and race. Meanwhile, **energy inclusion** is a broader and complementary concept, more aligned with **procedural justice** and **recognition justice**. It goes beyond simply providing energy and advocates for a more integrated relationship between consumers and the electricity sector, focusing on reducing inequalities and valuing citizenship. These approaches aim to ensure that the right to energy becomes an element of social transformation and a tool for combating poverty in its broadest sense. However, it is important to highlight that the debate on

[1] Among these, the most relevant and first to introduce the 10% indicator was the book *Fuel Poverty: From Cold Homes to Affordable Warmth*, published in 1991. The reference corresponds to twice the median share of energy expenses in consumer income in the United Kingdom at the time.

[2] According to data from the Household Budget Survey (POF), published by IBGE in 2009.

the best way to finance the costs associated with energy inclusion remains highly relevant: if energy inclusion is pursued exclusively through electricity tariffs, undesirable side effects may arise, such as higher final consumer tariffs and price signal distortions.

Within this conceptual framework, tariff justice can be defined. For the purposes of this paper, beyond material equality guiding fair public policies, the concept of justice can be drawn from John Rawls' liberal egalitarian theory. According to Rawls, a just society must be structured based on principles chosen under a **veil of ignorance**—a mental experiment in which individuals deliberate on social rules without knowing their position in society (whether they will be rich or poor, residential or industrial consumers). Applying this reasoning to tariff justice, a fair tariff system should be designed so as not to privilege specific groups, ensuring equitable access to energy and avoiding disproportionate burden-sharing among consumers. Moreover, it is crucial to seek a framework that minimizes the global costs of service provision, avoiding inefficiencies and the transfer of costs unrelated to the service itself onto tariffs.

Within this structure, **tariff justice** can thus be defined as *"the condition in which the composition and distribution of electricity sector costs ensure universal access to energy at affordable and equitable prices,"* ensuring that no consumer, especially the most vulnerable, is disproportionately burdened. Adapting the **natural rights** conception embedded in Article 5 of the Brazilian Federal Constitution to the context of tariff justice, public policies must ensure that this principle is reflected in the tariff structure, promoting equity in access to energy for all Brazilians, without any distinction.

A DIAGNOSIS OF TARIFF (IN)JUSTICE IN BRAZIL

The Burden of Electricity Tariffs on Household Budgets

In the electricity bill paid by consumers, in addition to costs directly related to energy consumption, which covers generation, transmission, and distribution, there are also charges and taxes. As shown in Figure 1, charges (which mainly include subsidies) represented, on average, **17%** of consumers' bills in 2023, while taxes accounted for around 20%. Thus, charges and taxes together represented 37% of the final bills.

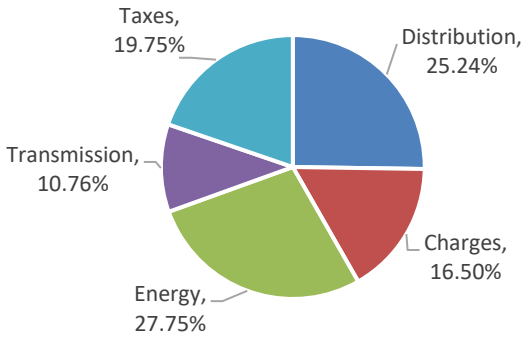


Figure 1 - Electricity Tariff Composition (Brazil Average in 2023). Source: ABRADEE.

Between 2010 and 2023, the "charges" component was the fastest growing element of electricity tariffs (**240.5%**), expanding at a rate **twice** that of inflation (IPCA). In contrast, the distribution component was the only one to grow below inflation (**76.5%**), reflecting the efficiency incentives established by ANEEL's regulation[3]. Meanwhile, the generation and transmission components grew slightly above inflation (**123.3%** and **121.1%**, respectively).

These effects are illustrated in Figure 2.

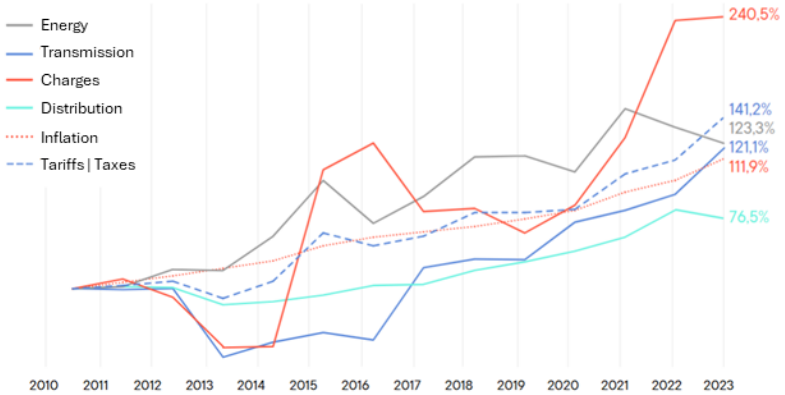


Figure 2 - Cumulative Evolution of Tariff Components and Inflation (2010–2023). Source: ABRADEE.

[3] National Electric Energy Agency (ANEEL), which is an independent government agency under special regime linked to the Ministry of Mines and Energy (MME), responsible for regulating the Brazilian electricity sector.

The expansion of subsidies deserves particular attention, as it has increasingly raised sectoral charges passed on to final consumers, a consequence of various legislative interventions[4]. For example, the Energy Development Account (CDE) charge—which accounted for almost **60%** of sectoral charges passed on to tariffs in 2023—**more than doubled** over the past 10 years.

As illustrated in Figure 3, this growth was largely driven by the expansion of subsidies to incentivized sources[5], which increased more than **fifteenfold** during the period. Despite technological advances that have made these sources progressively cheaper and more competitive—especially wind and solar, favored by Brazil's abundant natural resources—subsidies for these sources have continued[6] to expand.

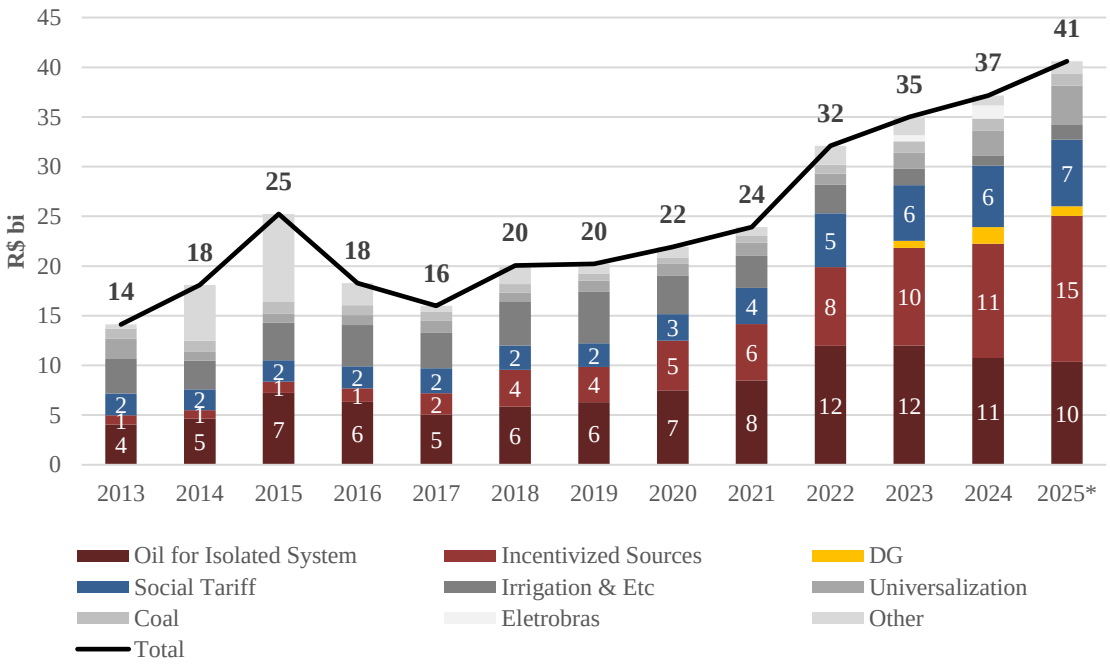


Figure 3 - CDE Evolution (2013–2025) in Billion BRL. Source: Own elaboration, based on ANEEL data.

Another point that consistently draws attention in the composition of the CDE concerns the CCC (Fuel Consumption Account), which covers the costs of energy generation and contracting to supply the Isolated Systems. It is observed, first, that this cost increased by 140% between 2017 and 2022, despite various initiatives aimed at reducing it, such

[4] Unlike other tariff components, sectoral charges are created by laws passed by the National Congress aiming to enable the implementation of public policies in the Brazilian Electricity Sector.

[5] Includes small hydroelectric plants, solar, wind, biomass, and cogeneration sources. Consumers and generators using incentivized sources are entitled to discounts on the use of distribution and transmission systems (TUSD and TUST, respectively).

[6] In this context, Provisional Measure 1212/2024 can be cited, which recently expanded subsidies for incentivized sources.

as interconnecting part of the isolated systems using resources collected through tariffs. Since then, this expense has remained relatively constant, at around R$ 10 billion. In other words, although intuition would suggest a reduction in this longstanding charge due to its nature, the complexity of the legislation governing the CCC has ultimately prevented its decrease, highlighting the need to revisit the current rules and seek legal and regulatory pathways to reduce this item and rationalize its funding.

In addition to the CDE, various other charges and subsidies impact electricity tariffs, including the Reserve Energy Charge (EER), the Incentive Program for Alternative Energy Sources (PROINFA)[7], and the implicit subsidy for MMGD[8], which are indirectly incorporated into tariff formation. Together, these exceeded **R$ 60 billion** in 2024.

To enhance transparency regarding tariff formation and the economic costs caused by subsidies, ANEEL created the "Subsidy Meter," which indicated that subsidies reached **R$ 48 billion** in 2024[9]. Compared to 2023, when the value was R$ 41 billion, the increase was significant, mainly driven by the "Incentivized Source" and "MMGD" categories. The latter saw the most substantial growth, rising from R$ 7 billion in 2023 to R$ 12 billion in 2024, accounting for almost 4% of residential electricity tariffs.

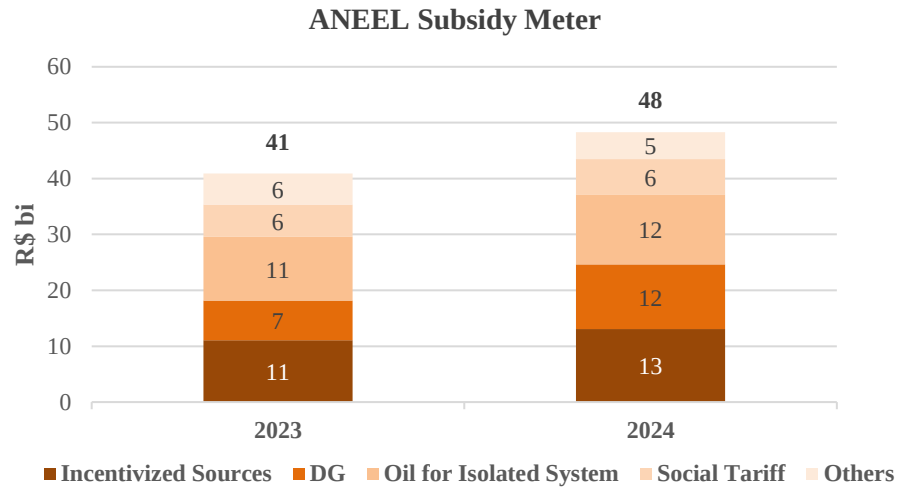


Figure 4 - Evolution of Subsidies Between 2023 and 2024. Source: Own elaboration based on ANEEL data, accessed on April 29, 2025.

[7] Incentive Program for Alternative Energy Sources (PROINFA), created in 2002 by Law No. 10,438/2002 to diversify Brazil's energy matrix.

[8] Before Law No. 14,300/2022, which established the legal framework for Distributed Generation (MMGD) in Brazil, the costs not borne by consumers with distributed generation were indirectly passed on to other consumers' tariffs during the tariff processes. Since distribution costs are mostly fixed, when a consumer with MMGD stops paying for them through compensated energy, these amounts are implicitly redistributed into the local distributor's tariff, resulting in tariff increases for other consumers or revenue loss for the distributor.

[9] ANEEL's Subsidy Meter does not include some sectoral charges, such as PROINFA and the Reserve Energy Charge, for example.

Finally, since this section focuses on the burden of electricity tariffs on household budgets, it is important to emphasize that the issues analyzed above primarily concern the direct impact on captive LV consumers who do not benefit from MMGD. However, analyses must also consider the indirect effects of electricity costs on the production of goods and services consumed by families, as energy is a fundamental input in several productive sectors, particularly industry.

Thus, the excessive allocation of costs and subsidies in the tariffs of other consumer classes (such as industrial and commercial), and across different voltage levels, also ends up burdening Brazilian households indirectly. This context highlights the need for public policies to adopt a holistic view of the direct and indirect impacts of electricity tariffs, considering all consumption classes and voltage levels.

For example, the study *"The Impacts of Energy Prices on Economic Growth and Development,"* conducted by Ex Ante Consultoria Econômica and ABRACE Energia, reveals that energy prices represent 23.1% of the final price of basic food baskets[10] in Brazil. According to the same report, direct and indirect energy costs account for up to 18% of the household income for families earning up to twice the minimum wage.

A third dimension of this analysis is the impact of electricity costs on the competitiveness of national industry, its role in promoting economic growth, and its intergenerational implications. The burden of electricity bills, besides disproportionately affecting low-income households, also limits Brazil's economic development, which is anchored in clean and affordable energy. In this context, progress toward reducing inequalities—thus promoting both energy and social justice—is hindered by tariff distortions. As a result, Brazil risks depriving future generations of the better quality of life enabled by the cheap energy matrix it possesses.

Tariff Subsidies: The Distribution of Costs in the Brazilian Electricity Sector

Regarding cost distribution, it is first important to highlight how these costs are recovered through the different tariff modalities and voltage levels. This concerns the design of the tariff structure in the country. Additionally, it is necessary to assess how costs are allocated among captive consumers, free consumers, and those benefiting from Distributed Micro and Mini Generation (MMGD).

Starting with the tariff structure, the tariffs applied to low-voltage (LV) consumers are single-part and volumetric, meaning they are entirely linked to electricity consumption. Moreover, virtually all LV consumers pay a fixed tariff regardless of their hours of usage throughout the day.

[10] According to the study, it refers to: "fresh agricultural products, meat and eggs, fish, forestry products, processed meat and dairy products, flours and sugar, bread, pasta, and other flour-based products."

It is worth noting that time-of-use tariffs provide an economic efficiency incentive that varies throughout the day, encouraging consumption shifts to periods of lower cost. This mechanism can be applied in single-part or two-part tariffs, which consider both electricity consumption and power demand, or in multi-part tariffs, which also consider factors such as locational signals.

With time-of-use tariffs, during peak hours—when demand is high and generation often depends on more expensive sources like thermoelectric plants—tariffs would be higher, discouraging excessive consumption. Conversely, during off-peak periods, when cheaper and, in Brazil's case, less emitting sources like wind and solar are more available, tariffs would be lower, encouraging consumption. This approach benefits consumers by reducing their bills and improves system management, mitigating the need for additional infrastructure investments, which in turn contributes to tariff affordability in the long term.

It should be emphasized that time-of-use tariffs are widely used in other countries and, in Brazil, are already applied to larger consumers. Unlike LV consumers, medium-voltage (MV) and high-voltage (HV) consumers are charged two-part tariffs[11].

Additionally, analyzing the distribution of sector costs among different types of consumers, it is important to recognize the asymmetries between the different energy supply modalities. For captive consumers, the upward tariff pressure is exacerbated by the migration of large and medium-sized consumers to the Free Contracting Environment (ACL)[12], which already accounts for about 40% of the country's consumer market. While free consumers can negotiate prices and potentially access cheaper energy, captive consumers are burdened with the high—and often inefficient—costs of the Regulated Contracting Environment (ACR), where energy purchasing is managed through government-organized auctions. It is important to note that the ACR primarily serves LV consumers, who currently do not have the option to migrate to the free market.

Indeed, energy contracting for the ACR includes a portfolio of projects with very specific characteristics, often more expensive than the country's marginal expansion cost. For example, energy from Angra 1 and 2 nuclear plants[13], the Itaipu Binational hydroelectric plant, and gas and oil thermal plants are examples of contracts that have brought—and often continue to bring—additional costs to captive consumers, despite their benefits extending to both captive and free consumers. In contrast, Power Purchase Agreements (PPAs) negotiated in the ACL, with a massive share from cheaper sources

---

[11] The "blue" time-of-use tariff is composed of differentiated consumption (R$/kWh) and demand (R$/kW) tariffs that vary according to the hours of use throughout the day. The "green" time-of-use tariff, in turn, has a fixed demand component (R$/kW), while the consumption component (R$/kWh) varies over the course of the day.

[12] While free consumers can choose their energy supplier and negotiate prices, captive consumers are obligated to purchase energy from the distributor to which they are linked. Currently, the free market is restricted to high- and medium-voltage consumers, which already exceed 60,000 consumer units.

[13] Whose responsibility falls exclusively on captive consumers, having exceeded R$ 4 billion in 2024.

like wind and solar, have progressively offered lower prices than those practiced in the regulated market, as shown in Figure 5.

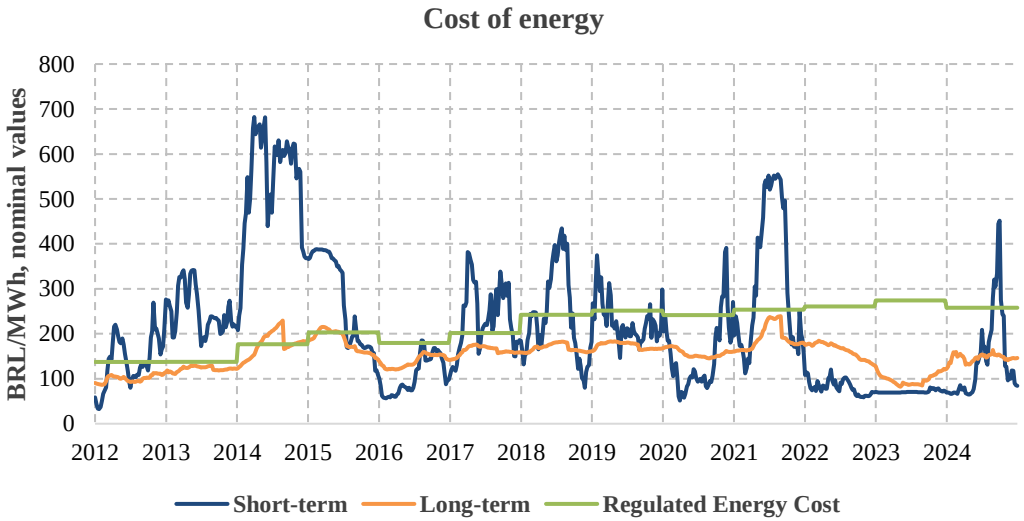


Figure 5 - Energy Costs in the ACR and ACL (R$/MWh). Source: Own elaboration.

Another important issue within the energy contracting for the ACR is the overcontracting imposed on distributors when consumers migrate to the ACL or MMGD. The current situation, where: (i) the contract terms in the distributors' portfolios are very long; (ii) ACR contract prices are significantly less competitive compared to ACL prices; (iii) existing subsidies for consumers leaving the ACR are substantial and further reduce the ACR's competitiveness; and (iv) portfolio management mechanisms are largely ineffective; has resulted in permanent overcontracting from 2016 to 2024.

However, the costs of this overcontracting have been allocated only to captive consumers under current rules, an inefficient and unfair outcome. One solution discussed within the electricity sector to prevent this situation from persisting—especially with the anticipated opening of the market to LV consumers—is the creation of a sectoral charge that would allocate the costs of overcontracting across all consumers, both in the ACL and ACR. It would also be important to consider allocating part of this cost to MMGD beneficiaries and to improve the effectiveness of existing distributor portfolio management mechanisms.

Cost allocation differences also occur across LV, MV, and HV consumers regarding sectoral charges. For example, the CDE (Energy Development Account) charge—expected to exceed R$ 40 billion in 2025—is higher for LV consumers, following the allocation criterion established by law[14]. This legal framework sets a transition rule until 2030, whereby the share borne by small consumers will gradually increase. In other words, the tariffs of LV consumers, which are already higher than those for MV and

[14] Defined in Law No. 10,438/2002 and later amended by Law No. 13,360/2016.

HV consumers, will become even higher over the next few years, reaching three times the level of HV tariffs by 2030, as shown in Table 1.

Table 1 - CDE Cost Allocation and Transition Rule. Source: ANEEL. ***Note: Figures represent the ratio of CDE tariffs for low-voltage and high-voltage consumers until 2030.***

Year	(S/SE/CO) / (N/NE)	AT / BT	MT / BT	BT
2024	1,91	0,53	0,80	1,00
2025	**1,72**	**0,49**	**0,77**	**1,00**
2026	1,54	0,45	0,75	1,00
2027	1,38	0,42	0,73	1,00
2028	1,24	0,39	0,71	1,00
2029	1,11	0,36	0,69	1,00
2030	1,00	0,33	0,67	1,00

The transition rule also provides for equalization across regions by 2030. Currently, CDE tariffs for consumers in the South/Southeast/Central-West (S/SE/CO) regions are more than 70% higher than those in the North/Northeast (N/NE) regions. However, by 2030, they are expected to equalize. Nevertheless, even after this adjustment, there will still be a transfer of resources from S/SE/CO consumers to N/NE consumers, as these regions receive the largest share of CDE resources[15].

Other factors further exacerbate the cost burden on captive consumers, mainly LV consumers. These include the implicit subsidy to MMGD, which accounts for the vast majority of subsidies for this modality—totaling R$ 12 billion in 2024, according to ANEEL's Subsidy Meter. Law No. 14,300/2022 stipulates that consumers benefiting from units already installed or requesting access by January 2023 will maintain full subsidies until 2045. These consumers, known as "GD1", will not pay any grid usage charges or sectoral charges, shifting these costs to other consumers until 2045.

As a result, MMGD has experienced extremely accelerated growth. Currently, MMGD's installed capacity stands at 34 GW, about 15% of the national generation park. It is now the second-largest source of electricity generation in Brazil and has grown sevenfold over the last four years. For this year, growth is expected to remain strong, as there is a backlog of 8 GW in projects filed before the legal deadline, awaiting connection to take advantage of the long-term and significant benefit. Thus, it is possible to affirm that, in 2025, the MMGD subsidy will become the largest in the Brazilian Electricity Sector (SEB), surpassing all other subsidized categories.

There is an important ongoing discussion about mitigating the amplification of these effects, centered around the valuation of MMGD's costs and benefits, as established in Article 17 of Law No. 14,300. This provision, aligned with international debates, aims

[15] The transfer of resources between regions persists even after the CDE tariff equalization due to structural factors and sectoral policies. The North and Northeast regions continue to receive more subsidies due to the high cost of thermal generation (CCC), greater participation of low-income consumers benefiting from the TSEE, and the need for investments in universal access programs (such as Luz para Todos and Mais Luz para a Amazônia).

to avoid unsustainable cross-subsidies through tariffs that accurately reflect MMGD's system-wide costs and benefits.

However, the implementation of this mechanism remains pending, undesirably delaying an important discussion to mitigate the cost transfer from MMGD beneficiaries to other consumers. Moreover, even after its eventual implementation, Article 26 of the same Law limits its scope, exempting GD1 consumers from cost reallocation, thus restricting regulatory progress for this class.

Regarding the explicit subsidy to MMGD[16], its impact on the CDE remains limited for now due to the transitional periods established by the law and by ANEEL's regulations. However, a significant increase is projected over the next few years as more consumers adopt MMGD, making it essential to reassess its allocation method—currently restricted to ACR consumers.

Another modality benefiting from exemptions on electricity bills—and which deserves analysis—is self-production, which exempts beneficiaries from paying a substantial portion of sectoral charges, including the CDE, PROINFA, and EER. Historically incentivized to reduce costs and enhance industrial competitiveness, recent regulatory changes have expanded distortions, particularly through the so-called "equated self-production," where consumers access self-production benefits via shareholding arrangements without direct investment in generation. This modality is now the fastest-growing self-production model.

Therefore, it is important to specifically assess whether maintaining the growing costs transferred by "equated self-production" to other consumers is appropriate, as it undermines tariff affordability and tariff justice.

The Chronic Inefficiency of Non-Technical Losses

One of the key themes for assessing measures capable of advancing tariff justice is related to non-technical energy losses. In the electricity distribution segment, these losses are calculated as the difference between total losses and technical losses[17]. Also known as commercial losses, they result from factors such as electricity theft ("gatos"), meter tampering, and metering errors. Non-technical losses represent a critical inefficiency and are mainly concentrated in areas of socioeconomic vulnerability, where informality, poverty, inequality, and irregular land occupation prevail[18].

---

[16] The explicit subsidy refers to the CDE-GD, which was established by Law No. 14,300/2022. The CDE-GD is a portion of the CDE intended to cover the costs of tariff benefits granted to new entrants (connection requests after January 7, 2023) and to existing consumers of distributors with a market below 700 GWh/year.

[17] Technical losses are inherent to the transmission of electricity and occur due to the conversion of electrical energy into thermal energy in conductors (Joule effect), losses in transformer cores, dielectric losses, among other factors.

[18] It is worth clarifying that in some regions of the country, such as Manaus, these losses are observed across all consumption and income classes.

The greater the tariff injustice, the lower the population's ability to pay electricity bills, leading to a higher propensity for electricity theft and delinquency. In other words, the increase in non-technical losses emerges as one of the consequences of energy poverty. Conversely, as non-technical losses rise, so does the cost of electricity distribution services, leading to higher tariffs. Thus, non-technical losses also become a cause of energy poverty, creating a self-reinforcing "cause-and-effect" cycle. Therefore, as mentioned, non-technical losses are a topic of utmost importance when assessing tariff justice.

Figure 6 clearly illustrates the disparity in non-technical loss rates across the low-voltage market[19] by Brazilian state, with Amazonas recording the highest rate (119.8%), followed by Amapá (67.4%) and Rio de Janeiro (54.9%).

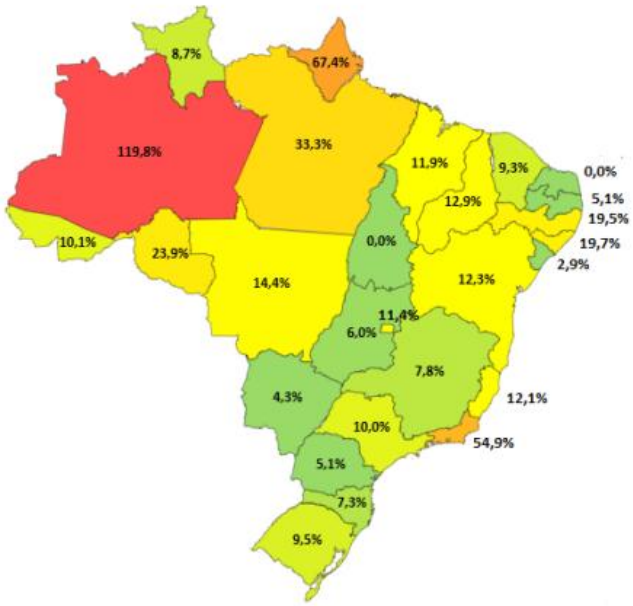


Figure 6 - Real Non-Technical Losses over Low-Voltage Billed Energy (2023). Source: Excerpt from "Electricity Distribution Losses Report 2024", ANEEL.

The high levels of non-technical losses have a significant negative economic impact on both distribution companies and consumers. This occurs because, to encourage efficiency and the continuous reduction of losses, ANEEL establishes[20] maximum limits for non-technical losses that can be passed through tariffs in each distributor's tariff review cycle[21].

However, when a distributor's actual non-technical loss levels exceed the regulatory

[19] In terms of indicators, ANEEL monitors the non-technical loss index relative to the low-voltage market, as it is at this voltage level that nearly all energy losses are observed.

[20] The definition of these levels is made by ANEEL's Regulatory Loss Methodology, based on econometric models and efficiency benchmarks. Details can be found in Submodule 2.6 of the Tariff Regulation Procedures (PRORET).

[21] The tariff cycle is the period between tariff reviews and can vary from 3 to 5 years. The exact period is defined in the concession contract of each distributor.

limits—that is, the portion eligible for tariff recovery—the distribution company itself must absorb the cost of the excess losses. In such cases, depending on the gap between the actual and regulatory levels, the financial impacts on the utility can be critical and, in the long term, jeopardize the company's economic and financial sustainability, ultimately affecting all consumers in the concession area.

In 2023, total energy losses in distribution systems were equivalent to 14.1% of all energy injected, with 38 TWh (48%) attributable to non-technical losses. **In monetary terms, non-technical losses totaled approximately R$ 9.9 billion**, with the amount split between distribution companies and consumers (ANEEL, 2024). Therefore, the economic relevance of this issue for Brazil's electricity distribution segment and consumers is clear.

From a regulatory standpoint, around 27 TWh of non-technical losses were passed through to electricity tariffs—approximately 70% of the total cost. In other words, **distribution companies had to absorb a loss of approximately R$ 3 billion** in 2023 due to non-technical losses exceeding the regulatory limit. As shown in Figure 7, in absolute terms, Light reported the highest loss amount for the year, at **R$ 874.5 million**, followed by Amazonas Energia with **R$ 646.1 million**, and Enel Rio with **R$ 218.8 million**. These financial losses significantly destabilize the distributors' economic and financial health, representing about 37% of Light's Regulatory EBITDA, 67% for Amazonas Energia, and 12% for Enel Rio. This scenario demands regulatory improvements and the review of public policies such as the Social Electricity Tariff (TSEE), as will be discussed later.

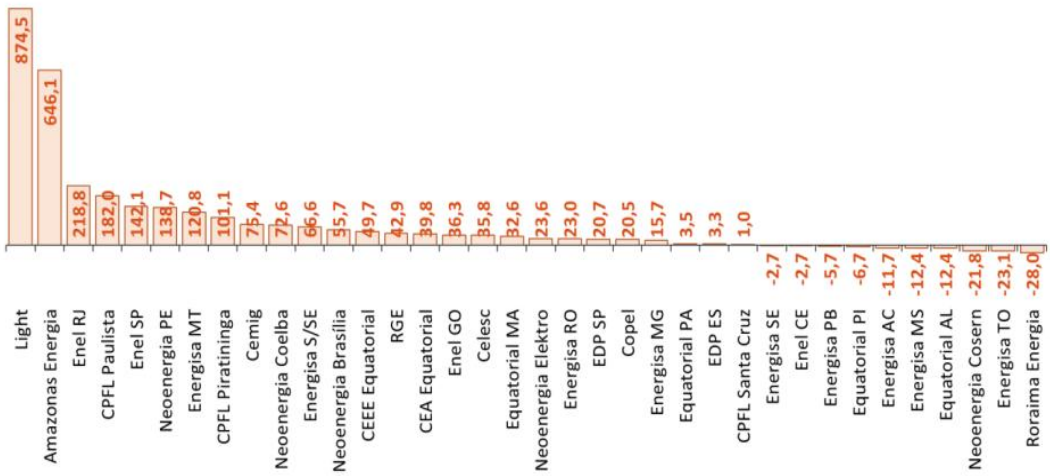


Figure 7 - Financial Impact of Disallowed Non-Technical Losses by Distributor (2023). Source: Excerpt from "Electricity Distribution Losses Report 2024", ANEEL.

On the other hand, as previously mentioned, beyond burdening distributors, non-technical losses also burden consumers. Nationwide, they represent approximately 3% of the average electricity tariff, excluding taxes. In distributors operating in regions with high socioeconomic complexity, such as Amazonas Energia and Light, the impact of these losses on tariffs is even more significant. This means that regular consumers must cover, through their bills, the costs associated with energy theft by irregular consumers. Figure 8 highlights the tariff impact of non-technical losses by distribution company

for the year 2023.

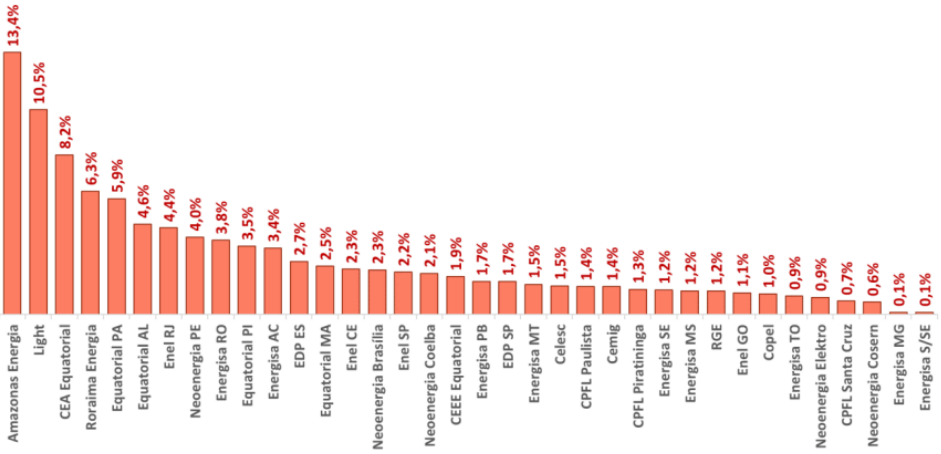


Figure 8 - Share of Non-Technical Losses in Residential Tariffs, Excluding Taxes (2023). Source: "Electricity Distribution Losses Report 2024", ANEEL.

In this context, the incentive-based regulatory model currently in place in Brazil presents a complex and stimulating challenge for the regulatory agency and distribution companies regarding the treatment of non-technical losses. On one hand, it is necessary to maintain mechanisms that encourage distributors to continuously improve efforts to combat electricity theft; on the other hand, it is essential to preserve the economic and financial balance of concessions, avoiding the imposition of loss reduction targets that exceed the distributors' management capabilities. These challenges are further intensified by the significant socioeconomic heterogeneity across concessions in the country and the frequent pass-through of undue or unnecessary costs and subsidies to final tariffs.

Beyond the impact on tariffs and concession sustainability, electricity theft also compromises the safety of electrical installations, significantly increasing the risk of short circuits, fires, and even fatal electric shocks. Illegal connections often do not follow technical standards and are typically installed precariously and without adequate safeguards. Due to their nature, clandestine connections also affect the quality of supplied electricity, causing voltage drops and supply interruptions, thereby hampering the efficient operation of distribution companies.

Regarding the socioeconomic complexities' influence on electricity theft, it is important to first highlight that poverty and inequality are central factors for understanding energy injustice in Brazil. For instance, in Rio de Janeiro and the North Region—where the highest levels of non-technical losses are recorded—**38.5%** and **21%** of the population, respectively, live in **poverty**[22]. This condition, exacerbated by the COVID-19

[22] These data follow the World Bank's poverty line parameters, defined as an income of US$6.85 per day in Purchasing Power Parity (PPP), based on 2017 international prices. This data was published in the "Summary of Indicators 2024" by IBGE.

pandemic, is compounded by high social inequality, as indicated by Gini indexes[23] of 0.540 and 0.500, respectively. These indicators reveal that access to regular electricity supply is a major challenge for many families, for whom electricity bills represent a significant share of their income.

Moreover, in some regions of Brazil, organized crime plays a significant role in controlling territories, defining the limits for commercial activities and services. Militia groups, criminal factions, and armed groups usurp state power and challenge the legitimate monopoly of force. In Rio de Janeiro, for example, according to a study (Fogo Cruzado, 2024), between 2005 and 2021, the area under the control of armed groups in Greater Rio more than doubled, growing by 105.73%. During this period, militia control expanded by 204.6%, tripling their territorial dominance, while factions such as Comando Vermelho and Terceiro Comando Puro expanded their areas by 89.2% and 79.1%, respectively.

In the context of electricity distribution services, regions controlled by such groups perpetuate the phenomenon of non-technical losses, as distribution companies are often prevented from conducting operations such as billing, inspections, or service disconnections due to delinquency or illegal connections. Furthermore, some of these groups exploit electricity as a source of income, charging clandestine fees from residents and illegally competing in the distribution segment—even though the service is actually provided by the concessionaire.

In Brazil, besides the scenario of socioeconomic inequality and armed territorial control, there is also an urbanistic issue characterized by irregular constructions that form favelas and urban communities. The high density of construction creates urban heat islands that hamper air circulation and prevent the nighttime dissipation of heat accumulated during the day. Additionally, the reduction of green spaces—essential for evapotranspiration and thermal regulation—further exacerbates local heating, especially during heatwaves.

There is also climate inequality, which exacerbates urban challenges and its correlation with electricity consumption, serving as another vector for energy theft. Taking São Paulo as an example, a study by Mackenzie Presbyterian University (UPM) revealed that the heat sensation experienced by residents of the Paraisópolis neighborhood was up to 8°C higher than that of neighboring Morumbi. According to the findings[24], the main factors for this disparity are the lower number of trees, higher population density, and the type of buildings.

Also in São Paulo, a study conducted by researchers at the University of São Paulo (USP) classified Paraisópolis as a heat island, being 4°C above the city average. The maps shown in Figure 9, available on the UrbVerde platform, illustrate the evolution of

[23] The Gini Index is a statistical measure used to calculate income distribution inequality within a population. Its value ranges from 0, where 0 represents perfect equality (everyone has the same income), to 1, where 1 indicates maximum inequality (a single person holds all the income). This data was published in the "Summary of Indicators 2024" by IBGE.

[24] Available at: https://www.mackenzie.br/noticias/artigo/n/a/i/pesquisa-do-mackenzie-revela-diferencas-de-temperaturas-entre-bairros-de-sao-paulo.

this temperature differential between neighborhoods, comparing 2016 and 2021.

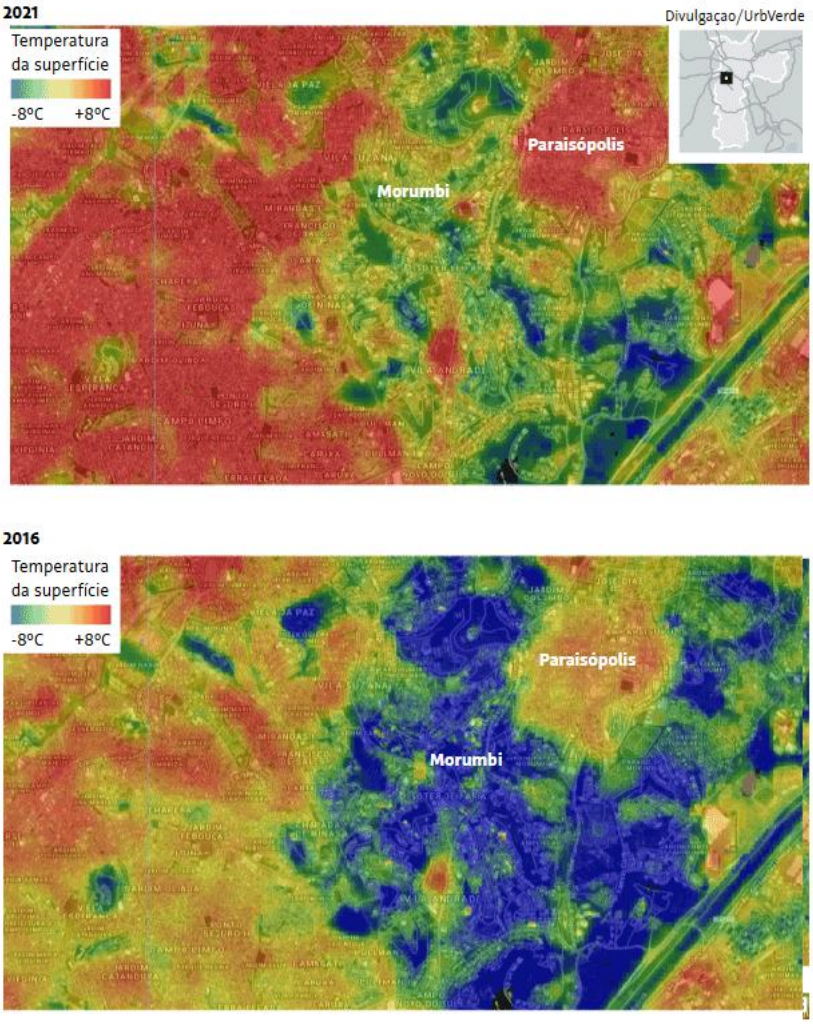


Figure 9 - Surface Temperature in Paraisópolis and Morumbi (2016 and 2021). Source: Folha de São Paulo.

As a corollary of these problems, amid the "new normal" of frequent extreme weather events that can cause thermal stress and health complications, the adoption of air conditioning units becomes a reasonable and necessary measure to maintain thermal balance. According to Procel, in 2019, the penetration of air conditioning units was 47.7% in Rio de Janeiro and 42.7% in Amazonas, significantly higher than the national average of 16.7% (PROCEL, 2024).

Often overlooked among these vectors of non-technical losses is the possession of inefficient appliances. According to the 2019 Survey on Possessions and Habits conducted by Procel, over 60% of households in the A and B classes owned refrigerators purchased within five years prior to the survey, whereas nearly 40% of D/E households had acquired their appliances between 6 and 10 years earlier, and 8% had appliances older than 11 years. Additionally, while more than 92% of higher-income households purchased new refrigerators directly from manufacturers, only 71% of D/E class households did so, with 27% using second-hand appliances (POLIS, 2022).

Given that many of these issues fall outside the competencies of distribution companies and often even the electricity sector itself, collaboration with other government bodies is urgently needed. Regarding non-technical losses, regulation, in conjunction with Public Security, Economic, and Urban Planning entities, could create conditions to reduce these inefficiencies and their tariff impacts. Such an integrated approach is necessary to promote greater sustainability in the electricity sector and strengthen tariff justice.

The Landscape of Tariffs for Low-Income Consumers

In order to serve the low-income population with affordable electricity prices, Brazil has implemented the *Social Electricity Tariff (TSEE)*, established by Law No. 10,438 of 2002 and reformed in 2010 by Law No. 12,212. It offers a discount of up to **65%** on electricity for consumers registered in the Single Registry for Social Programs (CadÚnico), with a per capita family income below half the minimum wage, and for beneficiaries of the Continuous Cash Benefit (BPC), as well as families with a monthly income of up to three minimum wages that include a person with a disability.

In addition to exemption from the quotas of the Energy Development Account (CDE) and the Incentive Program for Alternative Energy Sources (PROINFA), which together account for about 12% of the average supply tariffs for residential classes, the TSEE also grants an additional discount on the energy tariff, with cumulative discounts according to consumption brackets, as shown in Table 2.

Table 2 - TSEE Discount Brackets Source: Own elaboration.

Monthly Electricity Consumption Range (kWh)	Discount
from 0 to 30	65%
from 31 to 100	40%
from 101 to 220	10%
from 221 onwards	0%

Across Brazil, there are about **17 million** beneficiaries, representing approximately **21%** of residential customers. However, the benefit's penetration varies by region: it reaches 36% in the North and 33% in the Northeast, while in the Southeast (16%), South (11%), and Center-West (11%), the coverage is significantly lower. In 2024, the program cost **R$ 6.2 billion**, covered by CDE. Although it is a crucial public policy for combating energy poverty, there is evidence that the program's effectiveness in alleviating the tariff burden for low-income consumers is diminishing.

Among the reasons for this gap are issues related to CadÚnico. On the one hand, the registration process remains analog and bureaucratic at the Reference Centers for Social

Assistance (CRAS). On the other hand, many families are unaware of their entitlement to the benefit. Additionally, to maintain eligibility, families must update their registration every two years or when significant changes occur.

In this regard, Law No. 14,203/2021 established automatic benefit granting for families registered in CadÚnico, explaining the 80% increase in the number of beneficiaries since January 2022, when the measure came into force. Nevertheless, according to ANEEL, there are still more than 7.7 million families eligible for the benefit who do not receive it, for reasons connected to the socioeconomic vulnerabilities and complexities of the potential beneficiaries, which act as barriers to accessing the discounts. A common example is when the electricity bill holder is not the same person registered in CadÚnico.

Figure 10 shows the evolution of this gap between the number of families eligible for the TSEE and the number of families actually receiving the benefit. In January 2024, the proportion was 68.2%, confirming that there is room to improve access to the Tariff.

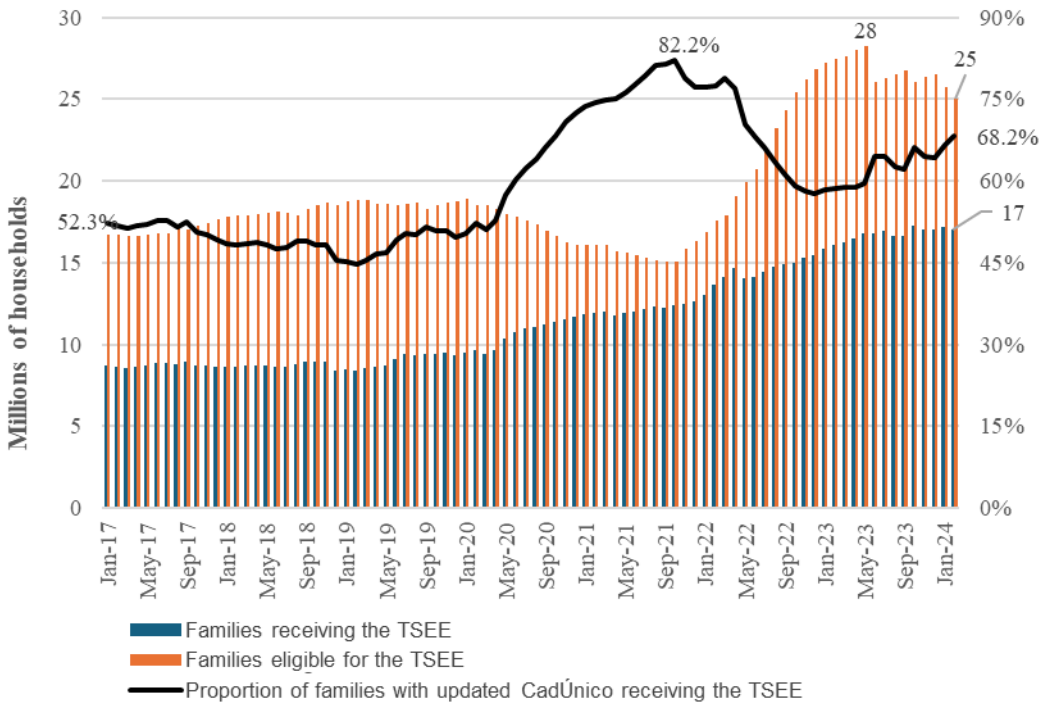


Figure 10 - Evolution of the Proportion of Families with Updated CadÚnico Registered for TSEE
Source: Adapted for Instituto Pólis based on data from the Ministry of Citizenship.

Another issue reinforcing the need to reform the Social Tariff relates to changes in household consumption patterns over the years. Figure 11 shows the growth in the average consumption of TSEE beneficiaries across Brazil. Between January 2017 and January 2024, there was a **29%** increase, which may be associated with greater thermal comfort needs imposed by climate change, especially during the summer, among other factors that deserve further study.

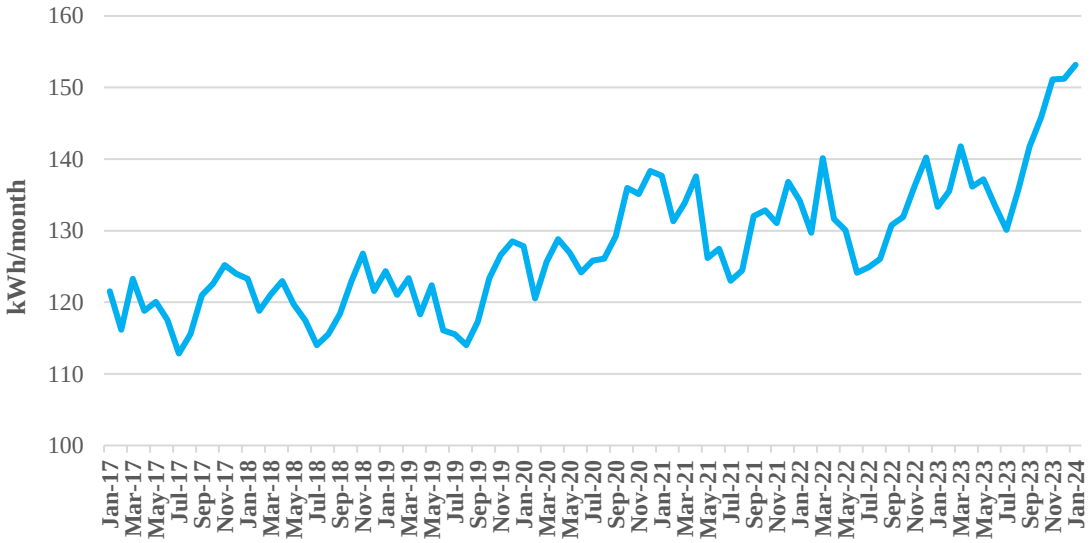


Figure 11 - Average Consumption of TSEE Beneficiaries Source: Adapted for Instituto Pólis based on data from ANEEL.

Finally, Figure 12 below illustrates the profile of TSEE discounts relative to energy consumption. It is observed that these two variables are inversely proportional: higher consumption results in lower discounts, reflecting an implicit incentive for energy efficiency, which is commendable. On the other hand, given the trend of increasing average consumption among TSEE beneficiaries, the current discounts have become outdated.

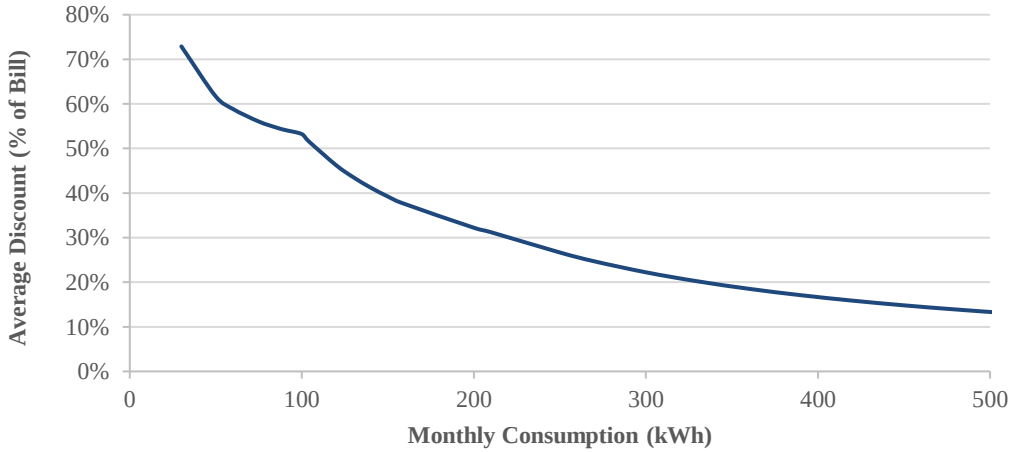


Figure 12 - TSEE Discount Curve. Source: Developed by PSR based on Law No. 10,438/2002.

The observations outlined above reduce the effectiveness of the public policy related to the Social Electricity Tariff (TSEE) in combating energy poverty. For example, when applied to the average monthly electricity consumption of Brazilian households (**180 kilowatt-hours – kWh**), the TSEE discount would only cover about **35%** of the bill. In comparison, in countries like India (Delhi) and Colombia, social tariffs provide discounts of up to **100%** and **60%**, respectively, for the same consumption level.

Beyond these challenges, the TSEE's inefficacy is also linked to its inability to adequately consider the country's heterogeneities. First, the cost of living varies significantly between regions. This implies that in places where expenses for food, housing, transportation, and other basic needs are higher, the income threshold set for TSEE eligibility (half the national minimum wage per capita) may exclude families who, despite not formally qualifying, still struggle to afford their energy bills under standard tariffs.

Second, consumption patterns—affected by climate and land use (e.g., urban heat islands)—lead to higher energy bills, further burdening families. Since the TSEE discounts are applied in consumption brackets, in regions where electricity consumption needs are higher, the mechanism becomes less effective in making energy bills more affordable for low-income populations. For instance, the average discount under the TSEE is 52% in Bahia but only 33% in Amazonas.

Additionally, ANEEL data[25] reveals that beyond regional differences in TSEE coverage, there are also discrepancies between concessionaires within the same region. A closer look at the two largest distribution companies in the North Region, Equatorial Pará (in Pará) and Amazonas Energia (in Amazonas), is telling: both have some of the highest regulated tariffs in the country, mainly due to the high distribution costs associated with serving highly dispersed populations. In 2024, the regulated tariff for Amazonas Energia was R$ 0.857/kWh, while for Equatorial Pará it reached R$ 0.938/kWh—the highest in Brazil. These elevated tariffs reduce the effectiveness of the TSEE because, even with the discounts applied, the final bill may still represent a significant burden for low-income families.

Nevertheless, the broader coverage of the TSEE partially mitigates these effects. In Pará, for example, the TSEE covers 41% of residential consumers[26], providing an average discount of 38%. Thus, although electricity tariffs in Pará are higher, the TSEE plays an important role in alleviating the energy cost burden for low-income households. In Amazonas, the situation is less favorable, as the benefit reaches only 23% of residential consumers. Therefore, as mentioned throughout this section, improving the TSEE could make it more effective, especially if it better accounts for the heterogeneities of each concession across continental Brazil.

In addition to the TSEE, there are other tariff discount possibilities that could favor justice. For example, the Tariff Sandboxes promoted by ANEEL allow for new tariff modalities or billing methods in a "controlled environment," with regulatory waivers, which can be useful for testing tariff modernization and encouraging consumption

[25] Extracted from the Electric Energy Market Monitoring System (SAMP).

[26] This difference may reflect the very high level of non-technical losses in the concession area, leading to the conclusion that part of the families who could be TSEE beneficiaries are stealing or committing electricity fraud.

reduction or optimization. In ANEEL's first Sandbox Call, innovations included prepaid billing, time-of-use tariffs, and locational signals. In the second call, multipart tariffs and fixed billing associated with non-tariff incentives were highlighted.

Other innovations deserve mention, such as those provided for in Decree No. 12,068, which regulates the bidding and renewal of electricity distribution concessions. It explicitly allows: (i) ANEEL to authorize differentiated tariffs for areas facing elevated levels of non-technical losses and high delinquency rates; and (ii) ANEEL to define different types of tariffs based on technical, locational, and quality criteria, applied non-discriminatorily and with transparency regarding calculation and values.

Regarding item (i) above, which may involve granting tariff discounts to consumers in areas with high non-technical loss rates, there is significant potential to reduce the overall financial losses from electricity theft—benefiting both utilities and other consumers. In the context of efforts toward tariff justice, collaboration between different actors is fundamental. Strengthening relationships between utilities and vulnerable consumers in high-loss regions, enhancing social programs, and promoting a virtuous cycle could benefit both parties and society at large.

Furthermore, the economic feasibility of these concessions could be enhanced through other measures, such as reducing taxes on electricity bills (e.g., the ICMS tax) or making special credit lines available for programs of this nature. This model is already widely applied in the sanitation sector and could be replicated for the Brazilian electricity sector, thereby reducing energy poverty.

Climate Change and Adaptation Costs

Another crucial theme in the discussion on tariff justice is directly linked to climate change. The costs of adapting to the new reality, especially to strengthen the resilience of the electricity system, are high and inevitable. Therefore, it is essential to balance economic viability and tariff affordability, ensuring that the electricity sector can prepare for climate challenges without compromising access to energy.

Climate change is already imposing tangible challenges on society, various economic activities, and particularly on the electricity sector, with extreme weather events becoming increasingly frequent and severe. In 2024, for example, Brazil faced two major events illustrating this "new normal": the floods in Rio Grande do Sul in May and the storms in São Paulo in October, both leaving around 2 million customers without electricity.

According to the Copernicus Observatory, 2024 was the first year to exceed the 1.5°C global warming threshold compared to pre-industrial levels. In this scenario, climate impacts are no longer a concern for the future but a present reality that requires

immediate and coordinated action, particularly through adaptation, to mitigate the effects of extreme events on the electricity infrastructure.

The costs associated with these events—both the direct effects and the costs related to resilience actions—inevitably affect the entire sector's chain and pose a direct risk to tariff affordability. Strengthening the electricity infrastructure requires investments in technology, monitoring systems, and risk mitigation strategies. Furthermore, the increasing variability of climate patterns can cause fluctuations in supply and raise operational costs.

In this regard, investment decisions must consider the different types of resources available. (1) Structural resources, for instance, are designed to ensure supply most of the time and involve large-scale, high-cost investments, such as hydroelectric plants, wind and solar farms, transmission lines, and distribution networks. (2) Complementary resources are used to meet less frequent but significant events, including flexible thermal plants, generation reserves, circuit redundancies, and switching systems. (3) Resilience resources relate to High-Impact, Low-Frequency (HILF) events. In such cases, it would generally be economically less attractive to invest in large-scale structural resources that would remain idle most of the time; rather, it would be more important to restore supply as quickly as possible with contingency plans, even if they entail exceptionally high costs when activated, because of the very low probability of their use.

The challenge is that determining the best balance between structural, complementary, and resilience actions depends precisely on the frequency and severity of unfavorable events, which are exacerbated by climate change. In this new context, focusing on expensive contingency plans becomes less viable, as their activation becomes more frequent. Additionally, more severe and widespread events require equally comprehensive contingency plans, demanding intense coordination between electricity sector agents and other stakeholders, such as public service providers and state and municipal governments.

Given the "new climate normal" and considering the diversity of resources and costs involved, the solutions adopted must be carefully planned to ensure the best cost-benefit outcome for the electricity system. Measures such as network undergrounding—although desirable in some areas, particularly in tourist regions[27], are not universally feasible due to their high costs[28]. Therefore, other measures aimed at increasing grid operational flexibility are becoming increasingly competitive, such as FACTs[29] for

[27] In such cases, the undergrounding of networks also contributes to landscape enhancement, preserving local aesthetics.

[28] On average, underground networks can cost up to 10 times more than overhead networks, due to higher infrastructure and installation costs (ABRADEE, 2024).

[29] FACTS (Flexible AC Transmission Systems) are flexible alternating current transmission systems that use power electronics devices to improve the stability and control of the electric grid. These systems allow the transmission capacity of existing lines to vary, reduce losses, and improve grid reliability as an

transmission networks; Self-healing systems[30] for distribution networks; and Energy storage solutions, with numerous applications.

Another important focus is the improvement of climate models to better predict extreme events, enabling more precise infrastructure and operational planning in the electricity sector.

Finally, it is crucial to seek coordinated solutions with public authorities and other public service providers, including concessionaires from other regions of the country, aiming for joint and planned actions to address extreme events. Specifically, in the case of municipal governments, joint studies should be conducted to adjust urban vegetation around electric networks to enhance the safety of installations during severe windstorms.

These resilience actions, however, involve additional costs, and it will be important to create a "tariff buffer" so that consumers can absorb them. This means that planning, through benefit-cost analyses among technological options, should avoid charging consumers for costs they do not need to bear and should minimize the costs paid for necessary services. Additionally, to make these investments more affordable for consumers, it is fundamental to seek to reduce subsidies embedded in tariffs and explore external financing options outside the tariffs.

In short, regarding climate change and the inevitable adaptation costs for the electricity sector, tariff justice must involve planning that anticipates challenges, protects consumers financially, and strengthens efforts to mitigate current injustices. In a context of growing investment needs, it is crucial to ensure appropriate tariff space to finance them.

Governance and Institutional Autonomy Challenges in the Brazilian Electricity Sector

As highlighted in the previous sections, the trajectory of electricity tariffs in Brazil has been increasingly raising the bills paid by end consumers, especially smaller consumers. Among the main factors driving this situation are: the increase in unnecessary subsidies to specific energy sources; the inclusion in tariffs of inefficient or service-unrelated costs; and the asymmetrical allocation of system costs among different types of consumers.

alternative to conventional transmission expansion, which relies on building new transmission lines and transformers.

[30] Self-healing refers to automated systems that monitor and reconfigure the electric grid in real time to isolate faults and quickly restore power supply. They use sensors, artificial intelligence algorithms, and smart grids to reduce the duration and frequency of service interruptions (SAIDI and SAIFI indices), thus improving the resilience and efficiency of energy distribution.

This situation largely stems from the growing number of interventions in the electricity sector (SEB), which seek specific benefits funded systemically, increasingly distancing the sector and the country from economic rationality. These initiatives, besides creating major distortions in price signals and leading to overcosts, often involve the Legislative Branch overstepping into functions typical of the Executive, such as energy planning, by mandating the contracting of specific energy sources in specific locations without regard for costs or infrastructure, or even interfering with ANEEL's decisions, attempting to override the regulatory agency's authority. Examples of such processes include some of the topics previously discussed, such as the subsidies to distributed generation (MMGD) reinforced by Law No. 14,300/2022 and the extension of subsidies to incentivized sources, recently expanded by Provisional Measure No. 1,212/2024.

Moreover, and even more critically, new costs associated with sectoral inefficiencies continue to be created and are being passed on to future tariffs. That is, even if efforts are made to mitigate current costs, future legislative interferences will continue to excessively burden tariffs. This represents one of the most serious issues for the electricity sector, as it essentially involves pre-contracting a future escalation of costs to be passed on to consumers, often detached from market logic and from the necessary pursuit of efficiency.

In this context, the inclusion of "jabutis" (unrelated amendments) [31]by Congress in the Offshore Wind Bill is particularly concerning. These provisions distribute benefits to various segments of the electricity sector, ranging from renewables to coal-fired generation and inflexible thermal plants. The potential implicit costs of these "jabutis" reached unprecedented levels in comparison to previous interventionist initiatives: R$ 658 billion over 27 years, equivalent to a present value of R$ 287 billion, according to PSR estimates. It should be noted, however, that in January 2025, the President sanctioned the Bill with vetoes — all applied to the unrelated matters — which was a positive move for the sector. The Bill now returns to Congress for discussion on the presidential vetoes, which could be overturned if the absolute majority of parliamentarians (257 deputies and 41 senators) decide so — a development that would, in our view, be highly detrimental to the electricity sector and the country, completely contrary to the principles of efficiency and equity that underpin Tariff Justice.

Thus, to prevent the sector from remaining trapped in this death spiral, it is necessary to rebuild governance through coordinated efforts aimed at a structured reform, preferably leveraging the collective intelligence of the sector. To that end, it is crucial to strengthen sectoral communication, clearly explaining to society the real impact of so many subsidies on tariffs, which increase tariff injustice and energy poverty.

For this effort to succeed, it is essential that the tariff justice agenda transcends the boundaries of the electricity sector and be addressed through an intersectoral approach,

[31] Expression given to amendments unrelated to the main subject of Bills being processed in the National Congress.

involving other ministries and strategic government agencies. After all, this is a cross-cutting issue that represents strategic development for the country, requiring articulation with the Ministry of Planning and Budget, the Ministry of Social Development and Fight Against Hunger, the Ministry of Regional Development and Integration, the Ministry of Finance, among others.

Additionally, we consider it important to evaluate improvements to legislative practices to prevent new laws from increasing distortions in the electricity sector. One example is the requirement of an Economic and Social Impact Analysis, which could be conducted by the consultancy offices of the Senate and the Chamber of Deputies for bills related to tariff policy.

RECOMMENDATIONS

Given the challenges presented in the Analytical Section of the previous chapter, we recommend the following public policy guidelines to mitigate tariff injustice in the Brazilian Electricity Sector. These are examples of relevant measures, without claiming to be an exhaustive list, as many actions are necessary to bring the sector closer to economic rationality, leverage new development opportunities, and better adapt the sector to the impacts of climate change, ultimately reducing the tariff injustice that heavily burdens Brazilian consumers.

- **Strengthen the Institutions of the Brazilian Electricity Sector**

The balance of the Brazilian Electricity Sector depends on autonomous, financially sustainable, and technically capable institutions to ensure decisions based on technical foundations and efficient economic signals. It is essential to strengthen institutions, especially the Ministry of Mines and Energy (MME), ANEEL, EPE, the National Electric System Operator (ONS)[32], and the Electric Energy Trading Chamber (CCEE)[33], ensuring their independence and budgetary stability so they can perform their duties without external interference.

For instance, in pursuing tariff justice, the **MME should be strengthened as the strategic body for guiding national energy policy**, ensuring sector guidelines are formulated with a long-term vision and free from electoral cycle distortions. Its action should prioritize regulatory predictability and security, creating a stable environment for investors and consumers. Likewise, **EPE must be reinforced as a technical pillar for Brazilian energy planning**, expanding its capacity for modeling, data analysis, and scenario formulation for the sector's sustainable expansion.

ANEEL must have its autonomy reinforced, with institutional guarantees preventing unpredictable and excessive budget cuts that would compromise its operations and regulatory oversight capacity. It is also crucial to ensure that the Agency can exercise the powers and duties established by law (primarily Law No. 9,427/1996, which created ANEEL) independently and structured. Among these duties, setting tariffs for all system agents and users based on technical and transparent criteria stands out.

---

[32] The ONS (National Electric System Operator) is responsible for coordinating and controlling the operation of the National Interconnected System (SIN), ensuring the safety, reliability, and optimization of energy resource usage. It manages energy generation and transmission, ensures real-time operation, and supports planning for the expansion of the electric system.

[33] The CCEE (Electric Energy Trading Chamber) administers the electricity market in Brazil, enabling trading among generators, distributors, and free consumers. It is also responsible for the financial settlement of transactions and the accounting of sectoral charges, ensuring transparency and balance in the electricity sector.

Additionally, it is important to apply Regulatory Impact Analysis (RIA)[34], as required by Decree No. 10,411/2020, whenever necessary.

Other important points include: (i) **inserting the tariff justice agenda into the priorities of other ministries and strategic government agencies beyond the MME**; and (ii) **seeking improvements to the legislative process**. For example, by requiring an Economic and **Social Impact Analysis for bills dealing with tariff policy, which could be conducted by the Senate and House consultancy offices**.

In summary, the formulation and implementation of energy policies must be guided by strategic long-term foundations, ensuring regulatory predictability, economic efficiency, and affordable tariffs for consumers. Strengthening the sectoral institutions is thus a necessary condition for a sustainable Electricity Sector aligned with a just energy transition.

- **Improve and Publicize Indicators for Diagnosing Energy Injustices**

Developing effective public policies to eradicate energy poverty and promote tariff justice requires an accurate and multidimensional diagnosis of existing vulnerabilities. **Brazil must consolidate and disseminate a set of robust and integrated indicators to measure energy injustices and assess the effectiveness of existing policies**. International experience shows that specific metrics are essential to map energy poverty and guide strategies that ensure equitable and sustainable access to energy.

In recent years, important institutional advances have strengthened this agenda. EPE has led fundamental initiatives, such as the creation of the Observatory for the Eradication of Energy Poverty (OBEPE), aimed at consolidating a broad diagnosis of energy poverty in Brazil and supporting the development of more effective public policies. Additionally, EPE launched the Portal for Monitoring and Information on Isolated Systems (PASI), expanding monitoring and transparency regarding the energy situation in these regions. Meanwhile, ANEEL has played an essential role in increasing transparency regarding sectoral subsidies through the "Subsidy Meter," a platform that details the costs passed on to tariffs and supports more efficient public policies.

It is recommended, therefore, to strengthen institutional efforts for the creation, continuous monitoring, and effective dissemination of energy justice indicators, in line with the initiatives led by EPE and ANEEL. This improvement will allow Brazil not only to advance in providing clean and accessible energy but also to become a global reference in eradicating energy poverty, promoting a just energy transition based on robust and verifiable analyses.

[34] The RIA (Regulatory Impact Analysis) is a tool used to assess the potential economic, social, and environmental effects of new regulations or public policies. In the electricity sector, its objective is to support ANEEL's decision-making process by enhancing regulatory efficiency and minimizing negative impacts on agents and consumers.

- **Increase Transparency in Electricity Bills**

The lack of clarity regarding the composition of electricity tariffs compromises consumer participation in the debate on tariff justice and the sector's efficiency. Currently, millions of Brazilians are unaware that a significant portion of their bill corresponds to cross-subsidies, sectoral charges, and additional costs that artificially inflate electricity prices. To correct this gap, **it is recommended to adopt a unified model for presenting the cost composition on electricity bills across the country in a clear and accessible manner, including the embedded subsidies**.

This transparency will enable the population to understand how much they pay for the electricity actually consumed and how much is directed towards sectoral policies and subsidies, **encouraging a more qualified public debate and pressuring for greater efficiency in cost management in the electricity sector**. Moreover, **a standardized and detailed bill strengthens regulatory governance, reduces information asymmetry between agents, and facilitates the implementation of strategies to rationalize charges, promoting fairer tariffs**. Access to information is an essential pillar for social control and continuous improvement of tariff policies.

- **Reduce Tariff Burdens and Rationalize Additional Costs**

Reducing undue and unnecessary costs in electricity tariffs is essential to ease the burden on both residential consumers and the productive sector. Beyond impacting family budgets, electricity is a key input for the economy, and high tariffs directly affect the population's quality of life and production costs, generating inflationary pressures that disproportionately affect the poorest. Furthermore, the competitiveness of the productive sector depends on an efficient and accessible energy matrix. Reducing tariff burdens fosters economic development, helping build a more dynamic and less unequal country where clean (and, in Brazil, also cheaper) energy enables sustainable growth and job creation.

To achieve this, **it is essential to revisit sectoral charges, setting clear limits and expiration deadlines, and mitigating additional costs arising from poorly targeted subsidies whose continuation is no longer economically or strategically justified.** To this end, it is important to:

- **Significantly reduce the impact of subsidies for incentivized sources**, which in 2024 represented the largest subsidy category in the sector, surpassing R$13 billion.
- **Implement the planned end of subsidies for coal-fired electricity generation**.

- **Rationalize the funding of national policies directly related to energy justice**, such as the Social Electricity Tariff (TSEE), Luz Para Todos (LpT), and, especially, the Fuel Consumption Account (CCC), avoiding inefficiencies.
- **Ensure efficiency in the contracting of Reserve Energy and Capacity Reserve, avoiding interventions that seek mandatory contracting of specific sources at sectoral cost**.
- **Avoid centralized decisions for the compulsory contracting of energy for final consumers, which usually bring additional costs to the system**.
- **Gradually shift the funding of public policies currently charged through tariffs to the National Treasury through a phased transition mechanism over the years.**

Thus, energy would cease to be an excessive burden and would instead become a pillar of economic development, benefiting all Brazilians.

- **Improve Cost Allocation in the Electricity Sector**

Tariff justice requires that electricity sector costs be distributed more equitably and rationally among all system users. To achieve this, it is essential to enhance the current regulatory framework by mitigating the effects of subsidies granted to specific groups and evaluating them in terms of scope, coverage, and technical and economic relevance. In this context, legal changes may be necessary, provided they are based on robust and structured analyses, to reduce inefficient cost transfers between consumers. This approach is fundamental to easing the excessive burden on captive consumers, especially smaller ones, who are already affected by tariff components increasing above inflation.

Examples of related measures discussed in this document include:

- **Mitigating the impact of subsidies to Distributed Micro and Mini Generation (MMGD)** by better allocating the costs they impose across the entire sectoral chain—Generation, Transmission, and Distribution.
- **Significantly reducing the impact of subsidies for self-generation**, particularly in the "self-generation by equivalence" model.
- **Reviewing the allocation of costs associated with the energy supply for the Regulated Market (ACR)**, such as those from Angra 1 and 2 nuclear plants, aiming for these costs to be shared by the Free Market (ACL) as well.
- **Reviewing the allocation of overcontracting costs related to migration to the ACL and MMGD**, aiming to share these costs among all system users (including MMGD).
- **Improving the management tools for the regulated market's energy purchasing portfolios.**

- **Reviewing the allocation criteria of the Energy Development Account (CDE) costs by voltage level.**

- **Modernize the Tariff Structure and Improve Price Signals**

Modernizing the Brazilian electricity sector's tariff structure is essential to ensure well-calibrated economic signals, promoting greater consumption efficiency and rational cost allocation. To make this modernization viable, **it is necessary to advance regulation and the adoption of more advanced technologies**, such as smart meters, which enable the implementation of more dynamic tariffs, reducing bill burdens through more efficient economic signals.

For example, **the application of locational signals in transmission costs** is important to better allocate costs according to the location of generators and demand centers. **In distribution, adopting time-of-use tariffs, even for low-voltage consumers and MMGD beneficiaries**, would encourage consumption shifts to lower-cost periods, reducing peak load ramps and potentially lowering residential electricity bills.

It is worth noting that some of these topics are already under regulatory discussion. Decree No. 12,068/2024, which addresses the renewal of distribution concessions, brought relevant guidelines to be reflected in new contracts and regulations, **such as encouraging the gradual digitalization of grids and services (including smart metering) and allowing tariff differentiation based on technical, locational, and quality criteria, especially for areas with high non-technical losses**. Other regulatory processes currently underway address these themes, including the **modernization of distribution tariffs** (Public Consultation 11/2024), the **implementation of smart metering** (Public Consultation 13/2024), and tariff sandbox projects.

For these initiatives to succeed, **it is fundamental to ensure broad participation from society and the electricity sector**, building a robust regulatory framework aligned with present and future challenges. Furthermore, **swift and coordinated regulatory advances are critical** to avoiding bottlenecks that could undermine the effectiveness of the proposed measures and the modernization of the sector.

- **Reform the Social Electricity Tariff (TSEE)**

To strengthen the critical role of the TSEE in reducing electricity costs for low-income families, a structural reform of the discount model is recommended, making it simpler and better aligned with regional income disparities, as well as changing consumption patterns and climatic conditions.

The current structure should be replaced by a model integrating socioeconomic and territorial criteria, ensuring greater adherence to the different regional realities across continental Brazil. Additionally, **discount percentages should be simplified**

and expanded to more effectively mitigate the impact of electricity bills on vulnerable families, especially in areas where the cost of living and energy consumption are higher.

Moreover, this reform may require **revising eligibility criteria and modernizing the benefit allocation process, ensuring that all eligible families are automatically included without bureaucratic barriers**. Implementing technologies that integrate databases and allow proactive benefit allocation, eliminating the need for in-person or analog registration, is necessary. These changes would strengthen tariff justice by making the policy more efficient, accessible, and aligned with energy justice principles.

It is also important that the TSEE policy undergo periodic reviews to ensure it remains effective and responsive to social, economic, and climatic changes.

- **Enable the Economically Sustainable Opening of the Free Market for Low-Voltage Consumers**

Opening the free market for low-voltage consumers has the potential to increase competition in energy commercialization and generation, bringing benefits to consumers in the medium and long term, both in cost reduction and in a greater variety of products and services. However, for this opening to be economically sustainable, it is crucial to adopt pillars already widely discussed in sectoral regulation.

These pillars include imperatively legal and infralegal measures like the ones mentioned in the recommendation item related to cost allocation, such as: r**evising the allocation of energy purchase costs in the ACR, revising the allocation of overcontracting costs, improving the management tools for the energy purchase portfolio of the ACR**. Other critical measures include: **creating the "supplier of last resort" figure, separating commercialization and distribution activities, prohibiting the granting of subsidies to incentivized sources and self-generation for low-voltage consumers**, to prevent the free market opening from further increasing the burden on tariffs.

- **Combat Electricity Theft with a Holistic Approach**

Combating non-technical energy losses is a national and multifactorial challenge, requiring coordinated action from various actors, including the Public Sector, the regulator, distributors, and civil society. Non-technical losses, mainly stemming from theft and fraud, compromise the financial sustainability of the Electricity Sector and raise energy costs for all consumers. Addressing this problem demands integrated solutions, **combining effective public policies, especially in Public Safety and Urban Planning**, where public issues foster electricity theft in vulnerable communities.

Moreover, the **adoption of differentiated tariffs for high-loss regions** represents an essential mechanism to balance electricity sector costs without disproportionately penalizing regular consumers, as included in Decree No. 12,068/2024. **Implementing differentiated tariffs for socioeconomically complex areas** (considering factors like poverty, inequality, violence, poor urban infrastructure, irregular land tenure, high penetration of air conditioners, etc.), **alongside investments in distribution infrastructure and consumption regularization measures, can sustainably reduce losses, promoting a fairer and more efficient system**.

- **Adapt the Electricity Sector to the Effects of Climate Change**

Climate impacts are no longer a future concern—they are a present reality requiring immediate and coordinated action. In light of this scenario and its effects on the electricity sector, robust planning is essential to strengthen infrastructure resilience, mitigate impacts on tariff affordability, and ensure that the sector can prepare for climate challenges without compromising access to energy.

Some suggested measures include:

  - **Improving climate models and predictive tools for more accurate forecasts** and more efficient infrastructure and operational planning.
  - **Conducting rigorous cost-benefit analyses** to minimize the inevitable need to pass on costs and investments to tariffs.
  - **Prioritizing flexible technological solutions**, such as FACTs (in transmission), self-healing (in distribution), and storage, which are increasingly competitive and effective in mitigating climate risks.
  - **Seeking coordinated solutions with public authorities and other public service providers**, including concessionaires from other regions, for joint and planned responses to extreme events.
  - **Conducting joint studies with municipalities to adapt urban vegetation around electric networks**.
  - **Reducing tariff subsidies and seeking external financing sources** to avoid excessive cost pass-through to consumers and create a "tariff buffer" to absorb necessary resilience investments.

CONCLUSION

The Brazilian Electricity Sector still faces structural challenges that undermine tariff fairness. The composition and distribution of energy costs must be reformed to ensure that universal access is maintained at affordable and equitable prices. This study identified several barriers that perpetuate tariff injustices and hinder the sector's sustainable development.

In a challenging context regarding governance and institutional autonomy, the excessive burden of tariffs continues to grow, especially for smaller consumers, including low-income households. The latter end up bearing a disproportionate share of costs relative to their ability to pay.

Among the factors contributing to this situation are: the increase of unnecessary subsidies to specific energy sources, the allocation of inefficient or service-unrelated costs to tariffs, and asymmetries in cost allocation among different types of consumers. As a result, the propensity for electricity theft has risen, with part of this increase being passed on to tariffs, creating a vicious cycle. Simultaneously, the sector's need to adapt to climate change demands significant investments, which must be fairly and sustainably distributed over the coming years.

These challenges highlight the urgent need to reform tariffs, ensuring greater social justice and economic efficiency in cost allocation. To achieve a more efficient, accessible, and competitive electricity sector, ideally, users should be charged proportionally to the way they demand from the system, ensuring that those who generate additional costs are responsible for covering them. Correct cost allocation not only reduces distortions and avoids unfair cross-subsidies but also enhances the sector's economic efficiency, making energy in Brazil cheaper and internationally competitive. Reducing privileges contributes to a more equitable tariff model, ensuring that the energy transition is supported in a fair manner, without disproportionately burdening politically underrepresented groups.

For this reason, this study presented, without claiming to be exhaustive, a set of recommendations and proposals related to the following areas: strengthening the institutions of the Brazilian Electricity Sector; improving and publicizing indicators for diagnosing energy injustices; increasing transparency in electricity bills; reducing tariff burdens and rationalizing additional costs; improving cost allocation within the electricity sector; modernizing the tariff structure and improving economic signals; reforming the Social Electricity Tariff (TSEE); enabling the sustainable opening of the free market to low-voltage consumers; adopting a holistic view in combating electricity theft; and adapting the sector to the effects of climate change.

Additionally, the study recommended revising the eligibility criteria and the discount calibration of the Social Electricity Tariff to ensure that subsidies are more efficiently directed and aligned with the country's regional and socioeconomic realities. Actions were also proposed to increase transparency in electricity bills, enabling consumers to

better understand the costs embedded in their tariffs and participate more actively in the debate on tariff justice.

The implementation of these recommendations becomes even more critical in the current global context, where Brazil assumes a central role in discussions on energy transition and social justice. With the upcoming COP30 and its recent leadership position in the G20, the country has a strategic opportunity to consolidate an agenda that not only promotes the decarbonization of the global energy matrix but also ensures that the benefits of this transition reach the entire population, especially the most socioeconomically vulnerable groups. To this end, it is essential that tariff justice is recognized as a fundamental pillar of this transformation.

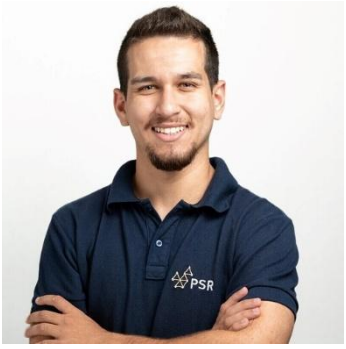
Therefore, these recommendations must consider the indirect effects of electricity bills on the production of goods and services consumed by families, as energy constitutes a key input for various productive sectors, particularly industry. Furthermore, it is crucial to consider the impact of electricity costs on the competitiveness of the national industry and the promotion of the country's economic growth. In other words, the burden of energy bills, in addition to disproportionately affecting low-income families, also limits the country's economic development, which is based on clean and affordable energy.

Thus, the complexity of the identified challenges requires coordinated and structural responses. Decision-makers — government, regulators, the private sector, and civil society — must act urgently to implement the necessary reforms and ensure that access to energy does not become a factor that deepens social inequalities. In this scenario, tariff justice must be treated as a priority on the national energy agenda, reflecting Brazil's commitment to a just energy transition.

AUTHORS

Angela Magalhães Gomes – Technical Director at PSR

With over 20 years of experience in the Brazilian electricity sector, Angela Gomes served as Regulatory Affairs Director at Light, where she was responsible for all regulatory projects of the group for 16 years. She also served as Director of Strategic Regulatory Affairs at the Enel Group in Brazil, leading initiatives focused on the Energy Transition. She was a board member of the Brazilian Association of Electricity Distributors (Abradee). Currently, she is the Technical Director for Transmission and Distribution Markets (Grids) at PSR. Angela holds a degree in Mechanical Engineering from PUC-Rio and an MBA in Corporate Finance from the *Simon School of Business*, University of Rochester, New York.



Leonardo Frazão – Analyst at PSR

Leonardo Frazão holds a degree in Economics with an emphasis on Philosophy and is currently pursuing a master's degree in Development Economics at **Université Panthéon-Sorbonne**. For the past three years, he has worked in the Grids area at PSR, engaging in strategic projects focused on economic regulation, electricity distribution, and energy justice. He participated in the Erasmus+ program at *Stockholm University* in Sweden, specializing in Climate Change and Econometrics. Additionally, he has completed training in Social Entrepreneurship at the *Latin American Leadership Academy (LALA)* at *Universidad de Piura*, in Peru.

Lucas Fachetti – Analyst at PSR

Lucas Fachetti is a master's student in Production Engineering at *COPPE/UFRJ*, specializing in Operations Research and Economic Engineering, and graduated *cum laude* in Electrical Engineering from UFRJ. In PSR's Grids area, he develops strategic and regulatory studies, with a focus on the economic regulation of the distribution segment. Previously, he worked in the FP&A area at the Energisa Group, conducting economic-financial analyses and revenue projections for the group's distribution companies. He is also certified in Corporate Finance, Investments, and Financial Markets from Alumni COPPEAD.

REFERENCES

ABRACEE, EX ANTE CONSULTORIA. "The Impacts of Energy Prices on Economic Growth and Development, 2024." Available at: https://abrace.org.br/site/wp-content/uploads/2024/09/Energia-competitiva-eletricidade-e-gas-2024-06_240624_210739.pdf

ABRADEE. 2024. "Sustainability Report of the Distribution Segment."

ABRADEE. "Distribution Analytics Platform." Accessed: Feb. 2025. https://analytics.abradee.org.br/

ABRADEE. "Undergrounding of Power Lines." Accessed: Feb. 2025. https://abradee.org.br/precisamos-ter-um-debate-franco-sobre-o-enterramento-de-redes-eletricas/

ANEEL. "Public Consultation 038/2024 – CDE 2025 Budget."

ANEEL. "Subsidy Meter." Accessed: Feb. 2025. https://portalrelatorios.aneel.gov.br/luznatarifa/subsidiometro

ANEEL. 2024. "Electricity Distribution Losses Report."

ANEEL. "Report on the Energy Development Account (CDE)." Accessed: Feb. 2025. https://portalrelatorios.aneel.gov.br/luznatarifa/contadesenvolvimento

ANEEL. "Tariff Regulation Procedures – Proret."

BOARDMAN, B. 1991. *Fuel Poverty: From Cold Homes to Affordable Warmth.* Belhaven Press.

CEBRI, LIGHT. "Energy Poverty: Negative Effects of Tariff Subsidies." 2024. Available at: https://www.cebri.org/br/doc/347/energy-poverty-negative-effects-of-tariff-subsidies. Accessed: Mar. 2025.

COPERNICUS CLIMATE CHANGE SERVICE. "Copernicus: 2024 is the First Year to Exceed 1.5°C Above Pre-Industrial Levels." Available at: https://climate.copernicus.eu/copernicus-2024-first-year-exceed-15degc-above-pre-industrial-level. Accessed: Jan. 20, 2025.

EPE. 2023. "Analysis of International State Experiences on Energy Poverty and Energy Justice: Definitions, Indicators, Measures, and Governance."

EX ANTE CONSULTORIA ECONÔMICA. "The Impacts of Energy Prices on Economic Growth and Development." Research Report. Abrace, July 2024.

FRAZÃO, L.; TAVARES, Y. "What is the Social Electricity Tariff?" Exame, 2025. Available at: https://exame.com/esg/o-que-e-a-tarifa-social-de-energia-eletrica/. Accessed: Mar. 2025.

GENI/UFF. "Update of the Historical Map of Armed Groups." Fogo Cruzado, 2024. Available at: https://geni.uff.br/2024/06/04/atualizacao-do-mapa-historico-dos-grupos-armados/. Accessed: Jan. 2025.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA – IBGE. *Continuous National Household Sample Survey: General Characteristics of Households and Residents 2019.* Rio de Janeiro: IBGE, 2020.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA – IBGE. "Household Budget Survey – POF, 2009."

INSTITUTO PÓLIS. "Energy Justice." Available at: https://polis.org.br/estudos/justica-energetica/. Accessed: Feb. 5, 2025.

KELMAN, J.; GOMES, A.; FRAZÃO, L. "Social Injustice and Energy." O Globo, 2023. Available at: https://oglobo.globo.com/opiniao/artigos/coluna/2023/10/injustica-social-e-energia.ghtml. Accessed: Mar. 2025.

NATIONAL ENERGY CONSERVATION PROGRAM – PROCEL. 2024. *Analysis Report of PPH 2019 Results.* ENBPar. Accessed: Mar. 2025.

UNIVERSIDADE PRESBITERIANA MACKENZIE. "Mackenzie Research Reveals Temperature Differences Between Neighborhoods in São Paulo." 2023. Available at: https://www.mackenzie.br/noticias/artigo/n/a/i/pesquisa-do-mackenzie-revela-diferencas-de-temperaturas-entre-bairros-de-sao-paulo. Accessed: Jan. 20, 2025.

INTERVIEWED INSTITUTIONS

We thank the institutions that kindly shared their time and knowledge for this study. Their contributions were fundamental to deepening the understanding of tariff justice in the electricity sector and enriching our analysis.

ANEEL

epe

Frente Nacional dos **Consumidores de Energia**

abradee

FASE | FÓRUM DAS ASSOCIAÇÕES DO SETOR ELÉTRICO

ABRACE ENERGIA

InstitutoPólis

iCS instituto CLIMA e SOCIEDADE

SUFFOLK UNIVERSITY BOSTON

deep

Rede Favela Sustentável

PSR

Global Energy Alliance for People and Planet GEAPP