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# INTRODUCTION

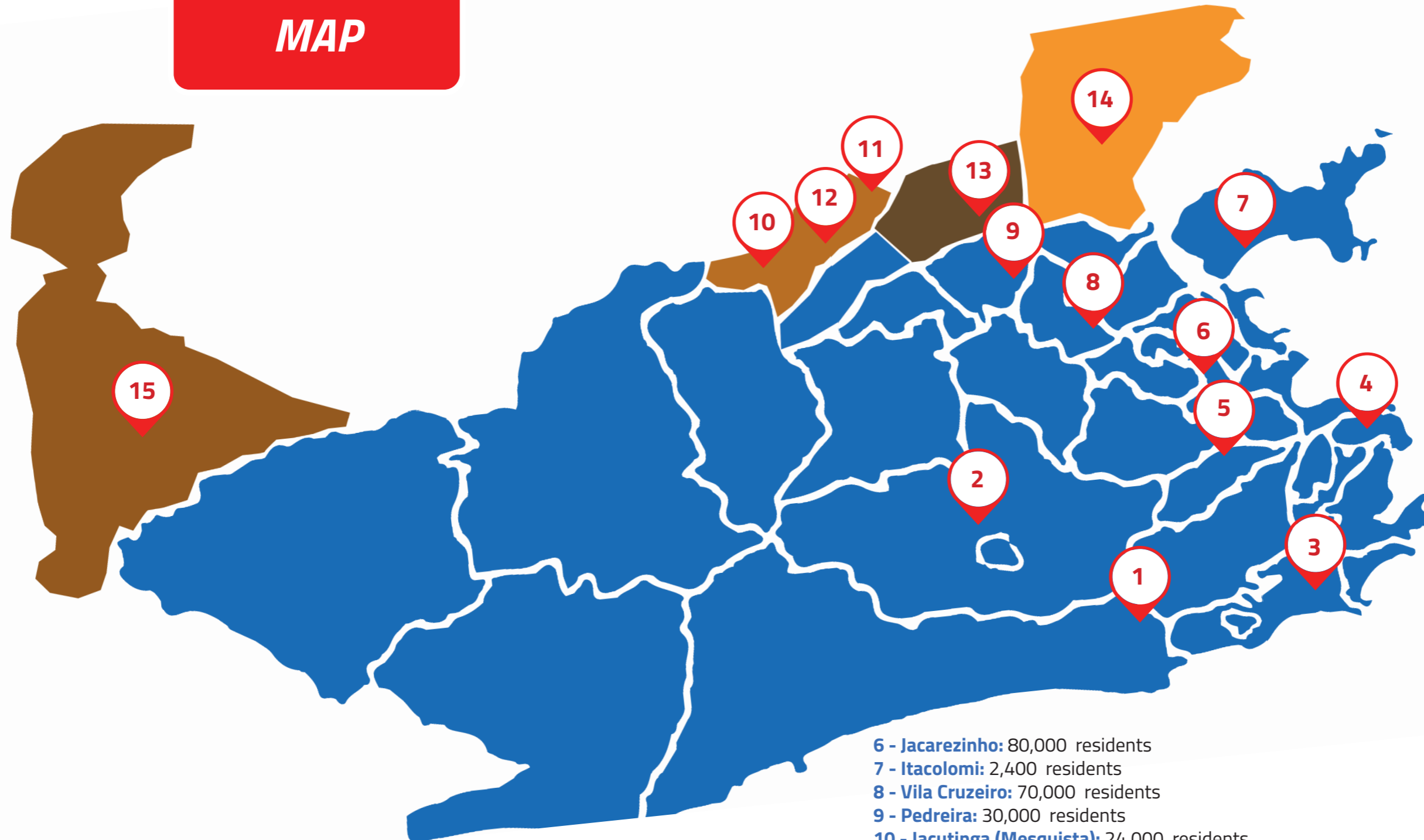
This report is one of the outcomes of the course “**Researching and Monitoring Energy and Water Justice in the Favelas**” realized by the **Favelas Unified Dashboard (PUF)** and the **Sustainable Favela Network (SFN)**, both networks organized by Catalytic Communities (CatComm) and made up of numerous **favela and allied organizations**.

The course was developed to **demystify the process of collecting and comprehending data, ensure community control over data**, and inform advocacy campaigns. It was the product of favela organizations realizing the existential importance of data collection to their outcomes, as the Covid-19 pandemic wreaked havoc on their communities.

**Energy and water justice was chosen** as the focus because of the fundamental nature of both these services for the full development and inclusion of favelas. **Three central themes were analyzed: access, quality and efficiency. The general report produced is available at [www.sosagueluz.org](http://www.sosagueluz.org).**

**This new report shares the findings and conclusions from data** produced specifically on the context and challenges **of energy efficiency in the favelas**. Cross-referenced with social and racial aspects of the communities where the research was carried out, they offer an in-depth analysis of the challenges and importance of energy efficiency for the integration of Rio de Janeiro’s informal settlements.

## MAP



### Showing data from the following 15 favelas:\*

- 1 - Rio das Pedras: 160,000 residents
- 2 - Cidade de Deus: 55,000 residents
- 3 - Pavão-Pavãozinho Cantagalo: 35,000 residents
- 4 - Morro da Providência: 12,000 residents
- 5 - Morro dos Macacos: 4,000 residents

- 6 - Jacarezinho: 80,000 residents
- 7 - Itacolomi: 2,400 residents
- 8 - Vila Cruzeiro: 70,000 residents
- 9 - Pedreira: 30,000 residents
- 10 - Jacutinga (Mesquita): 24,000 residents
- 11 - Cosmorama (Mesquita): 4,500 residents
- 12 - Coréia (Mesquita): 7,000 residents
- 13 - Edem (São João de Meriti): 1,000 residents
- 14 - Dique da Vila Alzira (Duque de Caxias): 4,000 residents
- 15 - Engenho (Itaguaí): 20,000 residents

Total number of residents in participating territories: **501,900**

\*Population estimates provided by local organizations



## Social Context in Which Research Was Conducted

This research was conducted in 15 favelas in the Greater Rio metropolitan region, including communities from different municipalities and regions of the state. Whilst each community has its own characteristics and faces its own challenges, there is a broader social context which all of them share. This context is related to social and racial inequality, insecurity in the provision of public services, poor implementation of basic rights, and a lack of opportunities, among other things.

Some of the data collected reveal this situation. Among the interviewed population, 52% of families only earn up to the minimum wage for one person (R\$ 1,200.00) and the average monthly income per capita is R\$427.80. 48.2% of families need a water pump to have access to water, which increases the cost of the electric bill and affects supply to other homes in the community. Of the families interviewed, 42% (490 families) had no access to water at some point during the pandemic, making the hygiene measures needed to protect them from coronavirus impossible to attain. 31.3% of families drink water straight from the tap without a filter, with at least 25% of people claiming the water has an odd smell, taste or color to it.

Regarding the social context in which the survey was conducted, 31.3% of families live in energy poverty and are forced to allocate a disproportionate share of the family budget to the electric bill. Furthermore, 69% of interviewees said that if their electric bill were halved, they would buy more food for their families with the savings. 51% of interviewees also suffer from flooding in their street or homes and notice a difference in the water supply during summer months. The income statistics gathered from the interviewed families shed light on the social impact these problems have, while the data on race indicate that the black population is disproportionately affected, as 74% of the people interviewed identified as black. Furthermore, the intersection between race and social class is evident when we observe that Afro-Brazilians are overrepresented in the lower income brackets.

**The issues of water and energy justice, climate injustice, and environmental racism are part of a broad range of other challenges faced by these communities and their residents. This study was developed around the issues of energy and water justice in terms of access, quality, and efficiency. The issues of access and quality are more commonly studied in relation to their social context, as it is known that access to and quality of water and electricity are challenges faced in the favelas. Meanwhile, the issue of efficiency in favelas is rarely studied. As we have found here, however, this is a mistake. Considering its extreme relevance, either for its ecological benefits, or for its financial and social benefits, energy and water efficiency in favelas warrants much closer attention.**

This research has contributed to understanding what is known about energy efficiency in these communities, the methods of residents who seek to use energy consciously, the challenges of energy efficiency within these areas, as well as the benefits and views about energy efficiency in the favelas. In this sense, it can be observed that while energy inefficiency disproportionately affects the most vulnerable in society, energy efficiency can be a tool to combat inequalities.

**Observation:** In this study a family was considered experiencing “energy poverty” when their electric bill represents over 10% of a family’s monthly income. Between 6.9% and 10% was classified as moderate and below 6.8% as within recommended levels. Since this study focused on electricity, the energy poverty calculation took into account only a household’s electric bill, not considering expenditures on gas, for example.

## Research Methodology

The survey was conducted in 15 favela communities with approximately 75 interviews per community, 1,156 interviews in total, and a reach of 4,164 people. The sample unit is the household. The sample was not selected randomly, so no assumptions are made about the population from the results obtained from the sample. The analysis made is descriptive and statistical.

Data collection was conducted door-to-door and face-to-face in the 15 communities during an eight week period (between May 16 and July 8, 2022). The tool used to collect data consisted of a 71-question survey in electronic format, utilizing KoboToolbox, developed collectively by students of the research course Water and Energy Justice in the Favelas, realized by the Sustainable Favela Network and Favelas Unified Dashboard, alongside eight research partners.

Although the sample was not random, geographic representation was realized by covering different areas within each of the participating communities. The 15 communities were subdivided using IBGE census tracts as references, and we actively ensured that in all communities, interviews were conducted in at least one household in each census tract of that community.

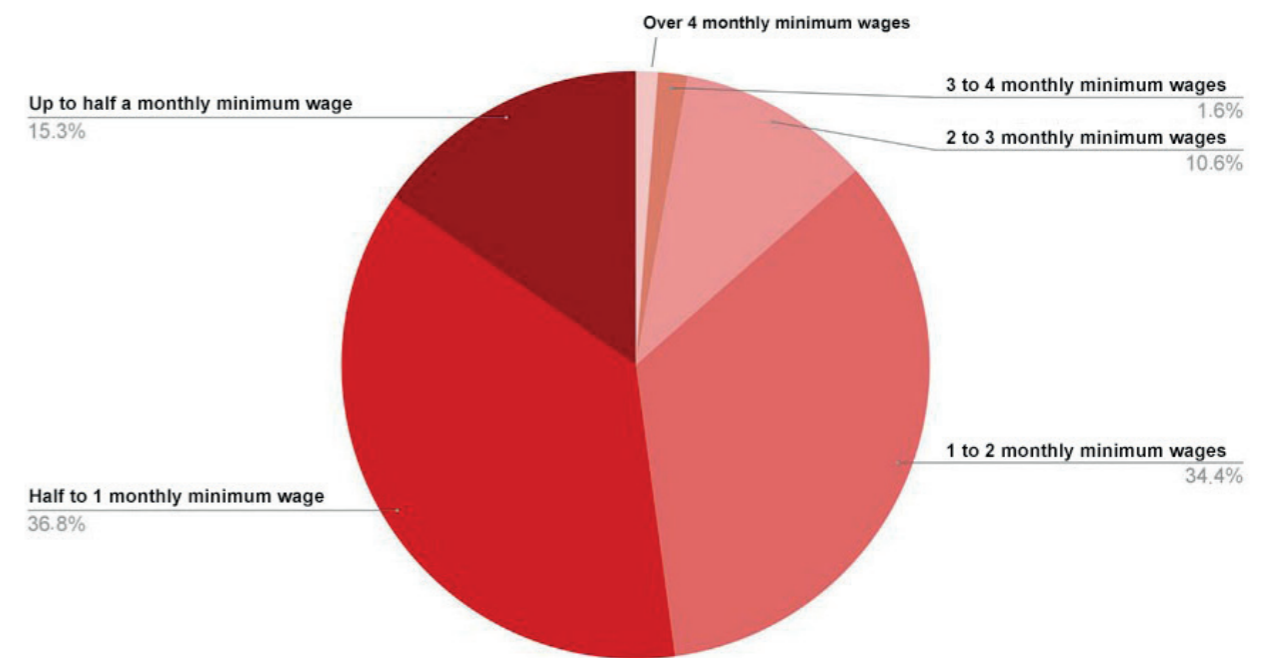
The interviews conducted guaranteed respondent and household anonymity. Although geographical data were captured, they were gathered with a security radius that prevents identification of the location of any specific household. The interviews were carried out by young people and community leaders from within their communities, which ensured greater reach and satisfactory response rates, even for information considered sensitive. This proves the power of citizen-generated data in the favelas.



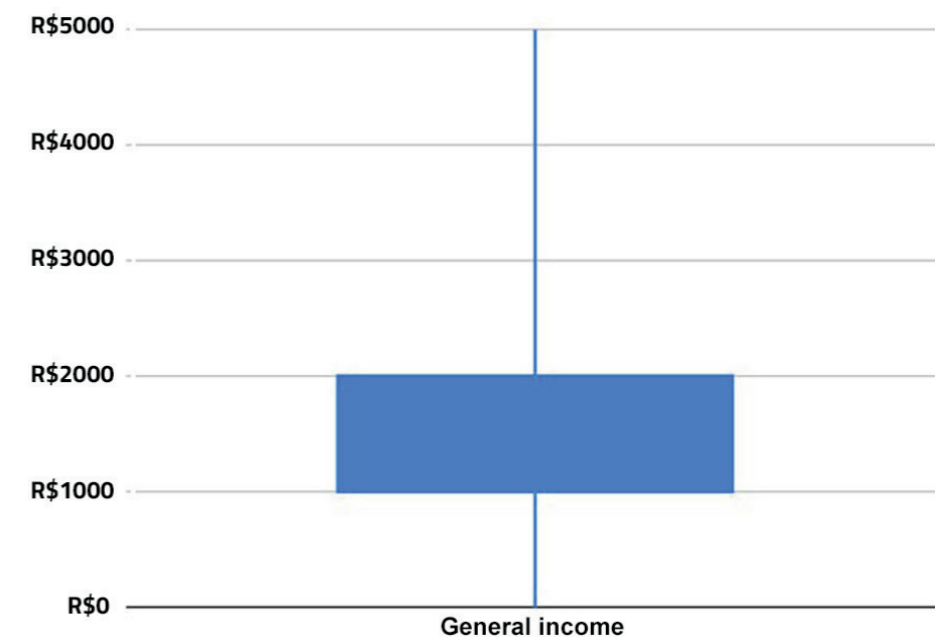
## Monthly family income

Income (monthly)	Mean	Median	Mode
Family	R\$1530.70	R\$1200	R\$1200
Per person	R\$427.80	R\$400	R\$300

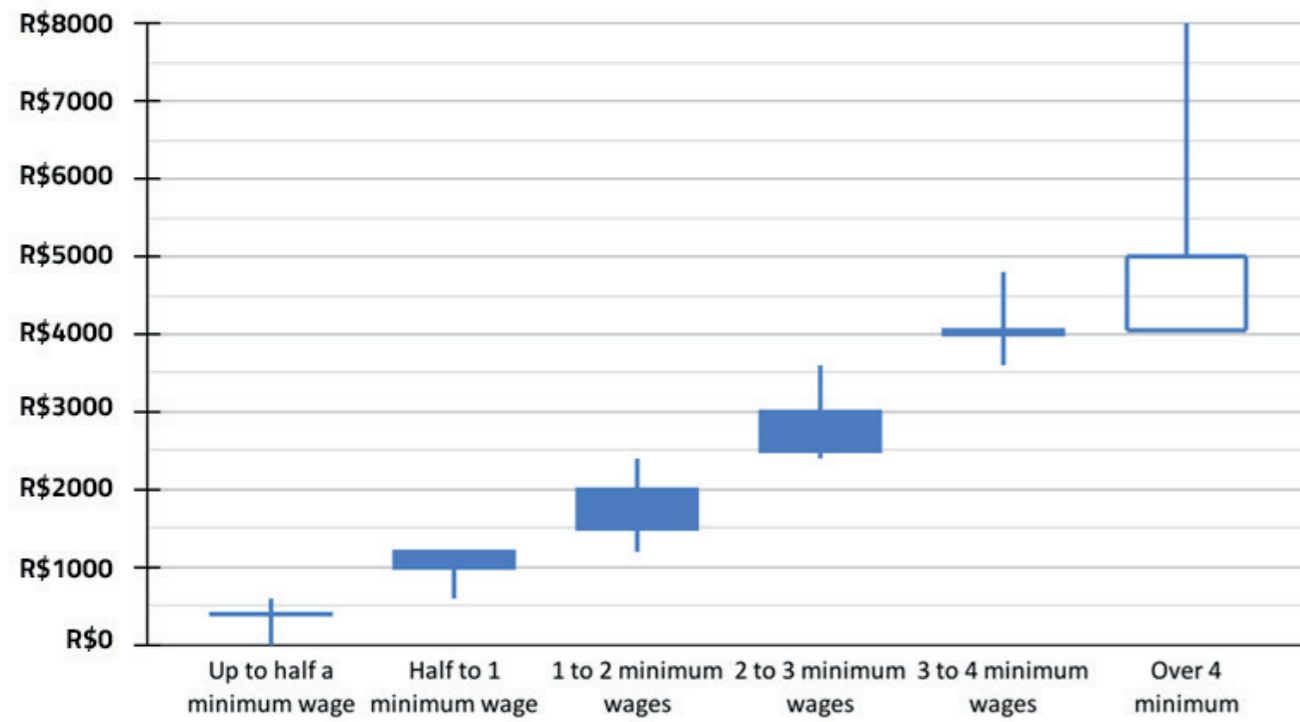
### Families that earn:



### General income distribution

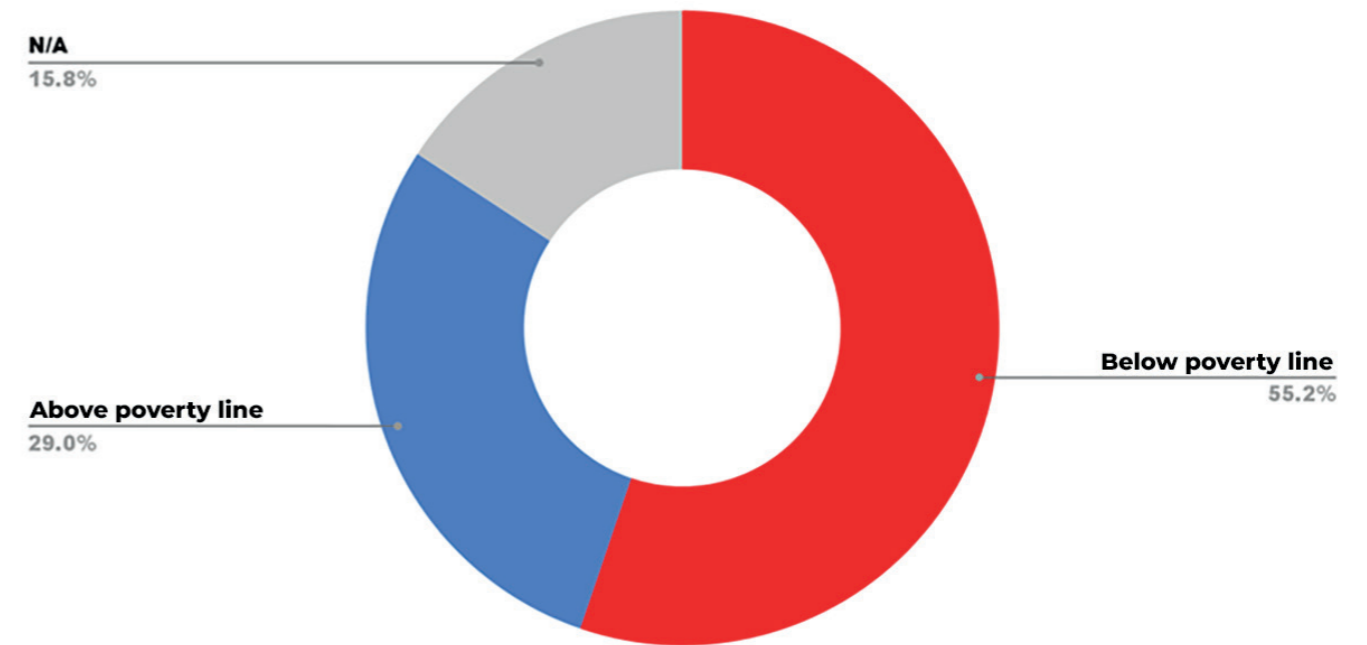


For visualization purposes, outlier values, such as R\$8000 and R\$6000, were removed in the elaboration of this chart



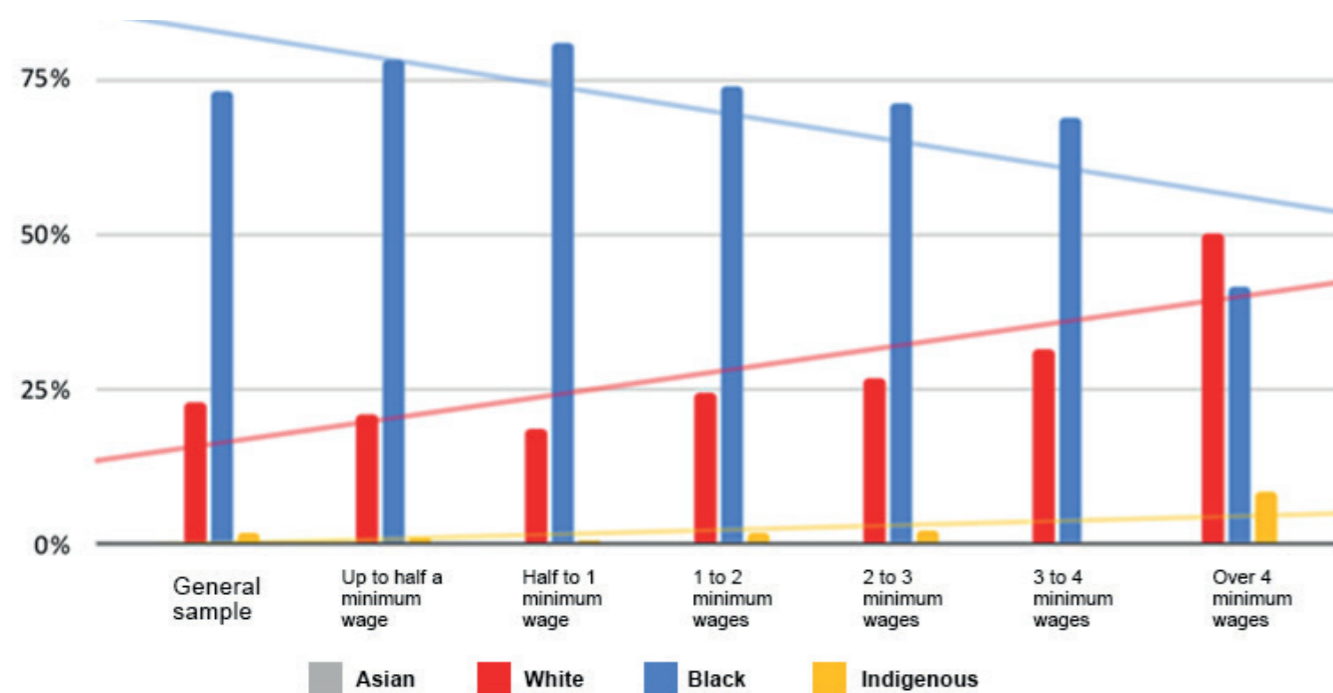
## Family income by international comparison

Percentage of respondents under the poverty line



## Income and Race

Breakdown by race and income



**Considerations:** While in Brazil in 2021, 29.6%\* of the population lived below the poverty line, in our study, realized in 2022, 45.5% of those interviewed experienced such conditions, making clear the context of social vulnerability among those interviewed.

**Observation:** The poverty line is established at R\$497 (US\$96) per month.

**Source:** FGV Social, via data from PNADC/IBGE.

**Considerations:** In this graph we see a progressive reduction of the presence of Afro-Brazilians as incomes increase. The opposite trend occurs among whites.

## How Energy Inefficiency is an Equity Issue and Harms Low-Income Brazilians

Energy inefficiency is a complex problem involving multiple actors with shared, yet distinct, responsibilities and agendas. Its impact on Brazil's favelas and peripheries is equally complex and multifaceted. Energy efficiency is determined by one's ability to meet one's needs with the least amount of energy necessary and is impacted by the ability of families to access electricity, the quality of the electricity they access, the appliances in their homes, in the safety of the distribution network and the electricity supplied, and in people's habits, among other areas. However, it is more easily recognized and its importance expressed more crucially when looking at the financial impact of energy (in)efficiency.

Those sampled in this study pay, on average, an electric bill that is twice as high as the average declared payment capacity. 32% of the families live in energy poverty, with families earning up to half the minimum wage suffering the most (with 20% in energy poverty). For these families, the average maximum payment capacity of an electric bill is R\$30 and the average bill of the families studied (R\$120) is four times greater. This highlights the extent of the economic bias surrounding the issue of energy efficiency.

Energy poverty is more present among those with the lowest incomes, and compromises a percentage of family income that could otherwise be spent on other necessities. Among the families who answered what they would spend their money on if their electric bill were halved, 69% said they would buy food (as the first option). Looking at the responses among racial groups, those who identified as black responded disproportionately higher that they would buy more food. "Food" was the answer given by 69% of black people who answered this questionnaire, while this same answer was given by approximately 66% of people who self-identified as white.

In relation to inconsistent electricity service delivery, or the impact of energy inefficiency on the quality of service provided, the same pattern whereby the most vulnerable were most negatively affected can be observed. By examining the representation of each income group according to the frequency of power cuts, the two lowest income groups (up to half a minimum wage salary and between half and one salary) are over-represented in the groups that suffer power cuts every day and every week. The lowest income bracket represents 13% of the total sample. However, 16.7% of these families suffer electricity shortages every day and 14.8% suffer with electricity shortages every week. Meanwhile no one in the two highest income brackets suffers from daily power cuts.

While the poorest suffer with power cuts more frequently, they also suffer with delays in the resumption of service. Families earning up to half a minimum wage salary and between half and one salary are over-represented in the group where it takes over 24 hours for service to resume. While families earning up to half a minimum wage represent 15.3% of the population, they represent 19.4% of those who wait over a day for electricity to return. Those earning between half and one minimum wage make up 27% of the total sample, but represent 39.7% of the families who report waiting over a day for power to return after a power cut.

The same pattern is evident when looking at whether there had been any incidents of power cuts lasting longer than 24 hours within the past three months. Even though the majority of respondents across all income brackets did not report such episodes, in the lower income bra-

## Efficiency: Impacts on Access and Quality

ckets the percentage of people who suffered recently from long power shortages was almost double that of the higher income brackets. Among people earning two to three minimum wages, for example, 23% had recently experienced lack of electricity for over 24 hours. The equivalent data point for those earning up to half a minimum wage salary was 41.5%.

In terms of the loss of appliances due to grid failures, among the four lowest income brackets, it is observed that the higher the income, the lower the percentage of appliance losses. This indicates that, when we examine these four lowest income brackets, the lowest income bracket suffers a higher proportional loss of appliances. However, in general, the class proportionally most affected is the one that earns more than three minimum wages. This is the only bracket in which the majority of people (almost 60%) said they had lost appliances due to power grid failures.

Though the poorest are most affected by service failures, they are least likely to contact the utility, whether to request a service or file a complaint. Among families earning up to half a minimum wage, 73% said they did not complain to or request service from Light. In families earning between half and one minimum wage salary, this percentage is approximately 65%. As the salary increases, the percentage of contact with the utility increases until we enter the income bracket from 3-4 minimum wages, where more people than not have contact with the utility. This is opposite to the relationship in the lower classes. This finding reveals a lot about the relationship between the utility and communities, where only 38% of the people said they appeal to the utility when there is a problem with the energy supply. Most seek community solutions such as local electricians, neighborhood associations, neighbors, or try to solve the problem themselves.

Alongside the challenges faced when promoting energy efficiency in these communities, another factor which illustrates the relationship between the utility and the favelas is that 43.5% of households sampled did not have an energy meter. Analyzing this information in each income bracket gives us an even deeper insight into how this situation is skewed to disadvantage the poorest. The only income bracket whose majority stated that they did not have an energy meter was the lowest—those who earn between zero and half of a minimum wage salary. As income increases, so does the proportion of people who have an energy meter. One must remember that the installation of energy meters is an obligation of the utilities and the meter is a fundamental tool needed to measure energy consumption and efficiency in homes.

One of the most critical points concerning electricity and the favelas is the issue of clandestine electrical connections. Classified by the utility company as “non-technical losses,” they are famously known in Brazil as “gatos” and are considered criminal acts. A narrative from outside the favelas generalizes the existence of “gatos” in these communities in a bid to stigmatize favelas as “illegitimate,” “illegal” communities whose residents are “spongers” and “criminals.”

The perspective adopted by this study opposes this view. We understand that the existence of “gatos” is, in most cases, the only way to guarantee access to electricity in these areas, which is a right in Brazil. The existence of “gatos” must therefore be analyzed considering the context of inequality, energy poverty, poor quality service, and the terrible relationship between utility companies and the community. Due to this, the data presented here debunk the hegemonic narrative surrounding “gatos,” instead understanding their existence from the perspective of guaranteeing access to the right to energy.

**When asked if they knew someone in their community who had a “gato,” 69.9% of people responded “yes” and 21.1% responded “no.” When asked if they had one or more appliances connected to an irregular installation (a “gato”), 48.8% answered “yes,” 41.1% answered “no,” and 9.7% said they didn’t know or didn’t want to answer. This despite 97.4% being connected to the formal grid, implying that some are connected to the utility but also use “gatos” for some appliances. This is very important to contemplate in a report about energy efficiency because despite the main reason for the existence of “gatos” being instruments that guarantee access to energy, they also highlight the challenge—and financial importance—of strengthening energy efficiency in the favelas.**

Considering this, we wanted to observe the percentage of people who have a “gato” across income brackets. This allows us to understand how this electricity access tool is distributed amongst different income groups in favelas, and once again the data reflect the impact of family income. The income bracket of those earning up to half a minimum wage had the highest proportion of people with a “gato” (69.3% admitted to having a “gato” compared to 28.5% who said they did not). This proportion gradually decreases as income increases. Among families with incomes between half a minimum wage salary and one minimum wage salary, 47.4% said they had a “gato” and 39.4% said they did not. Among families who earn a monthly income between one and two salaries, 49.8% have a “gato” and 42.7% do not. In higher income brackets, the ratio once again reverses, for example among families earning more than two minimum wage salaries more people do not have a “gato” than have one.

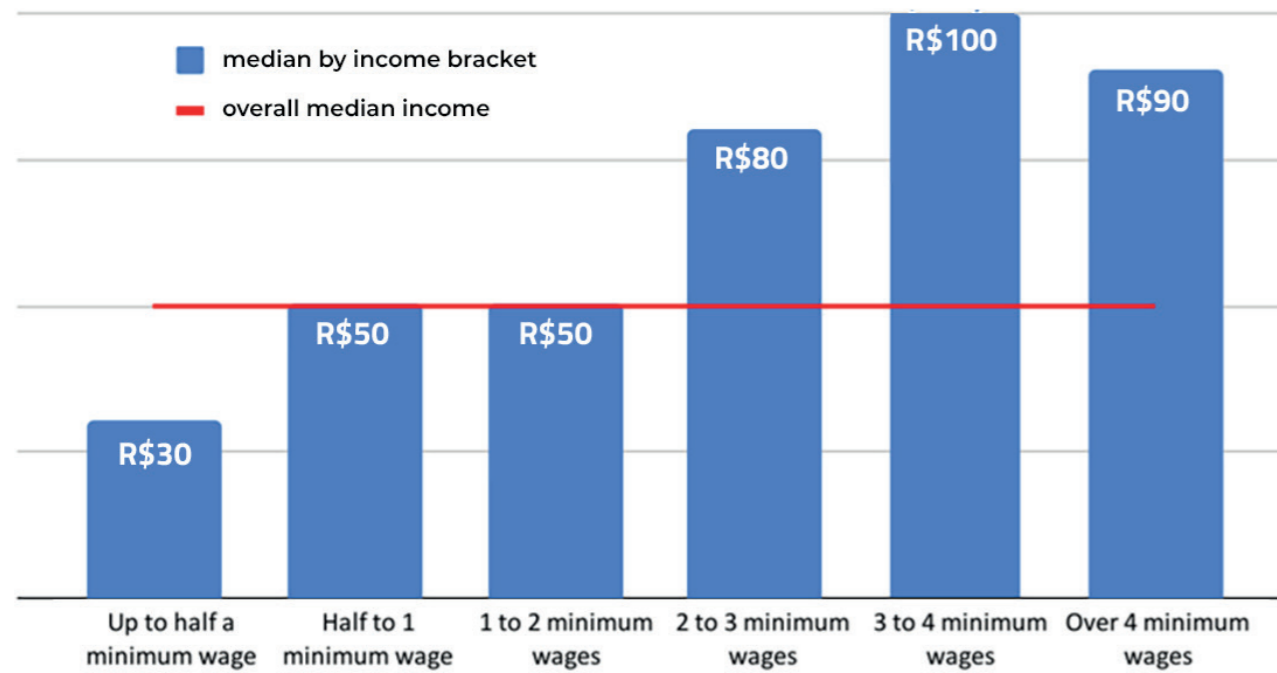
**The data collected contradict the perception from outside the favela that an overwhelming majority of residents have a “gato.” Even if a significant percentage does, it is not particularly excessive.**

**Observation:** *The analysis assumes answers given by respondents to be true. It should be kept in mind that interviewees were always given the option not to answer and were told their answers were guaranteed anonymity.*



## Research findings on how much families are able to spend on electricity

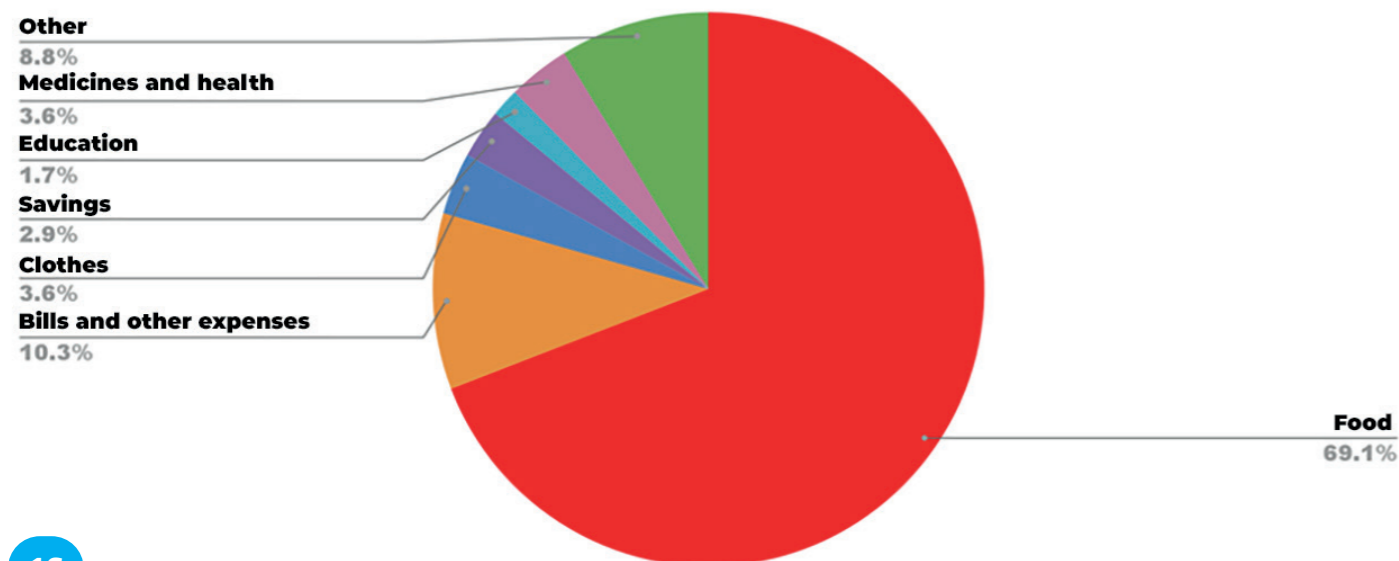
Payment capacity of families per income bracket



**Considerations:** The lowest income bracket is most exposed to the risk of energy poverty as they have the least capacity to pay. On the other hand, the value residents responded as their median payment capacity (R\$30), were it applied, would mean an end to energy poverty for all respondents.

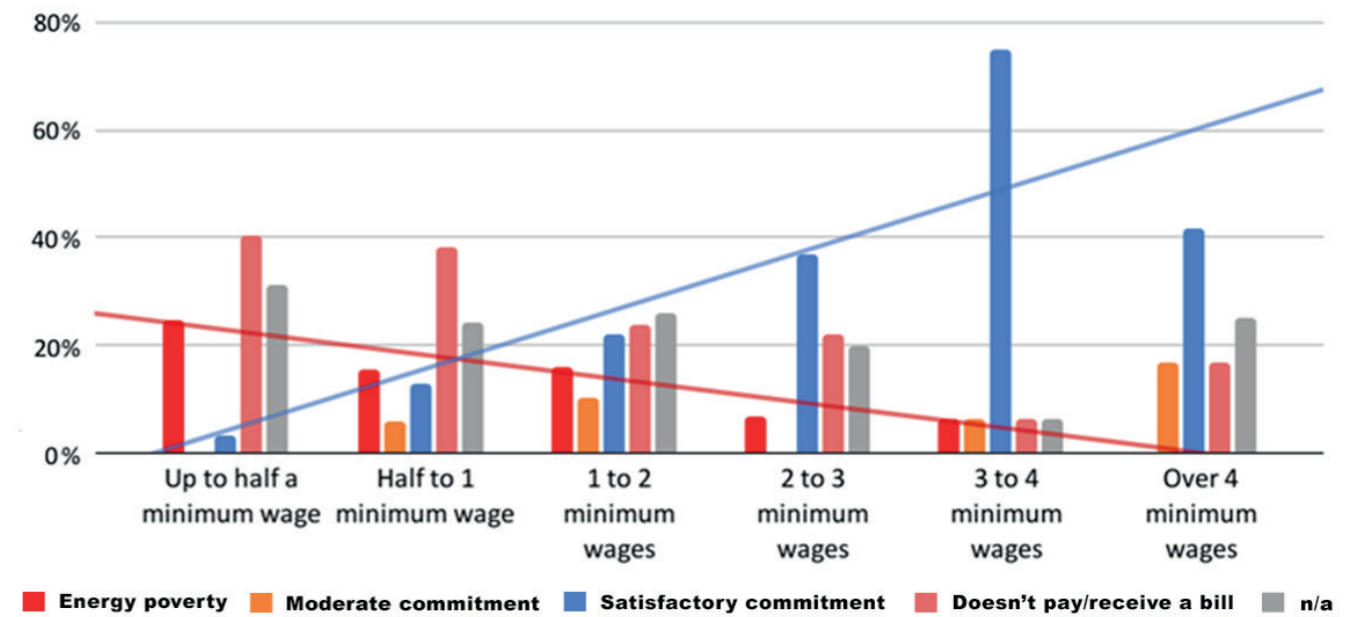
## Research findings on costs and bills

If your electric bill was reduced by half, what would you spend the savings on? (not including n/a which represented 42.3% of responses)



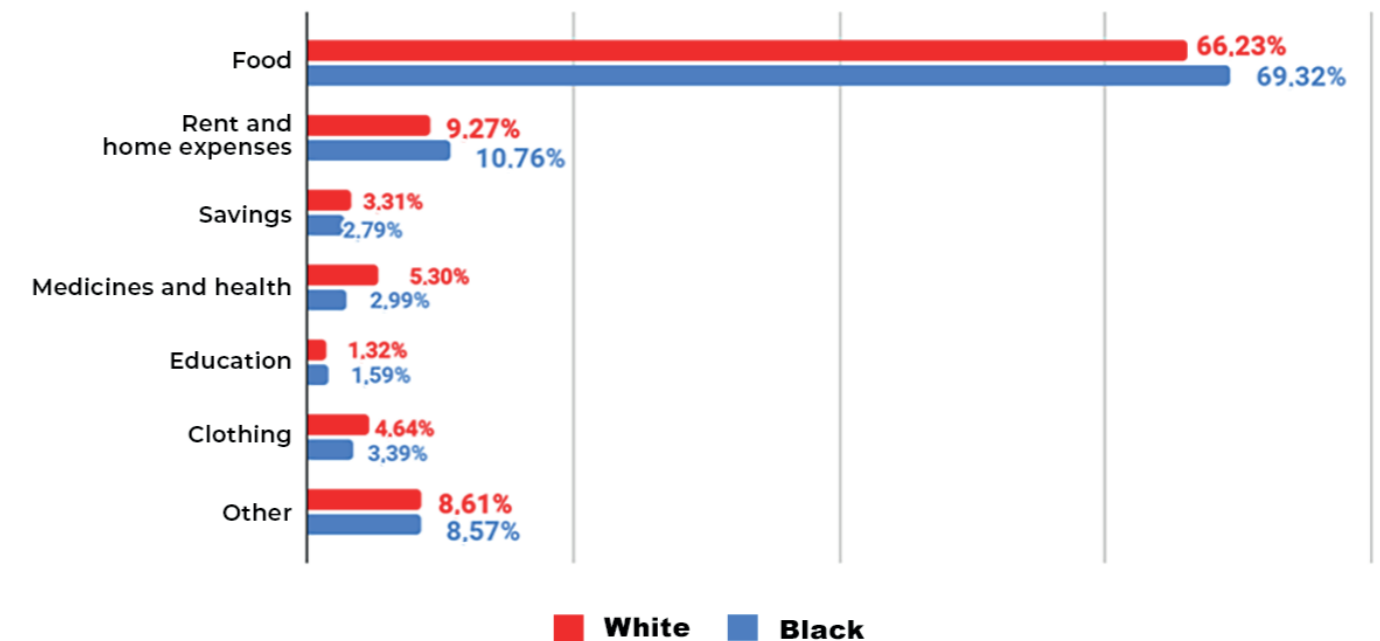
## Income and Energy Poverty

Energy poverty by income bracket



**Considerations:** Families in the lower income brackets are proportionally more affected by energy poverty than families with higher incomes. This is a strong indication that greater efficiency could help the most vulnerable families above all.

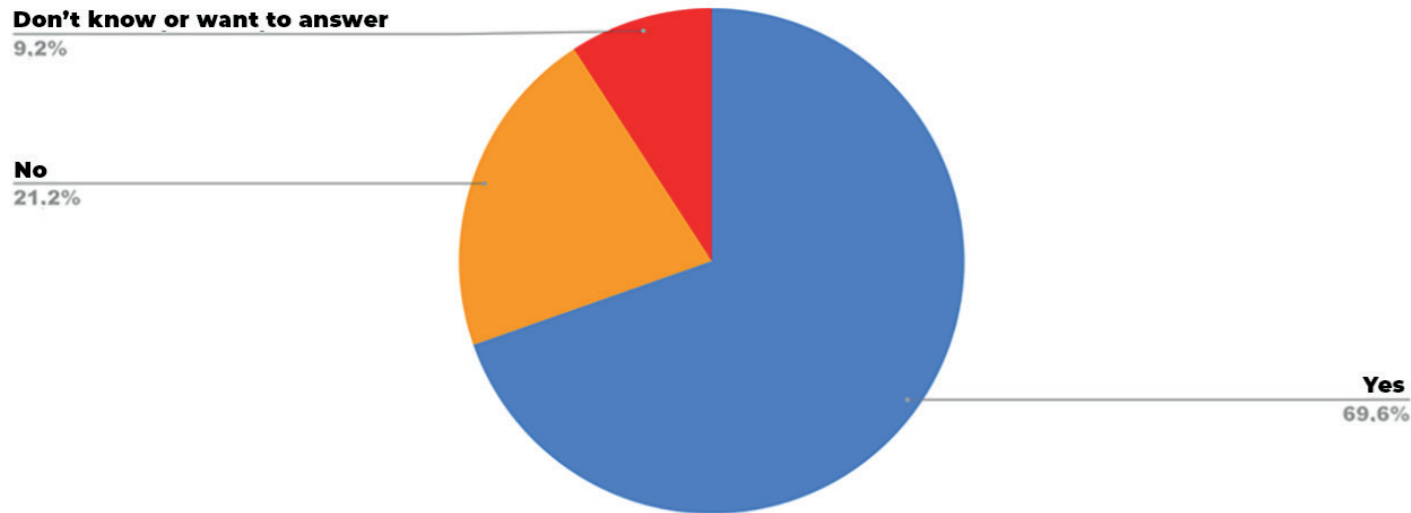
## What would you buy if your bill were reduced by half? (by race)



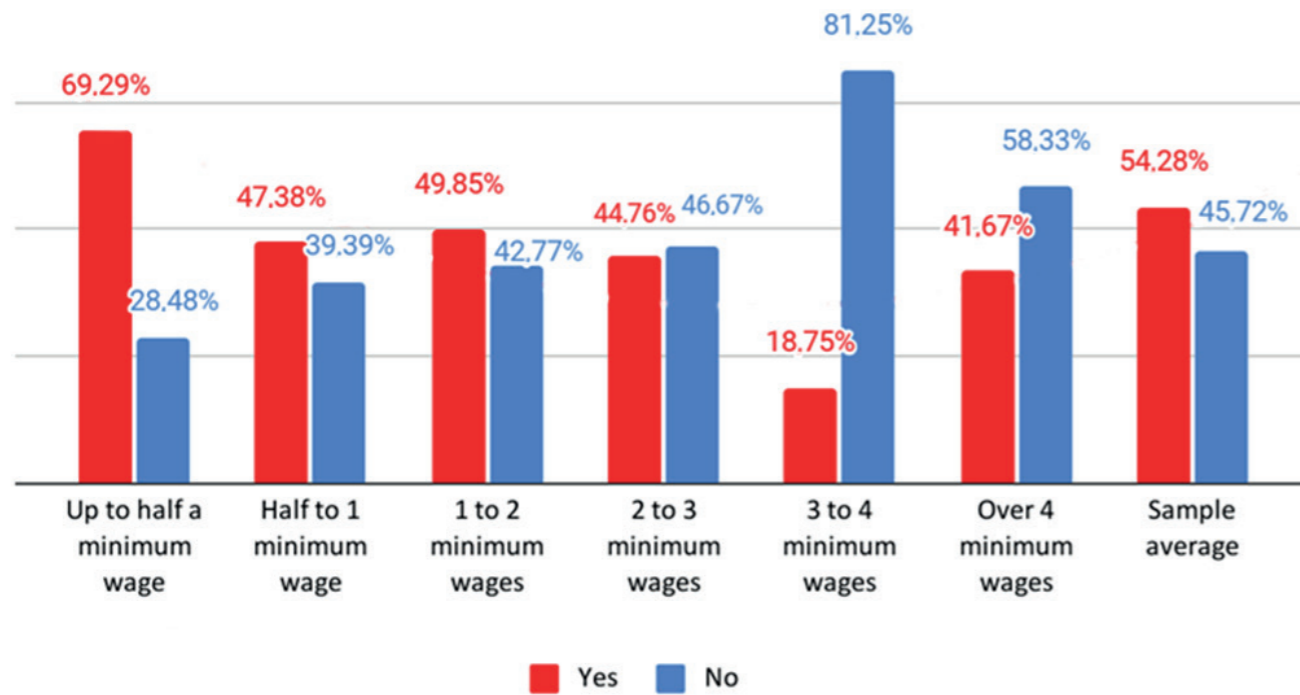
**Considerations:** Considering the responses by race, Afro-Brazilians responded at slightly higher rates than whites that they would buy food (as their first option), indicating a greater exposure of this group to food insecurity.

# Research findings on irregular connections to the grid

Do you know someone in the community who has an irregular electricity connection ("gato")?

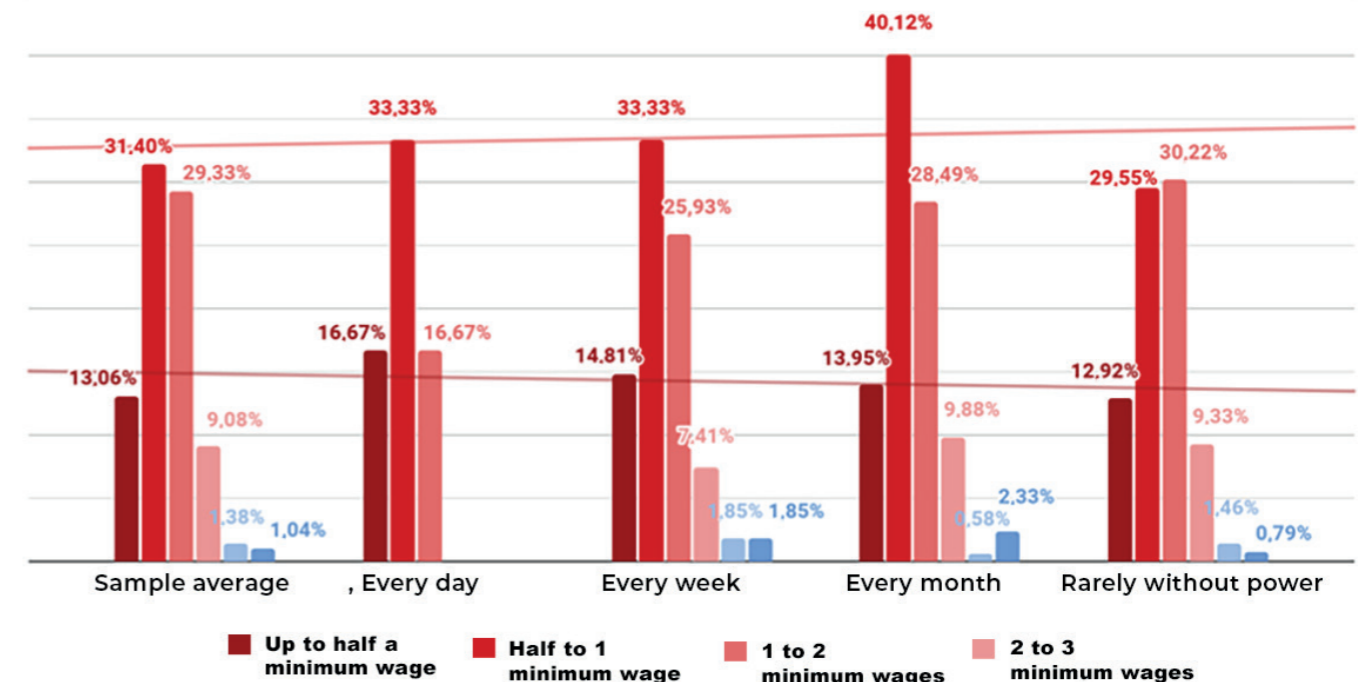


## Proportion of people who have a "gato" by income bracket



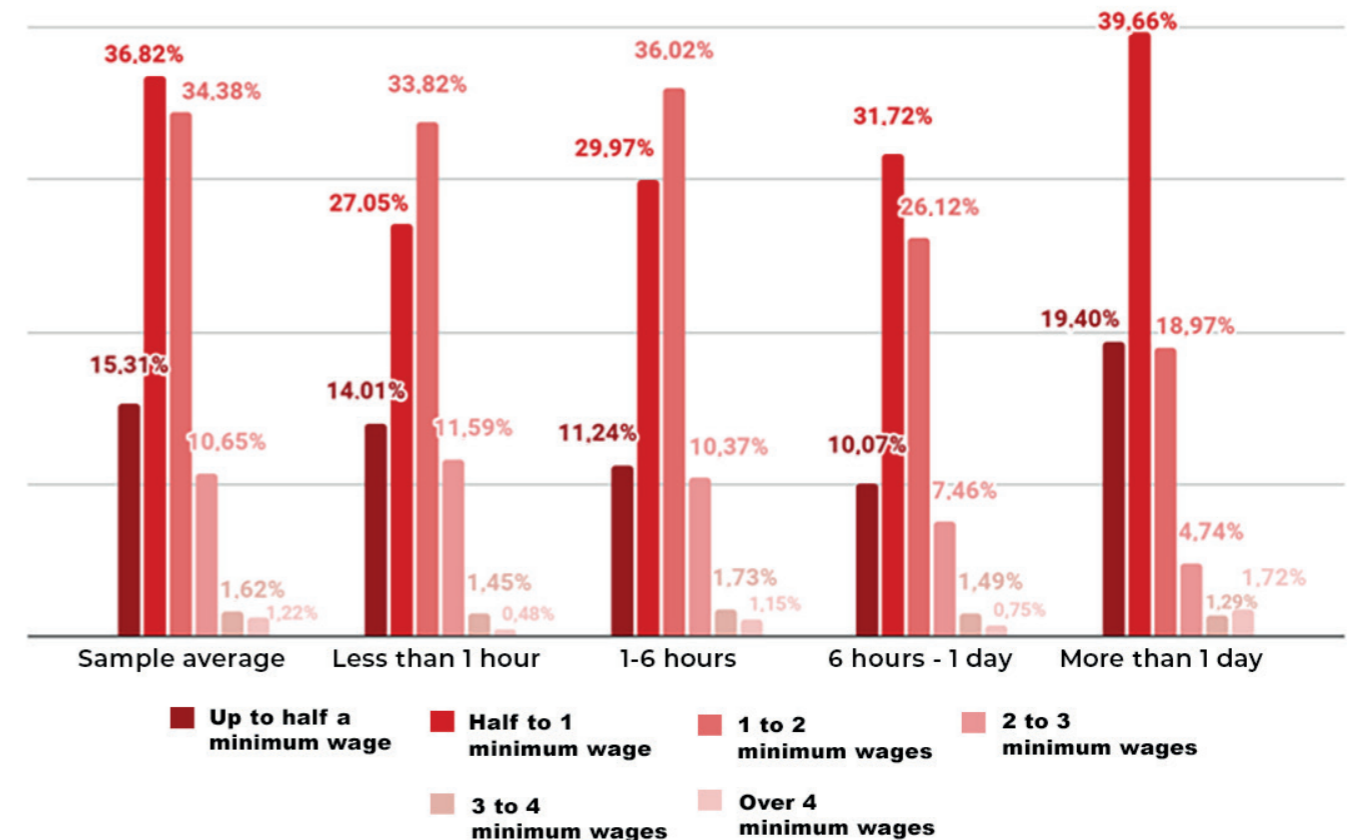
**Considerations:** The graph shows the proportion of people who claim to have at least one device connected to a clandestine electricity connection ("gato") in each income bracket. From this we see that the lowest income bracket (up to half a minimum wage) has a proportionally greater of number of people with a "gato". This proportion gradually goes down as income increases. The majority of families earning over 2 minimum wages don't have a "gato". This indicates that having a clandestine electricity connection is linked to family income and as such is a condition arising from the economic inaccessibility of a critical service.

## Income brackets as related to frequency of power cuts



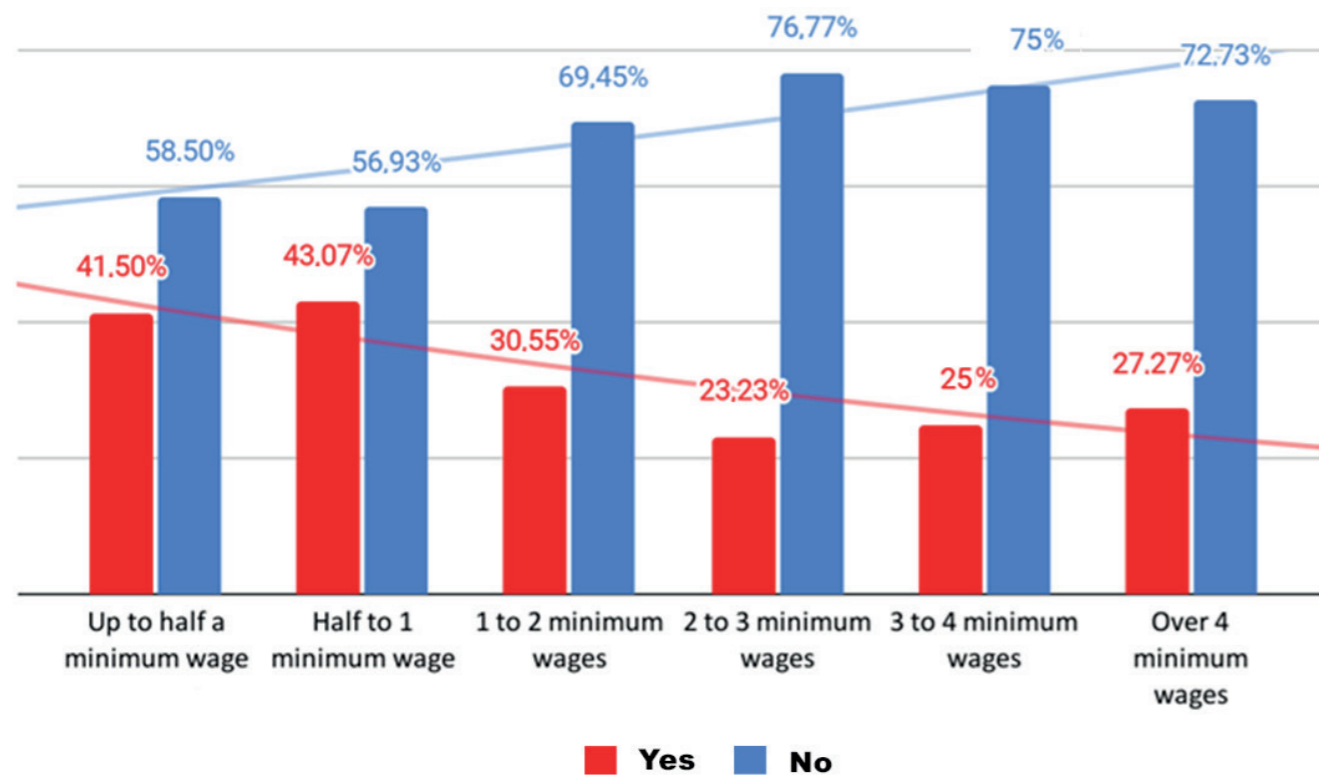
**Considerations:** Who suffers the most power cuts? Looking at the representation of each income bracket amongst those experiencing power cuts, one observes that the lower income brackets are overrepresented among those impacted. Another observation is that no one in the two highest income brackets experiences daily power cuts.

## Income brackets as related to speed of resumed service



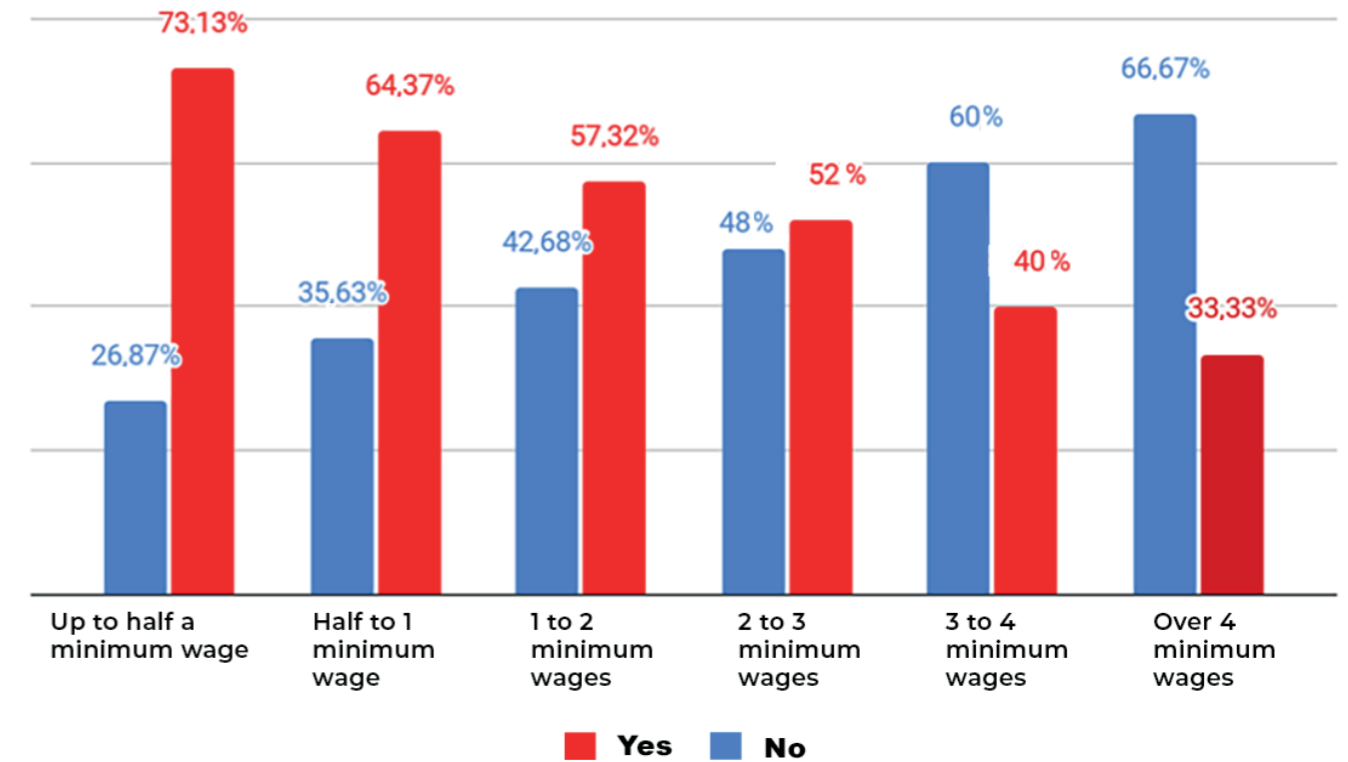
**Considerations:** This graph shows an overrepresentation of the two lower income brackets among those for whom service takes over a day to resume.

Income brackets as related to power cuts lasting over 24 hours (in the last three months)



**Considerations:** The lower income brackets were disproportionately affected by episodes of 24 hour (or longer) power cuts.

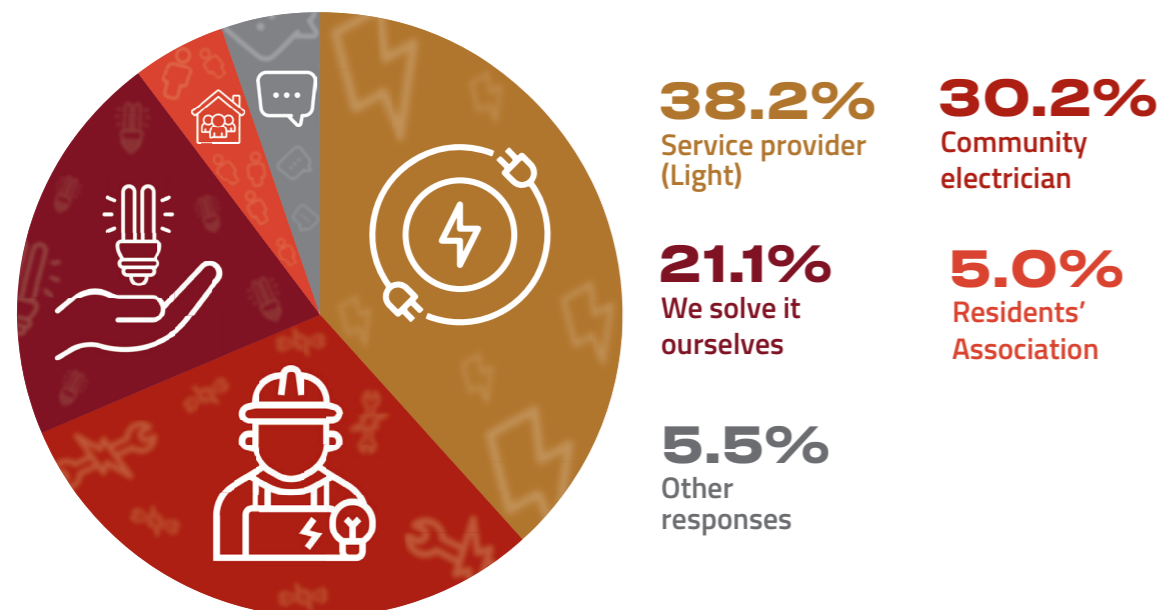
Have you ever complained or made a request to Light? (by income)



**Considerations:** The graph shows the proportion of people who have complained or requested service from the electric utility (Light) in each income bracket. It's clear that the lower income brackets have proportionally more people who have no contact with the service provider. As income increases, this proportion goes down until in the two highest income brackets the opposite occurs whereby more people have requested service from the utility than haven't. This shows the exclusion of the lowest income groups from a relationship with Light

## Research findings on service quality

Who do you turn to when you have an electricity supply problem?



## *Electricity Social Tariff (TSEE) and National Energy Conservation Label (ENCE)*

There are already measures in place in Brazil that aim to lower electric bills for the most vulnerable families. The Electricity Social Tariff (TSEE) provides subsidized power while also supporting conscious energy use by offering higher discounts for lower consumption brackets. However, the data collected in the sample reveal that 68.7% of respondents (794 people) do not know about the TSEE and among those who do, only 32.7% (93 people) said they receive the benefit, which represents 24.5% of the total. Looking at this distribution between income brackets, those earning between 0 and half a minimum wage and half to one minimum wage are the least familiar with the TSEE. This indicates a potential for the policy's expansion and a failure in its implementation, since these are the people most in need and who should be assisted by the tariff. In the sample taken for this study alone, 623 families fit the criteria to receive the TSEE, but said they do not have the benefit.

Another way to make electric bills accessible, especially to the poorest, is by investing in the energy efficiency of household appliances. In keeping with this perspective, the study sought to measure knowledge of household appliance efficiency in the population and the willingness/priority in adopting measures in this direction. When asked if they recognize the National Energy Conservation Label (ENCE), 70.7% (817 people) recognize it. Among the people who recognize it, 68.2% (557 people) said they knew what it means and 49.1% (401 people) said they had previously purchased a household appliance based on its classification within the ENCE category "A." In the sample as a whole, only 50.6% said they knew what the label means and only 34.2% said they had purchased a household appliance based on its classification within the ENCE category "A."

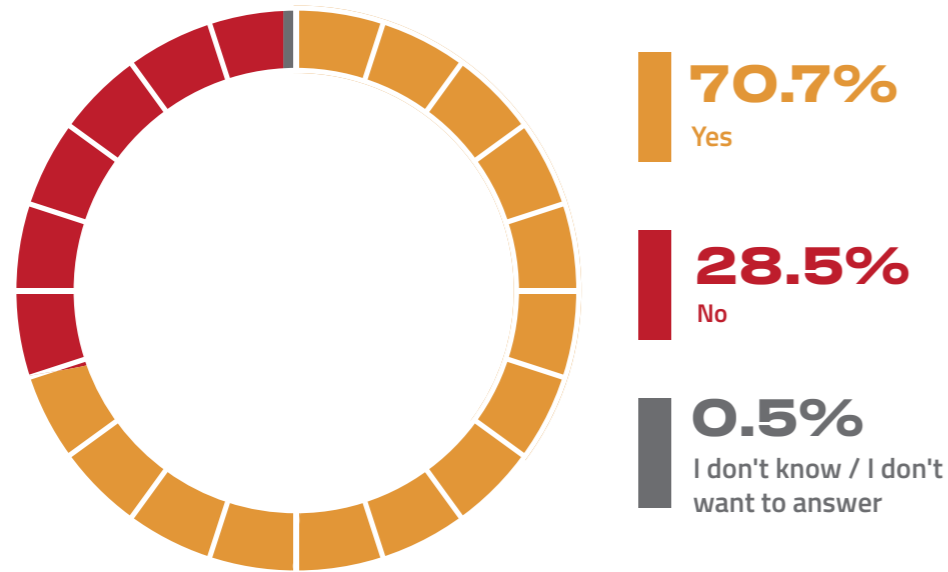
**These data show a relatively high level of recognition of the energy efficiency rating label. However, almost half of the sample did not know what it means, which shows how great a challenge these territories face in terms of a culture of energy efficient electric devices.**

A close look at the familiarity with ENCE in the different income brackets identifies, again, how lower-income families are more affected by lack of knowledge and, consequently, do not enjoy its benefits. Although the majority in all income brackets recognizes the label, it is less familiar to the two lower income groups. Regarding the meaning of the label, these same two ranges are the only ones that, for the most part, do not know what ENCE means.

# **KNOWLEDGE OF ENERGY EFFICIENCY RATINGS AND THE ELECTRICITY SOCIAL TARIFF (TSEE)**

## Research findings on efficiency labels

Do you recognize the National Energy Conservation Label (ENCE)?

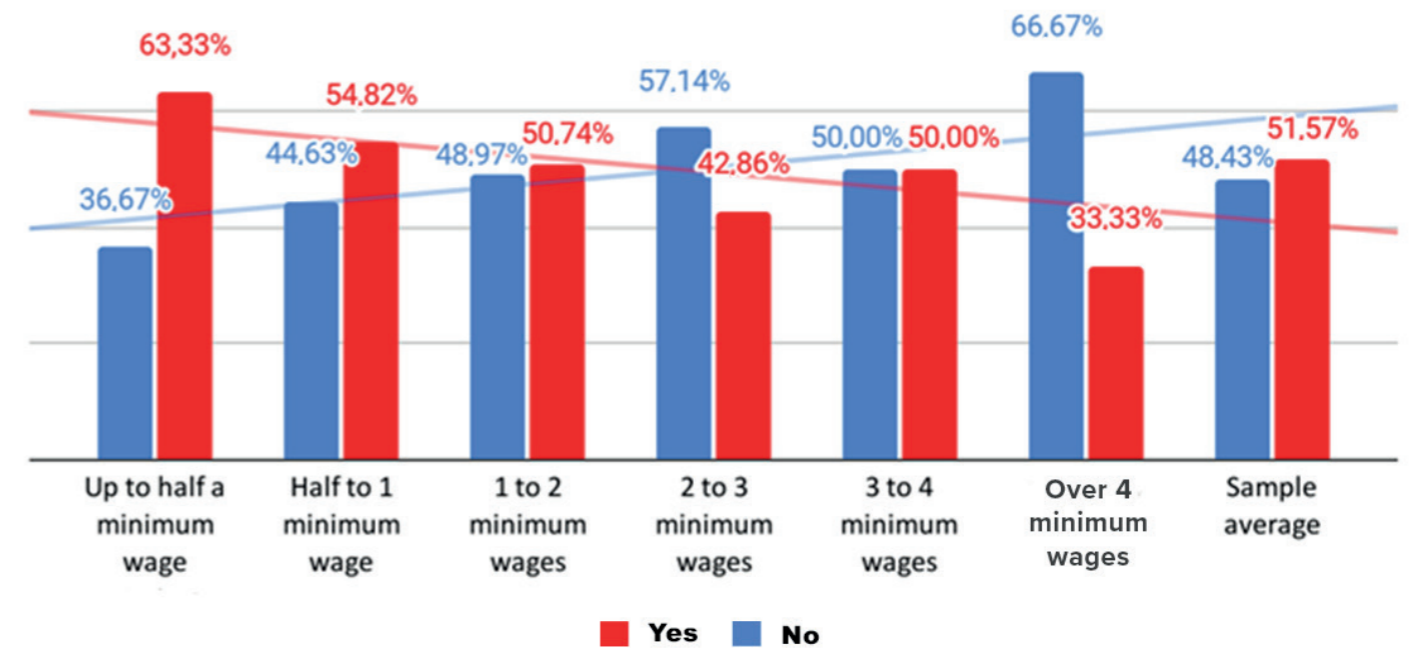


### Considerations:

- 70.7% (817 people) recognize the label. Among those who recognize the label:
- 68.2% (557 people) say they know what it means
- 49.1% (401 people) say they have purchased an electrical appliance based on it having a category "A" classification on the ENCE label

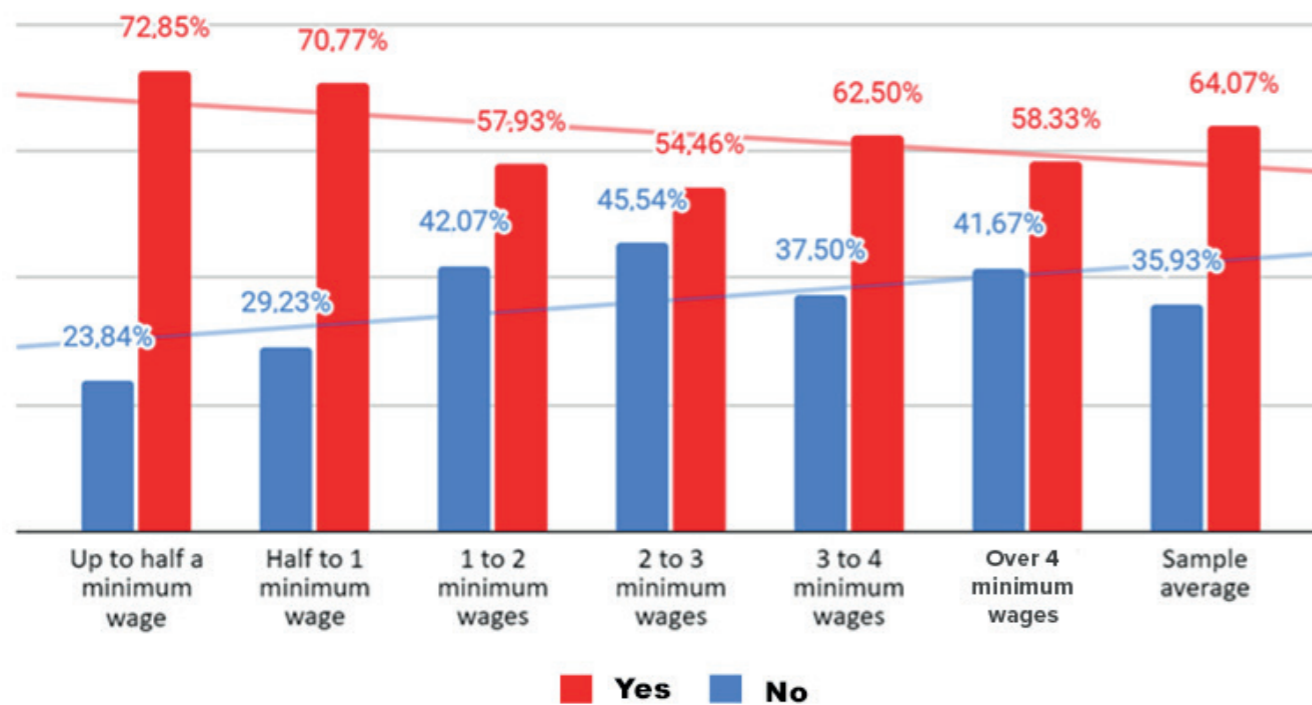
## Research findings on efficiency labels

Do you know what the ENCE label means? (Responses by income bracket)



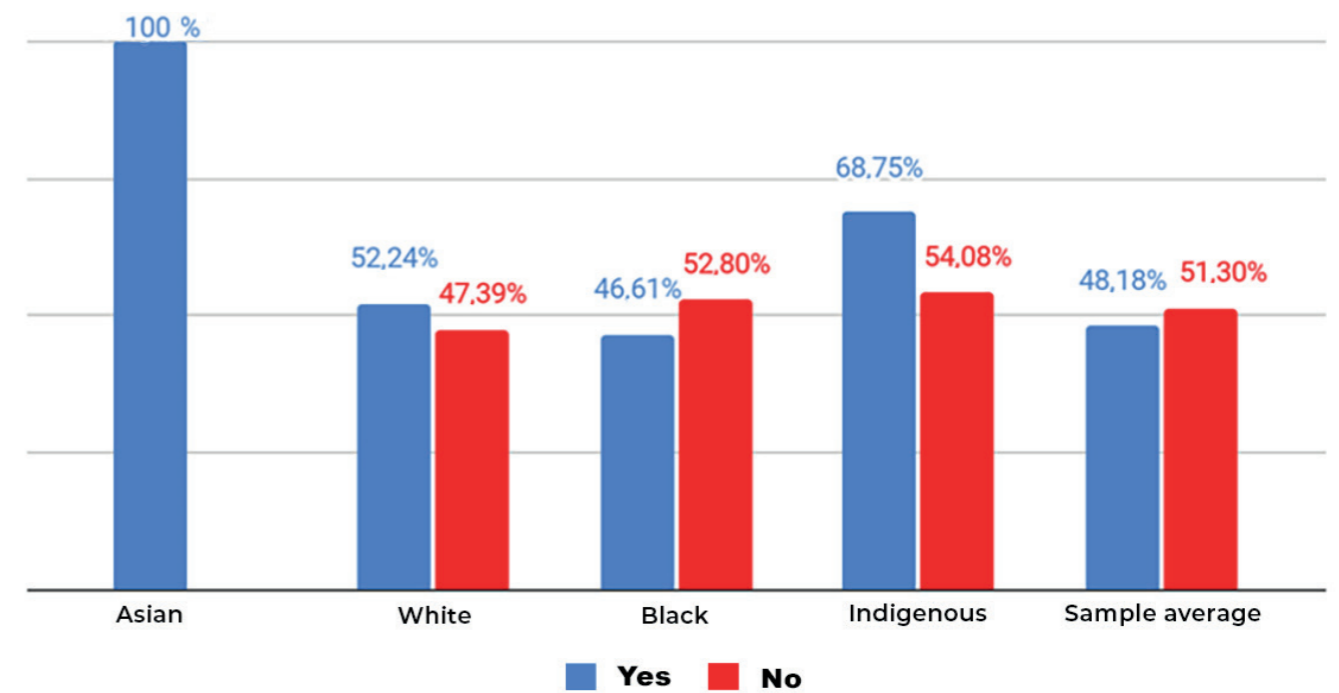
**Considerations** The graph shows that the majority in the three lowest income brackets—those with a monthly family income of up to 2 minimum wages—don't know what the ENCE label means. This suggests a lack of understanding around energy efficiency which could help reduce electric bills.

Do you recognize the ENCE label? Distribution by income bracket



**Considerations:** While the majority of all income brackets recognize the ENCE label, the two lowest income brackets show a lower than average knowledge of the label. We can also see that the higher the income bracket, the greater the level of knowledge, proportionally speaking. The exception is the highest income bracket, which shows a lower level of knowledge than the previous bracket.

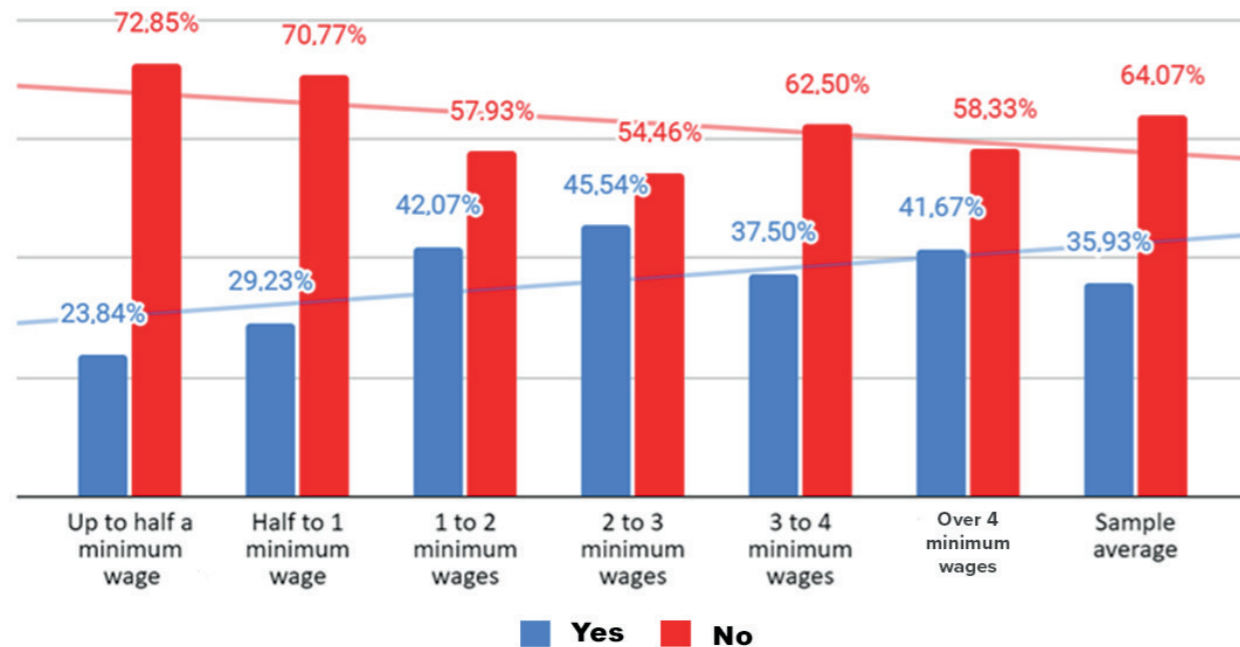
Do you know what the ENCE label means? (responses by racial group)



**Considerations:** In terms of race, the only group in which the majority don't know the meaning of the efficiency label ENCE are Afro-Brazilians, though the difference is minimal.

## Research findings on efficiency labels

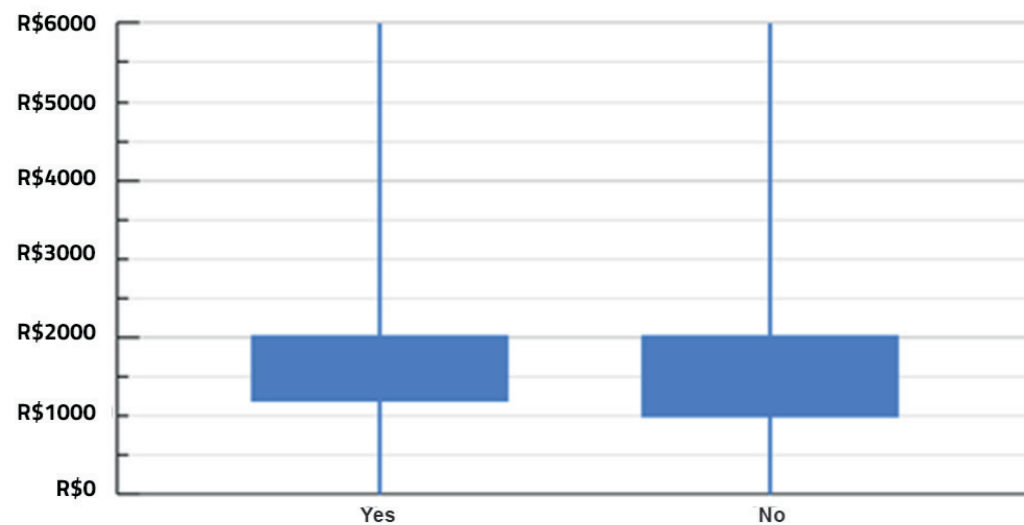
Have you bought an electrical appliance based on the ENCE label? Responses in each income bracket



**Considerations:** In all the income brackets, the proportion of people who have not purchased an electrical appliance based on the ENCE label is higher than those who have.

However, we can see that in the lower income brackets, there is a markedly greater difference in the proportion of those who have and haven't made a purchase based on the ENCE label.

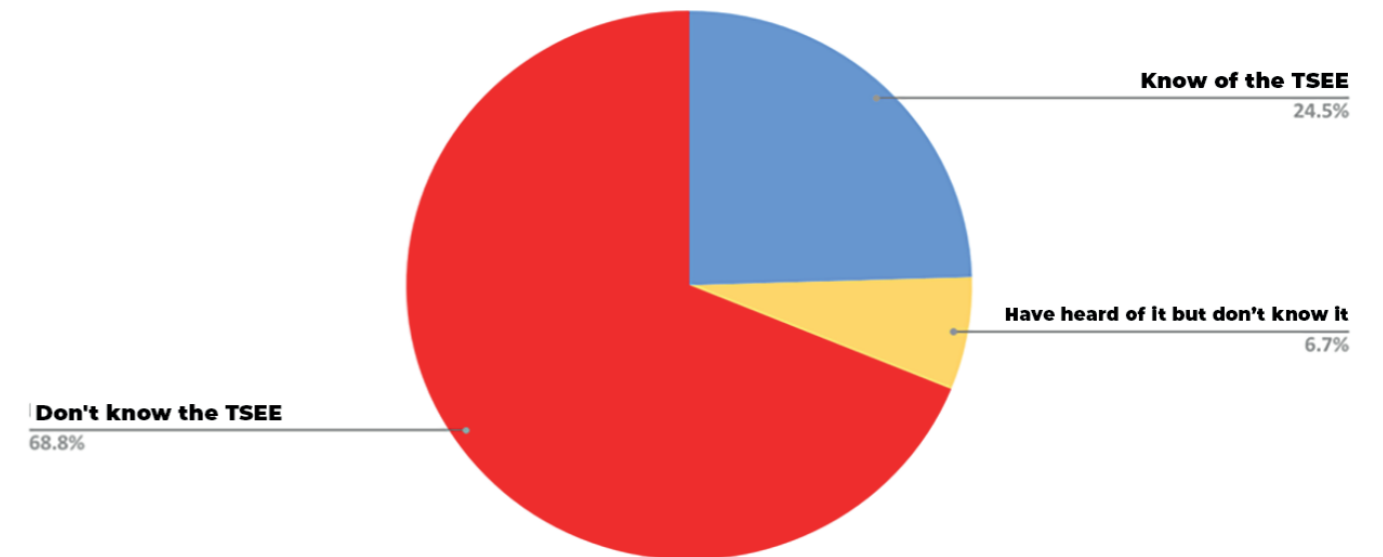
Have you bought an electrical appliance based on the ENCE label? (group income analysis)



**Considerations:** Separating the groups into those who said they have bought an appliance based on the ENCE label and those who haven't, we see there's a slight difference in income between these groups. Among those who said they've bought an appliance based on the ENCE label, 25% have a family monthly income of up to R\$1200, while those who said they haven't earn up to R\$1000. The median income of these groups is also different, being R\$1500 for those who have made a purchase based on the ENCE label and R\$1200 for those who haven't.

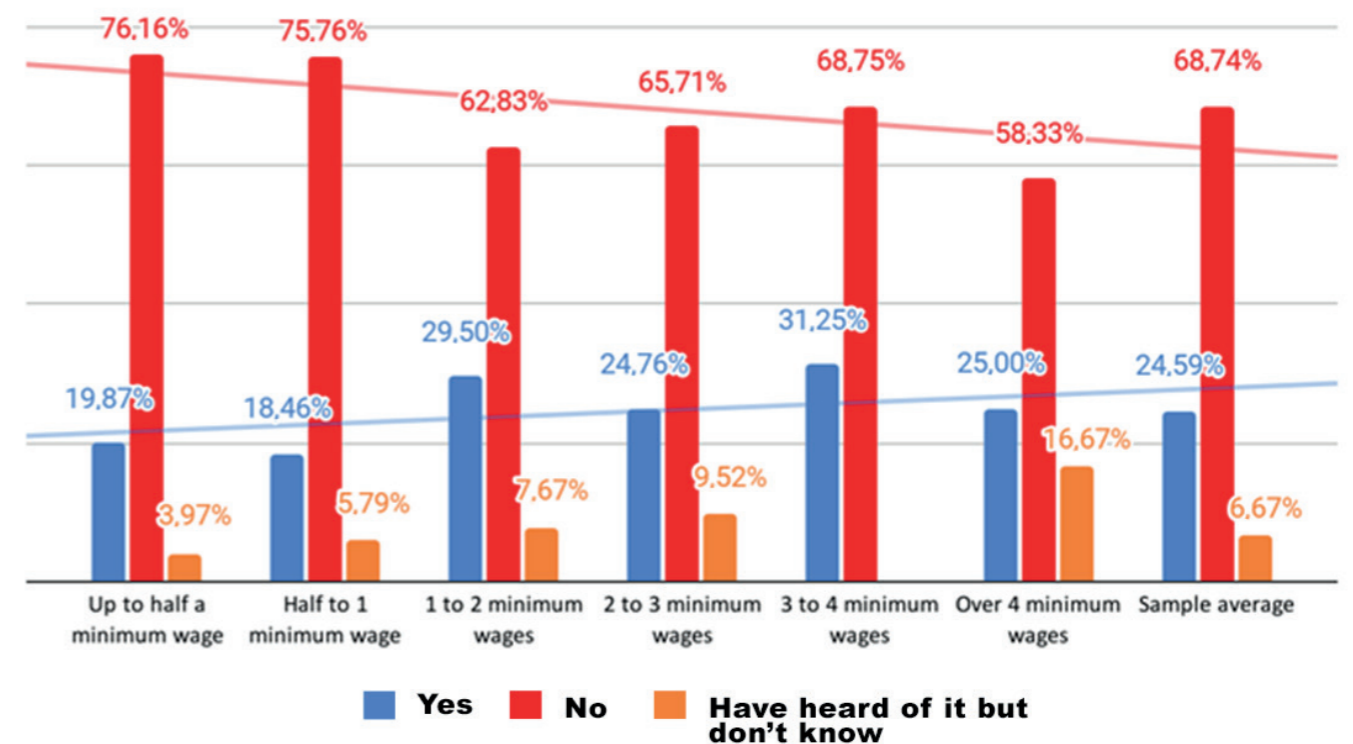
## Research findings on the Electricity Social Tariff (TSEE)

Knowledge of the Electricity Social Tariff (TSEE)

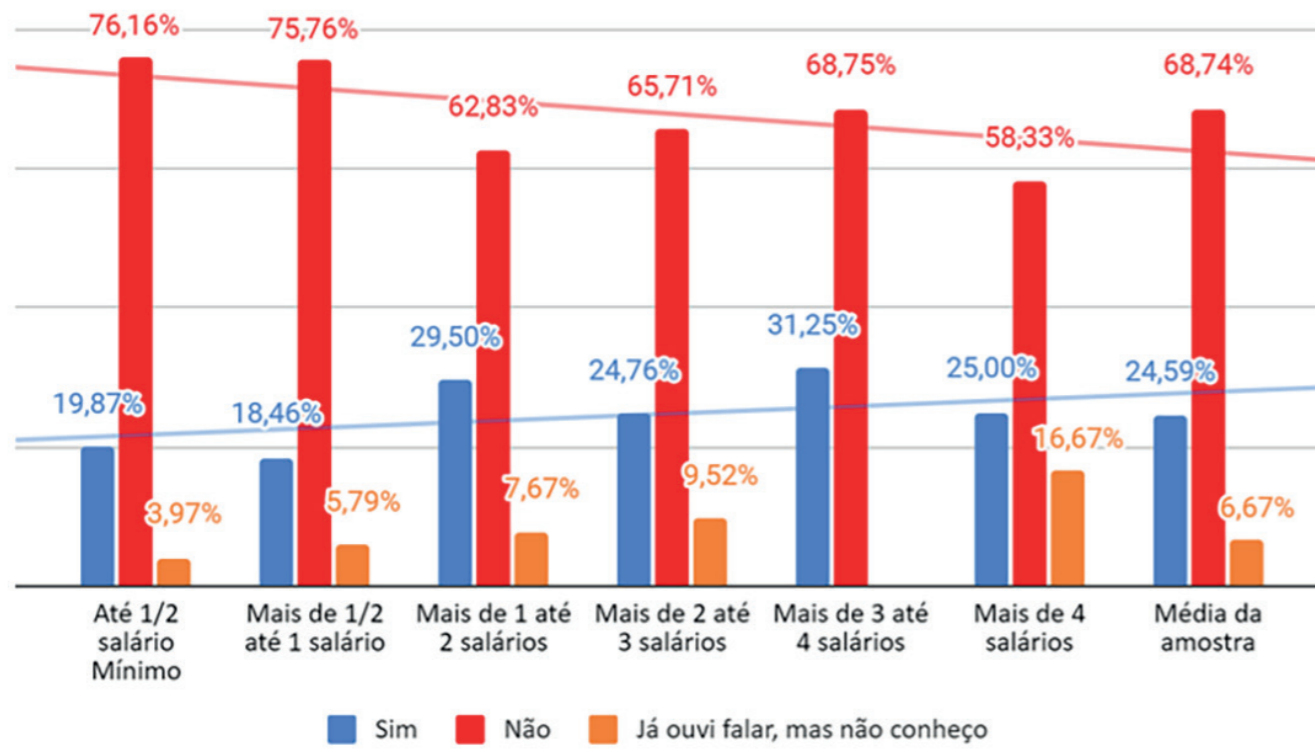


**Considerations:** 68.7% (794 respondents) don't know about the Electricity Social Tariff (TSEE). Among those who know about it, 32.7% (93 people) receive the benefit.

Knowledge of the TSEE by income bracket



### TSEE Coverage



**Considerations:** 59.55% of families meet the income criteria to take advantage of the Electricity Social Tariff (TSEE). However, only 8.04% of families confirm receiving the benefit, while 90.4% of those who qualify to receive it affirm not receiving the benefit.



## Energy Conservation Habits

## Index of efficiency habits

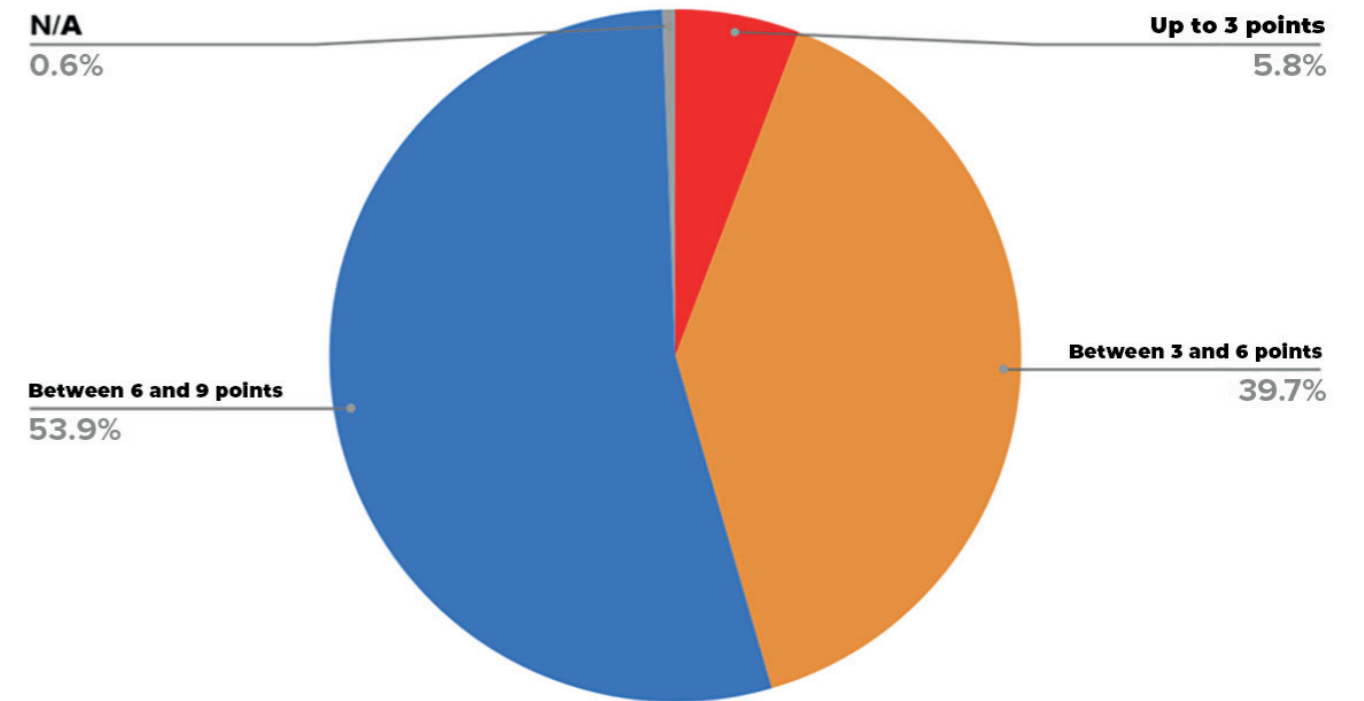
Even if it can be said that there is a moderate level of unfamiliarity about energy efficiency related to electronic devices in the territories surveyed, the existence of habits that seek to conserve electricity in their daily lives should not be disregarded. To measure the factor of energy conservation customs, an index was developed based on questions asked in the survey.

The index score was constructed by assigning 1 point when the person answered "always" for the frequency of a habit that sought energy conservation; 0.5 points were added when the answer was "sometimes"; and 0 when they answered "never." The index score therefore measures to what extent the person has habits that support energy conservation, with a minimum score of 0 and a maximum of 9. All questions about energy use habits, which gave rise to the index score, as well as the proportion of all the answers given, are shared in this report.

An analysis of respondents' index scores shows that there is a good level of energy conscious habits among the sample population. The average score was 6.21 and the mode was 7. More than half of the sample (53.9%) scored between 6 and 9 points.

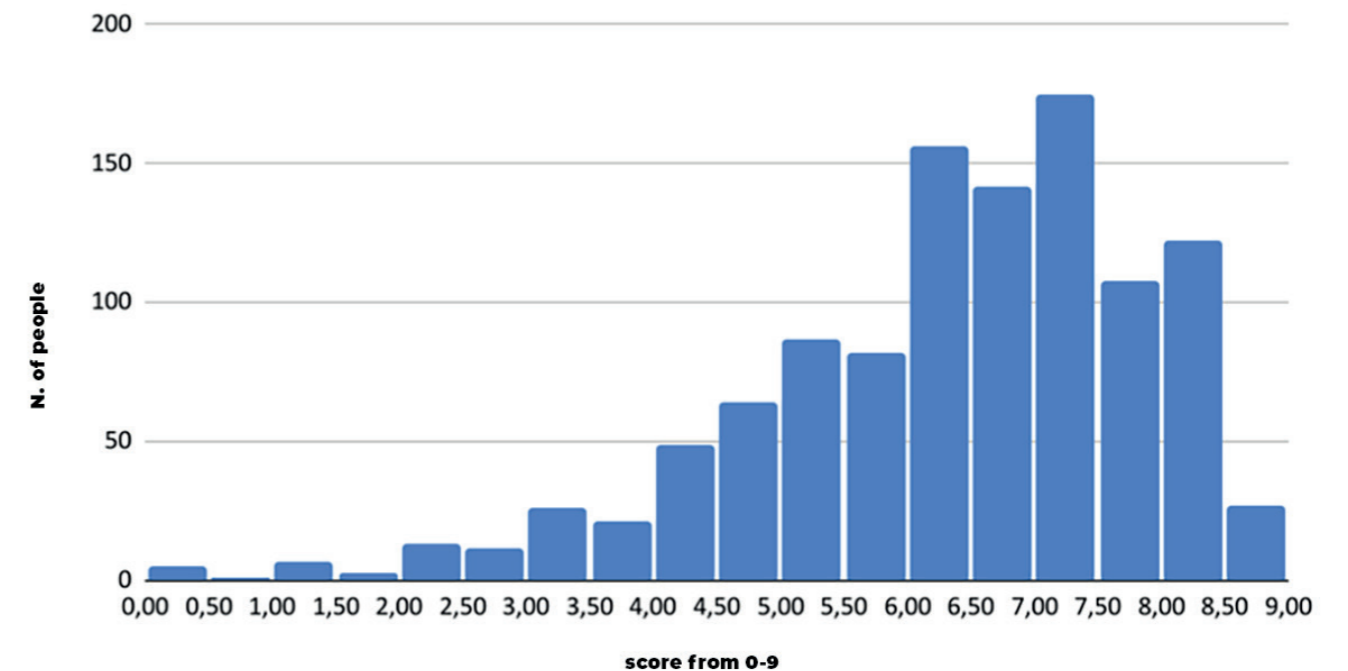
Habit Score	
Average	6.21
Mode	7
Standard Deviation	1.63

## Concentrations of energy efficient habit scores



The index score was determined by assigning 1 point when the person answered "always" for a habit that sought efficient energy use; 0.5 points when the answer was "sometimes" and 0 when the answer was "never." The maximum score is 9.

## Score (energy efficient habits)

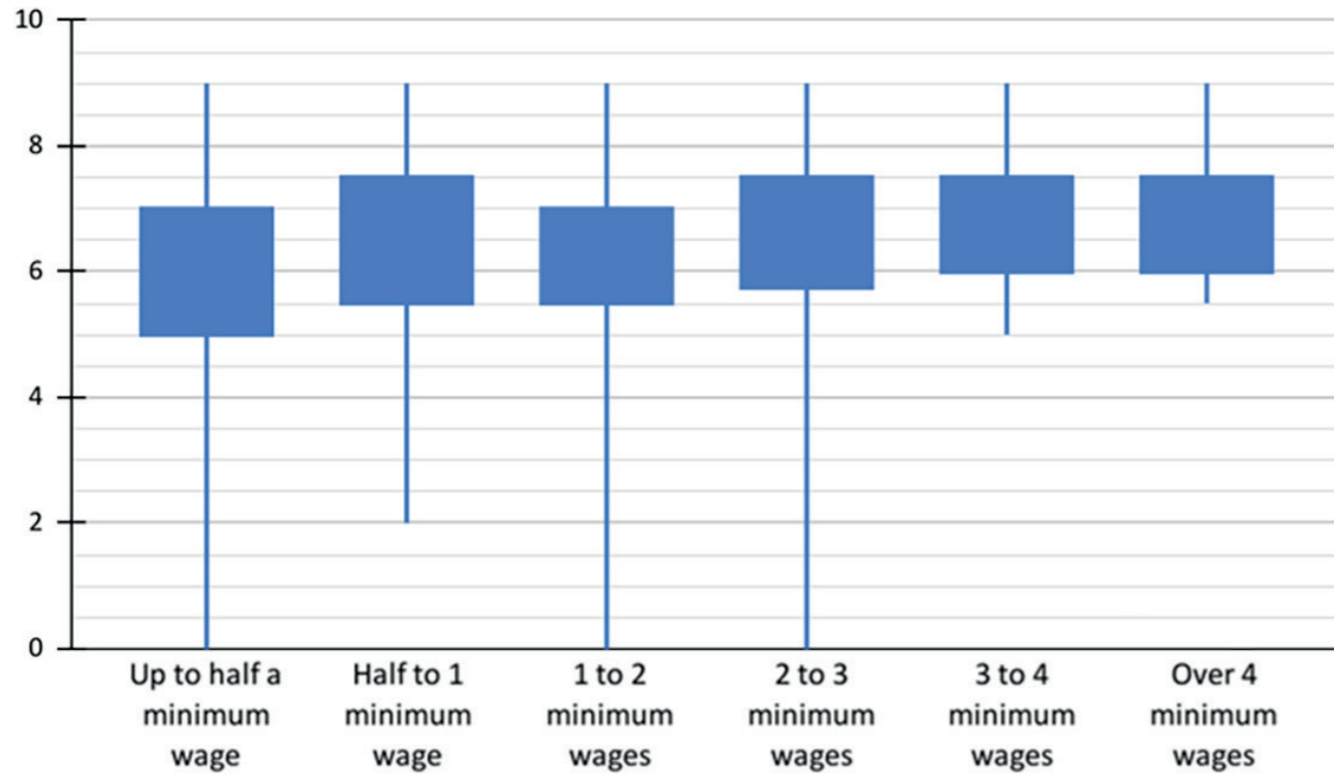


**Considerations:** Over half of the sample (53.9%) received between 6 and 9 points, which can be considered a satisfactory score, indicating that most people interviewed display energy efficient habits in their day-to-day lives.



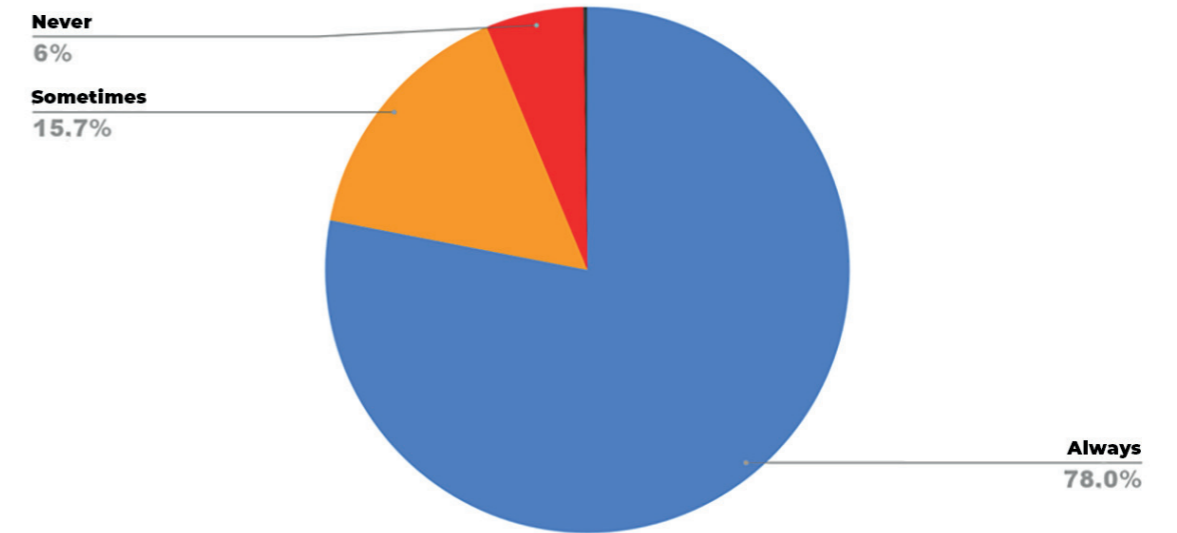
## Efficient habits

Distribution of sustainable habit scores by income bracket

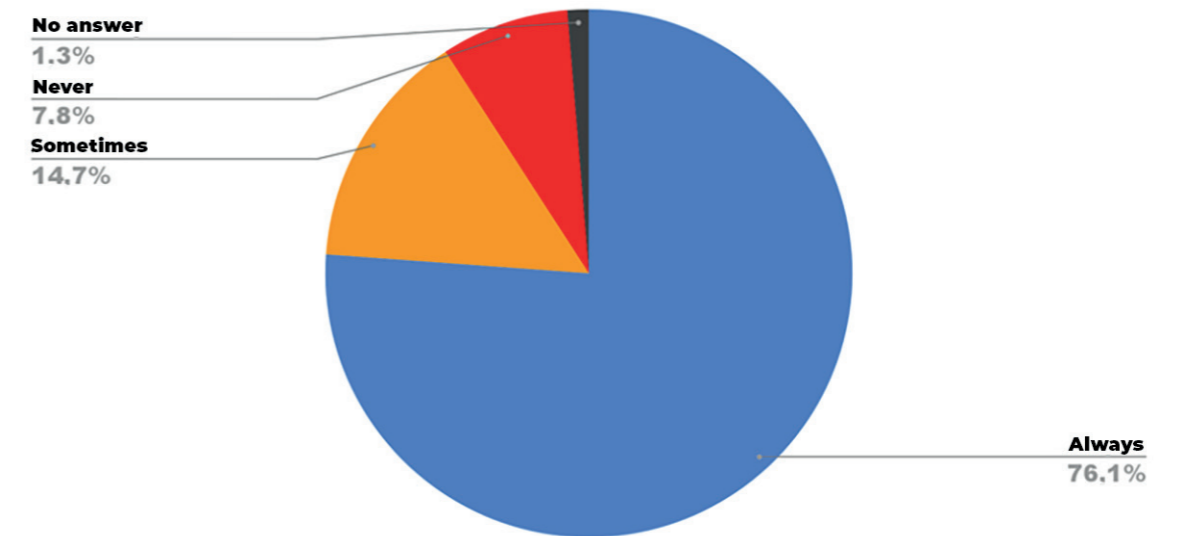


**Considerations:** In the graph, one can observe energy efficient habit scores by income bracket. There is a small median increase in efficiency habits with growth in income. The two highest income brackets have a minimum score well above the minimum scores among the lowest income brackets. That said, in all income categories there were people who achieve the maximum score (9).

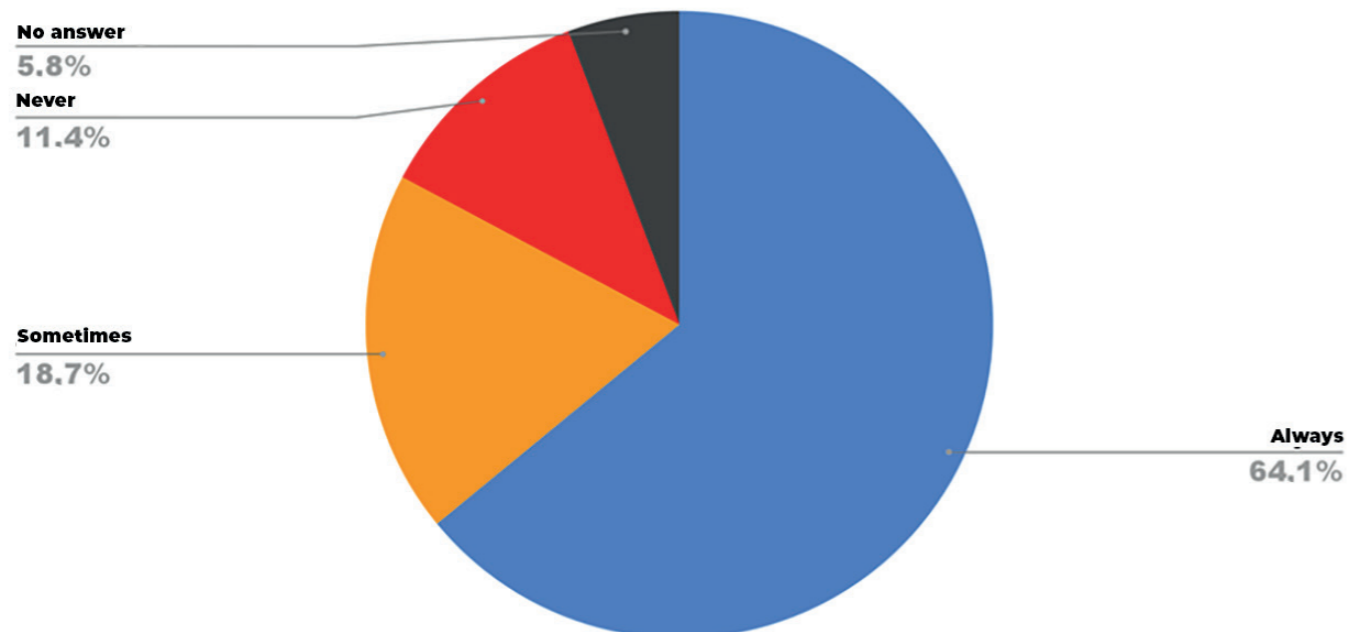
I remember to turn off the light when I leave the room



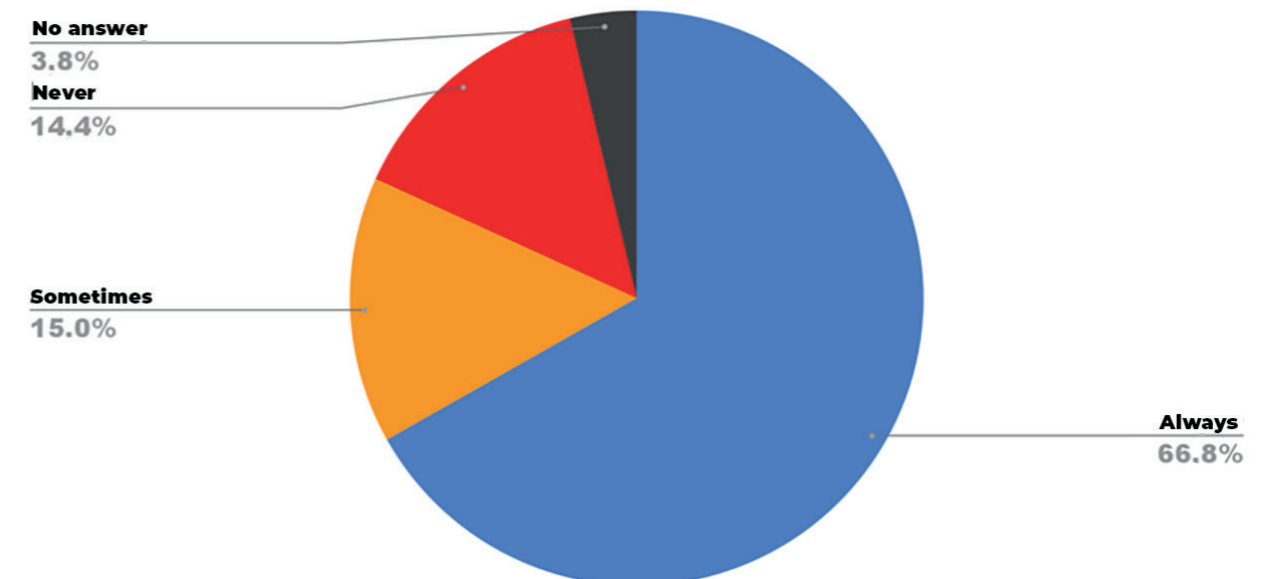
I turn off the TV when I'm not watching



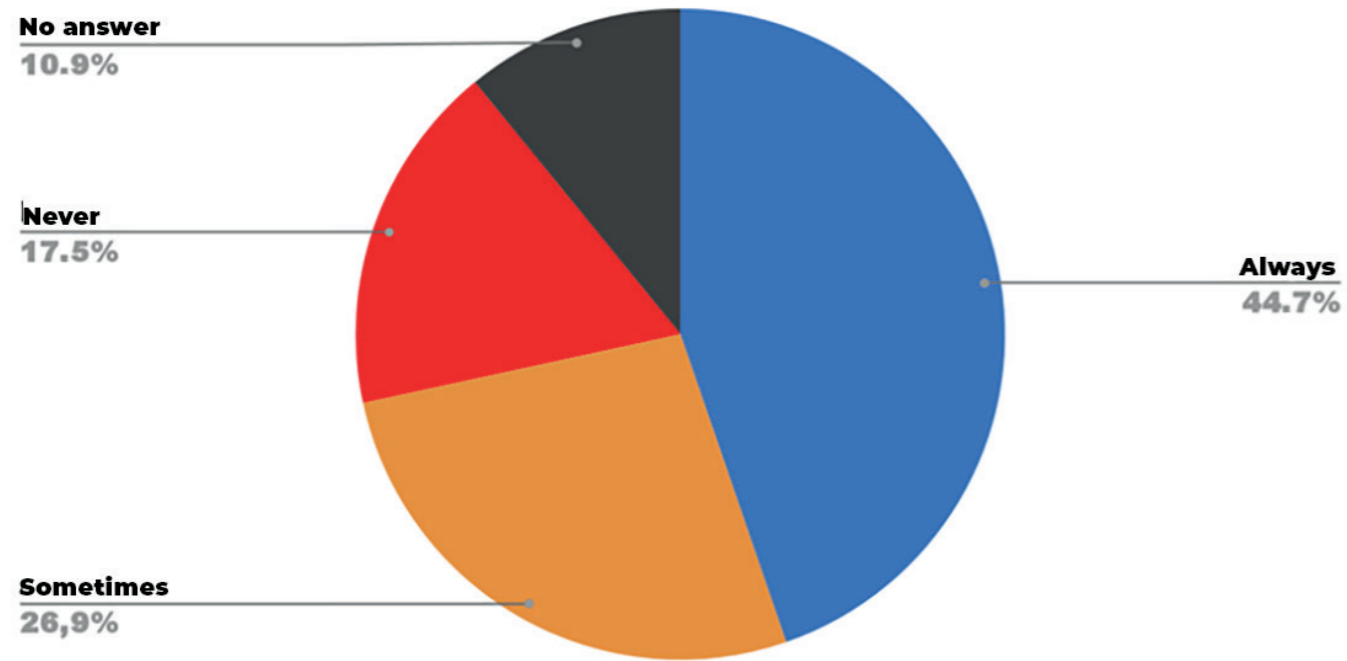
I buy fans instead of air conditioners



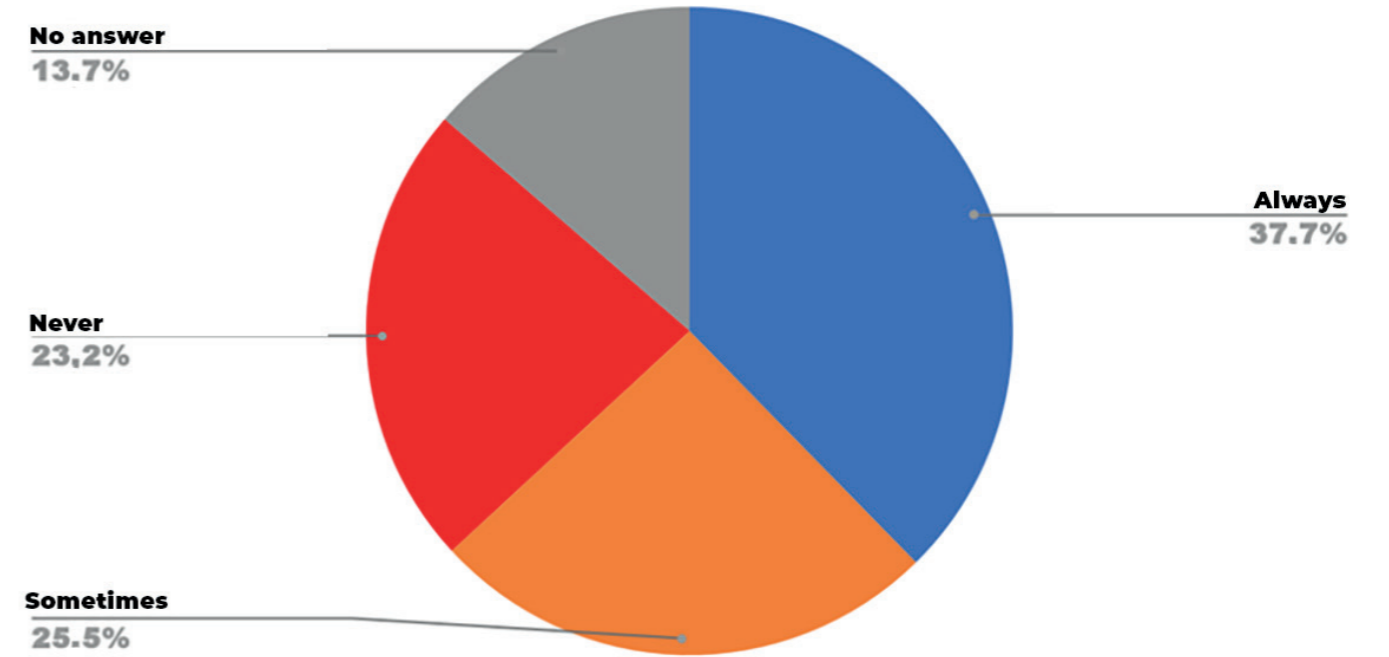
I prefer LED bulbs



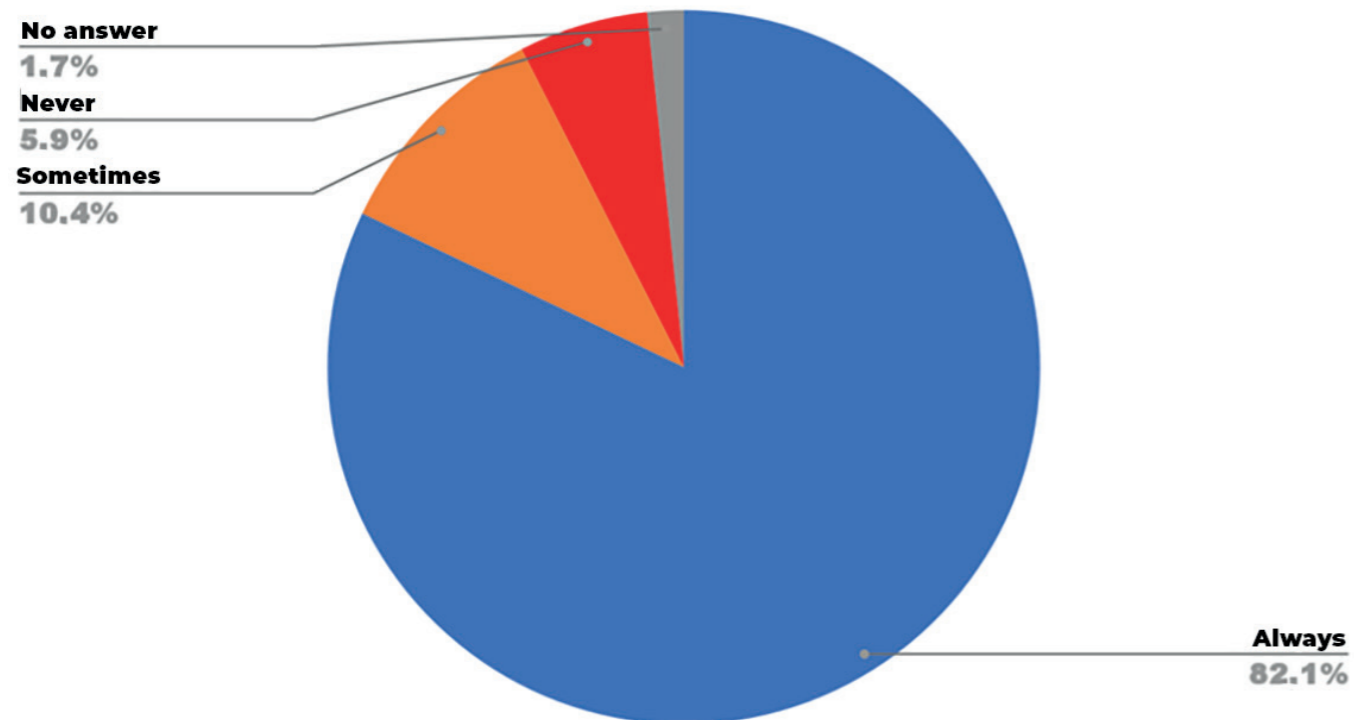
*I run the washing machine only with a full load of laundry*



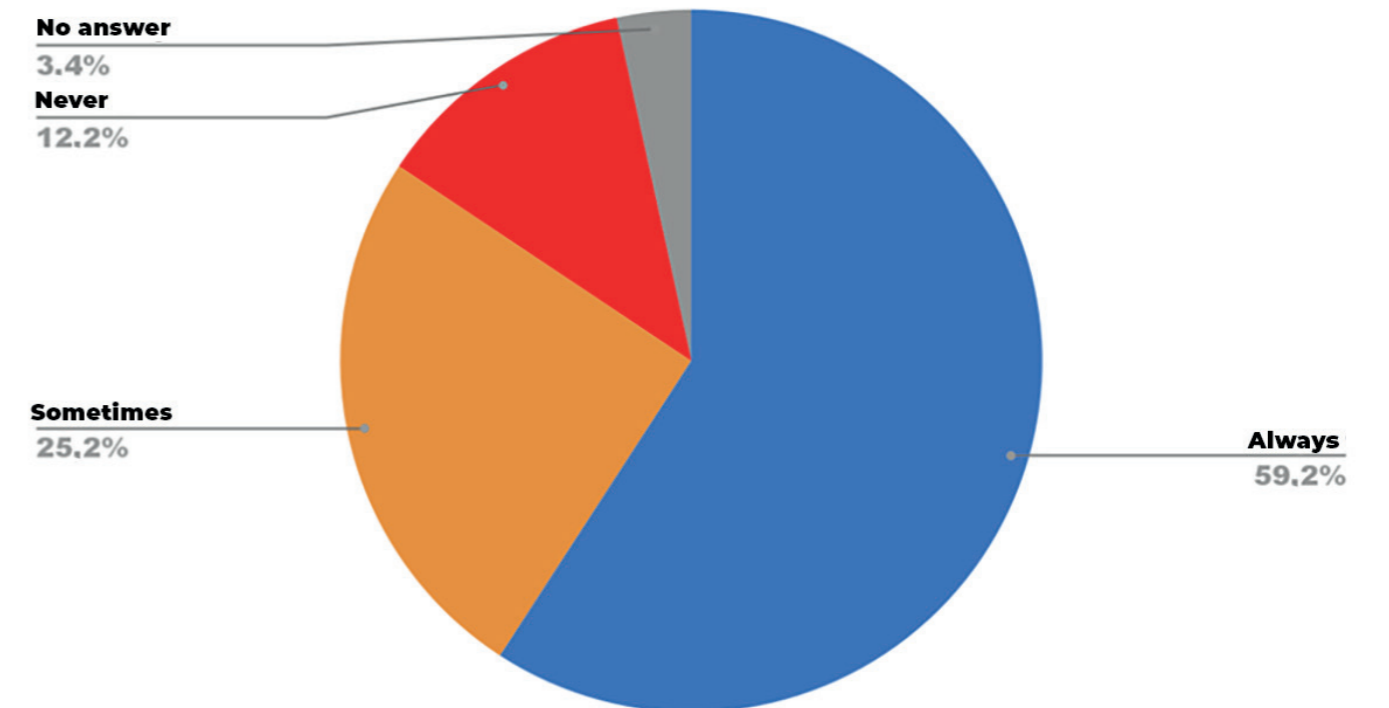
*I iron all of my clothes at the same time or avoid buying items that need to be ironed*



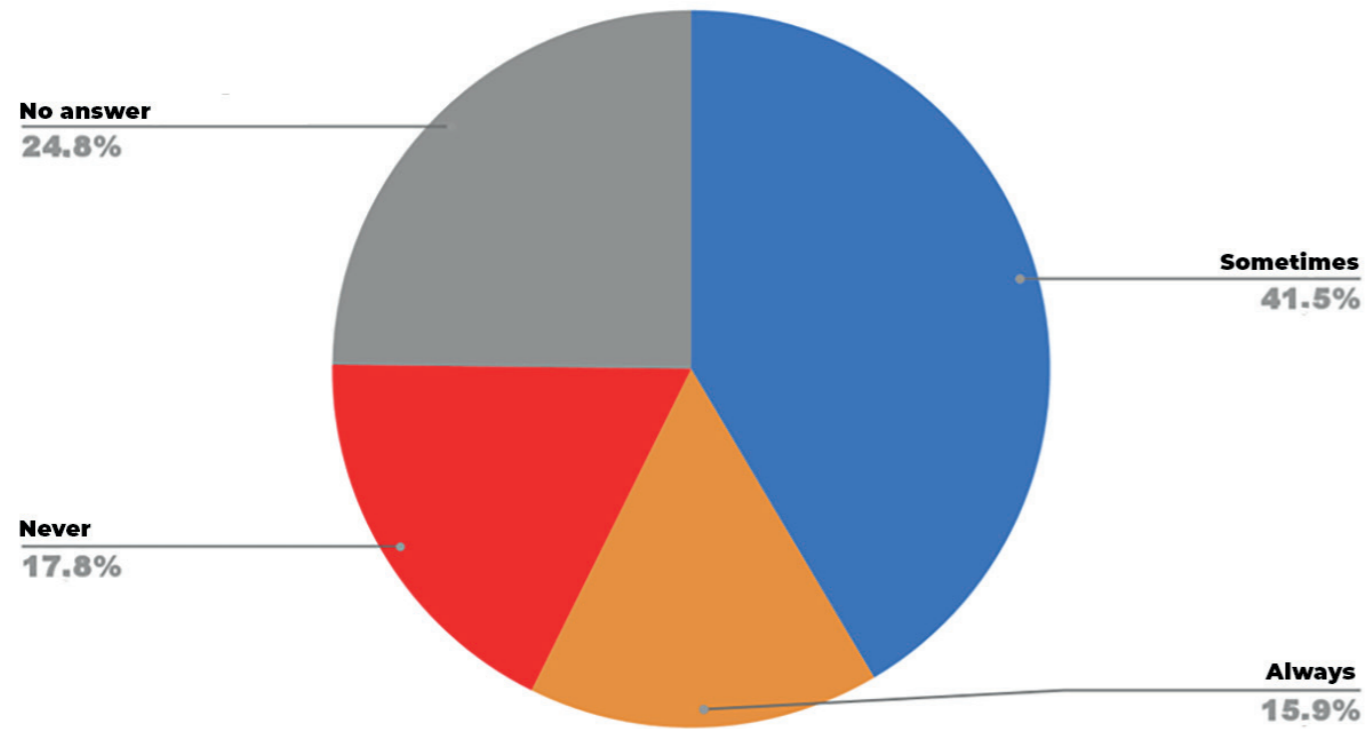
*I let food cool down before putting it in the fridge*



*I don't keep my fridge temperature too low*

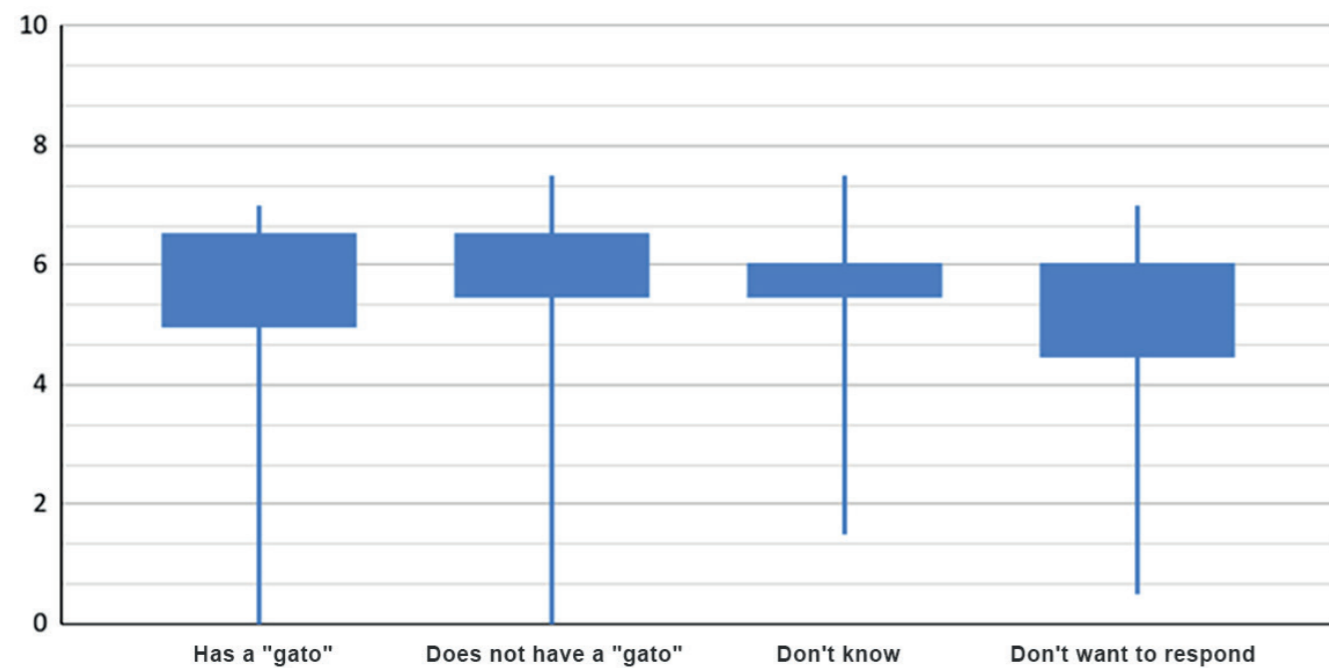


*I only turn on the air conditioner in extreme heat*



### Irregular installation findings

*Irregular installations ("gatos") and their relationship to energy efficient habits*



**Considerations:** Here we crossed data on energy efficient habits with those on clandestine connections ("gatos") to observe if there is an expressive difference between energy consumption habits among those with "gato" installations and those without them. The conclusion is that, despite a small difference between these groups, the difference was not as significant as one would have expected, according to stereotypes propagated against favela residents.










# Electrical Equipment, Energy Consumption and the Challenges of Efficiency

## Research findings on appliances

Having seen that—for the most part—people seek to conserve energy in their daily habits, we will now examine the results found in relation to the electrical equipment that they own. The average number of appliances possessed by each household when rounded is: one refrigerator, one television, one air conditioner, one electric shower, one washing machine, two fans, and five light bulbs. Based on the estimated consumption per appliance and the average number of appliances owned, the estimated average monthly consumption per household is 174.1 kWh.

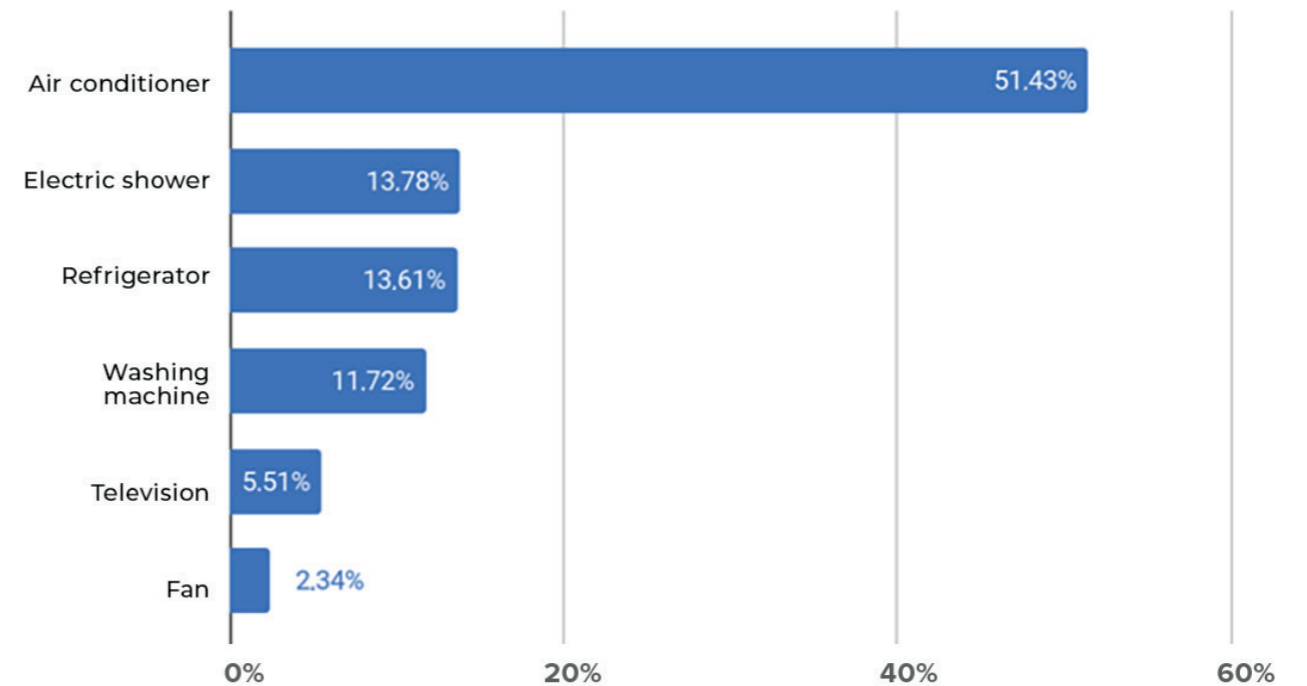
Among these appliances, the air conditioner presents the greatest challenge regarding energy consumption. Air conditioning can account for around half of a household's energy consumption, however it is the least common appliance in the households surveyed—47.8% of households do not have air conditioning. 64.1% indicated that they actively choose fans over air conditioners. Electric showers and refrigerators are the other appliances which consume the most energy. These are therefore the appliances where increased energy efficiency has the greatest potential impact on energy consumption. The ownership percentages with regard to each appliance—alongside a set of proposals aimed at making the electric bill compatible with the average capacity to pay declared by the sample group of this study—can be found later in this report.

OWNERSHIP OF EQUIPMENT/APPLIANCES (AVERAGE) PER FAMILY						
						
Light bulbs	Refrigerator	TV	Air conditioner	Electric shower	Washing machine	Fan
5	1	1	1	1	1	2

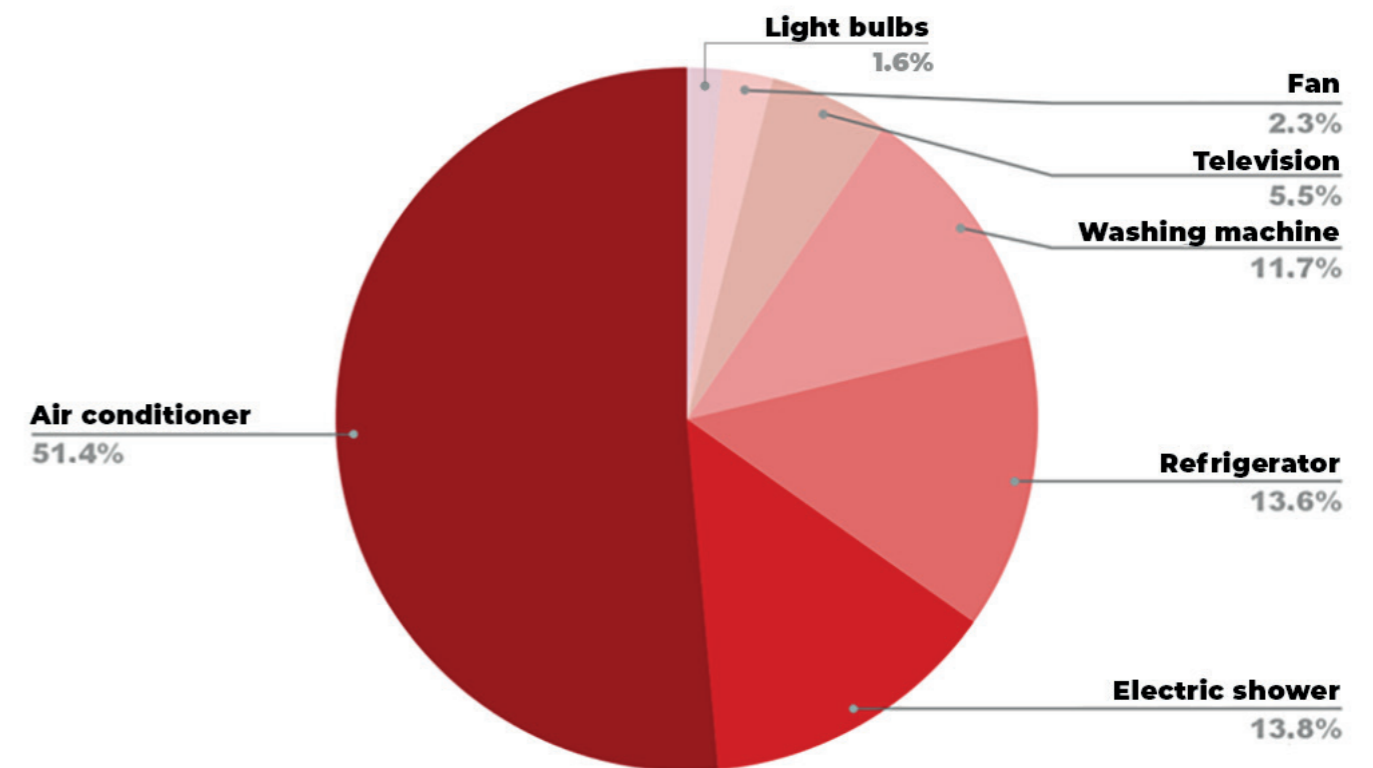


## Research findings on energy consumption

Impact of household appliances on monthly energy consumption (kWh)



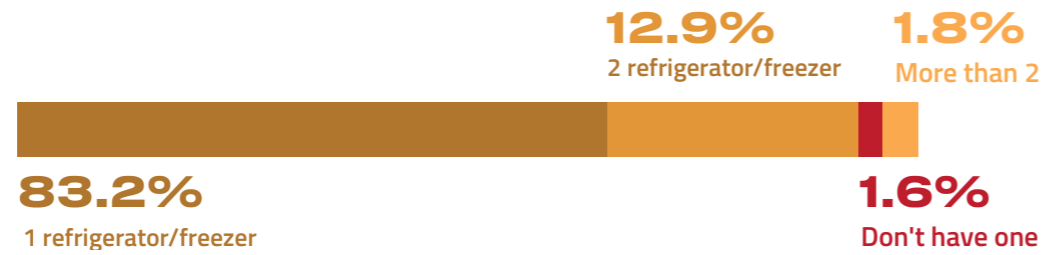
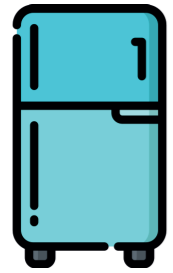
Proportional load of different appliances on monthly consumption (kWh)



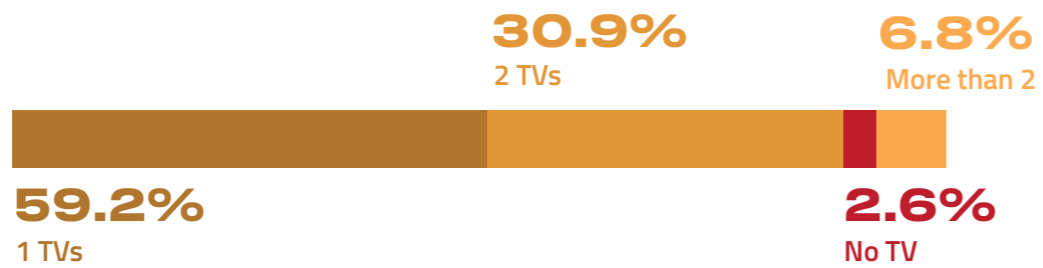
**Considerations:** Based on the estimated consumption per appliance and average number of appliances owned, the estimated average monthly consumption per household is 174.11 kWh.

# Research findings regarding appliances

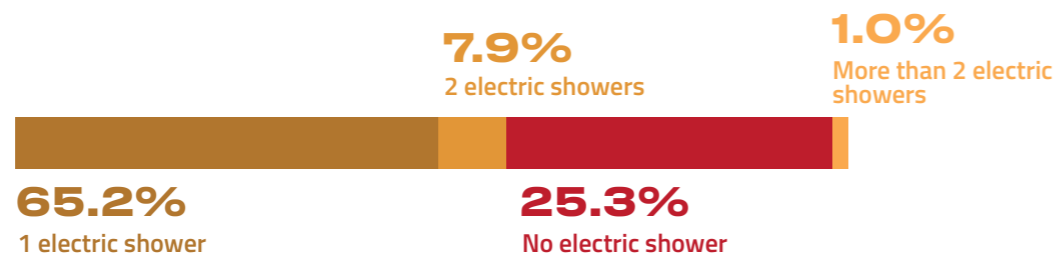
## Refrigerator/freezer ownership among families



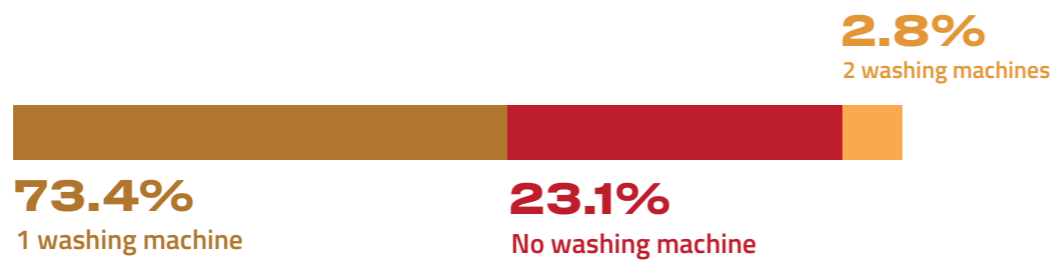
## TV ownership among families



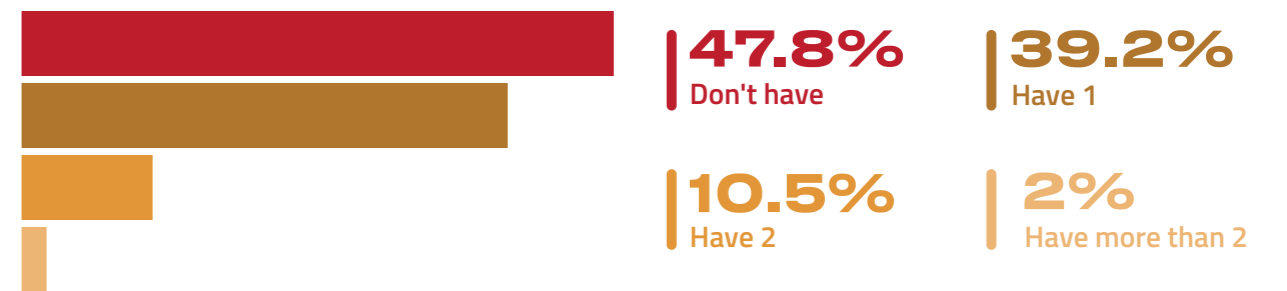
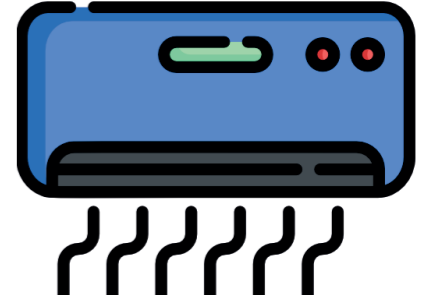
## Electric shower ownership among families



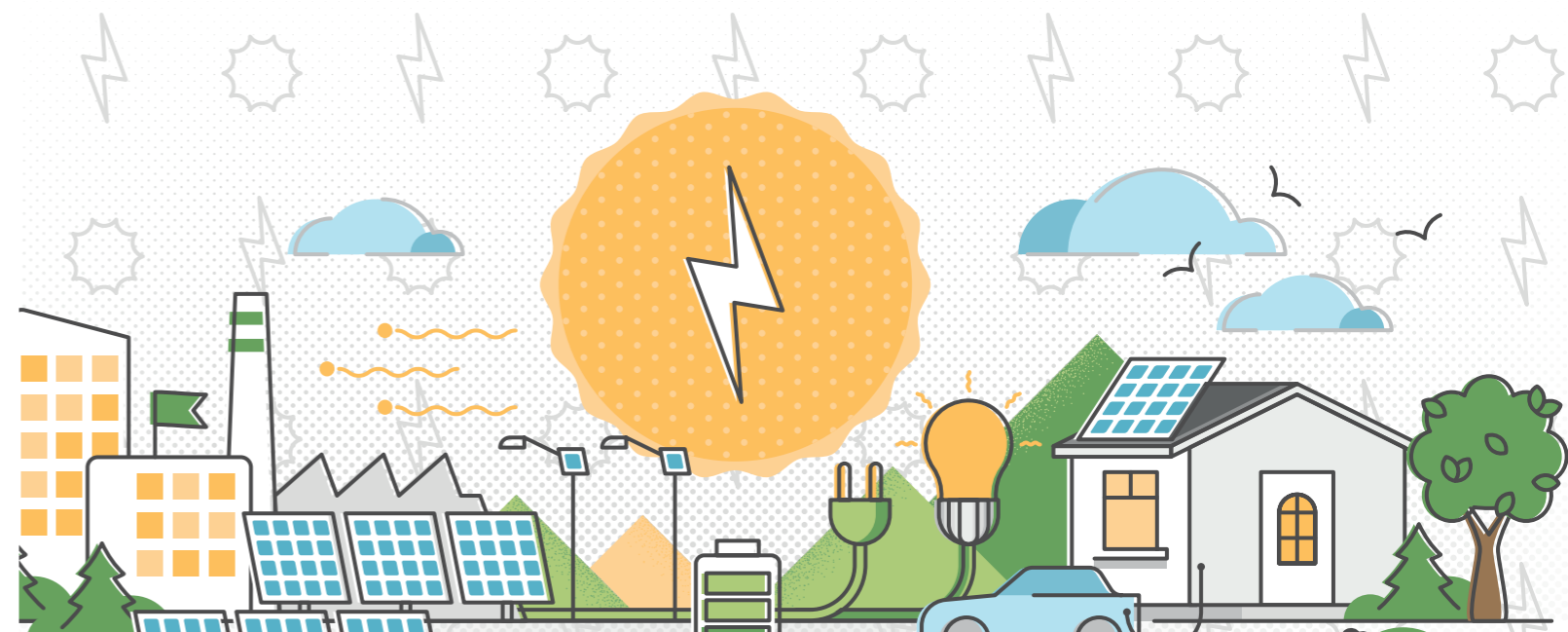
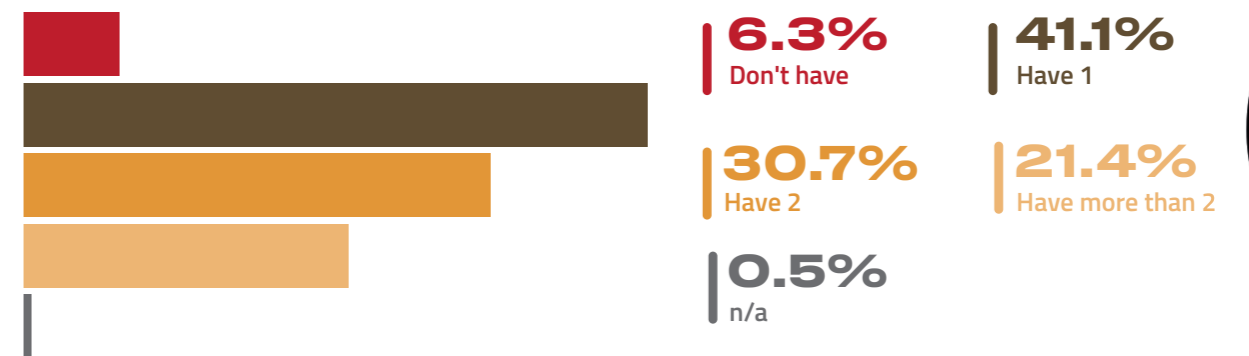
## Washing machine ownership among families



## Ownership of air conditioners among families



## Ownership of fans among families



## Appliance efficiency and tariff discount simulations for electricity bills to be compatible with average payment capacity declared by households

Favorable result	Weight	Strategy	Total bill (monthly)
I. Families with no electric shower	20% of total	Fridge and TV 2X more efficient	R\$57.19
II. Families with no AC	47.8% of total	Fridge and washing machine 2X more efficient	R\$52.64
III. Families with no AC	47.8% of total	TV and washing machine 2X more efficient	R\$58.58
V. Families with no AC	47.8% of total	30% discount on tariff + TV and washing machine 2X more efficient	R\$58.58
VI. Families with no AC	47.8% of total	25% discount on tariff	R\$53.41
VII. Families with no AC	47.8% of total	15% discount on tariff	R\$60.53
VIII. Families with no washing machine or electric shower	11.07% of total	Fridge and AC 2X more efficient	R\$61.54
IX. Families with no washing machine or electric shower	11.07% of total	25% discount on tariff + AC 2X more efficient	R\$53.64

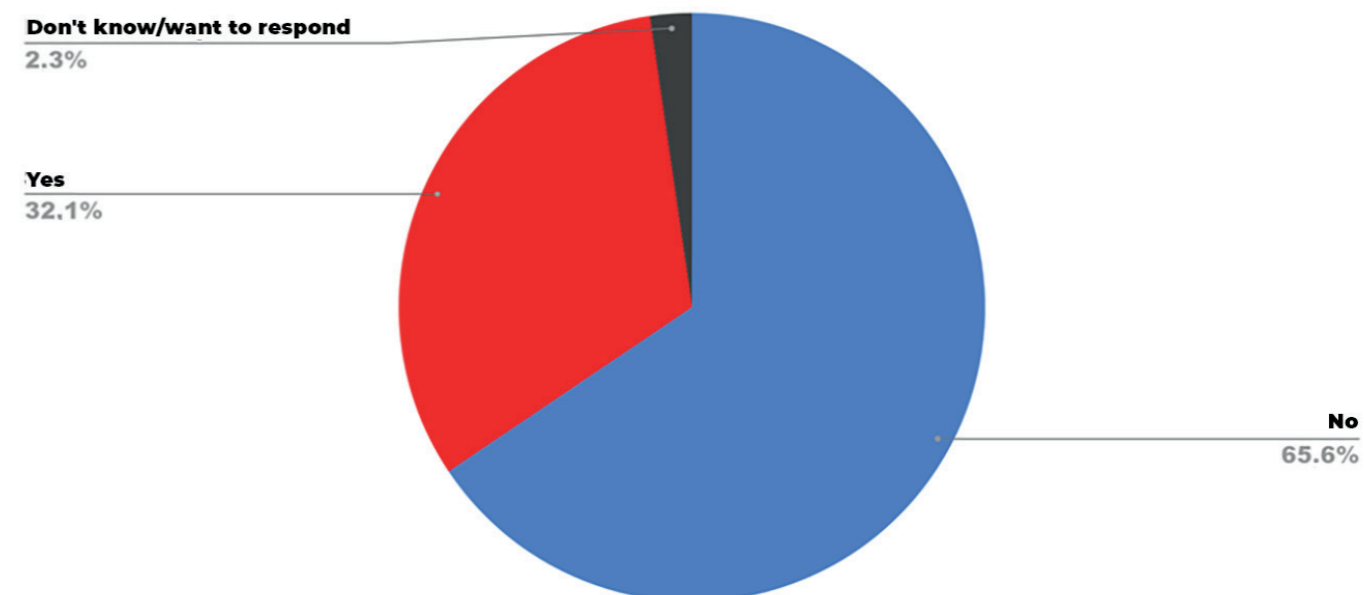
\*Households with 1 AC are a good proxy for households with at least 1 of all appliances analyzed.

### Considerations:

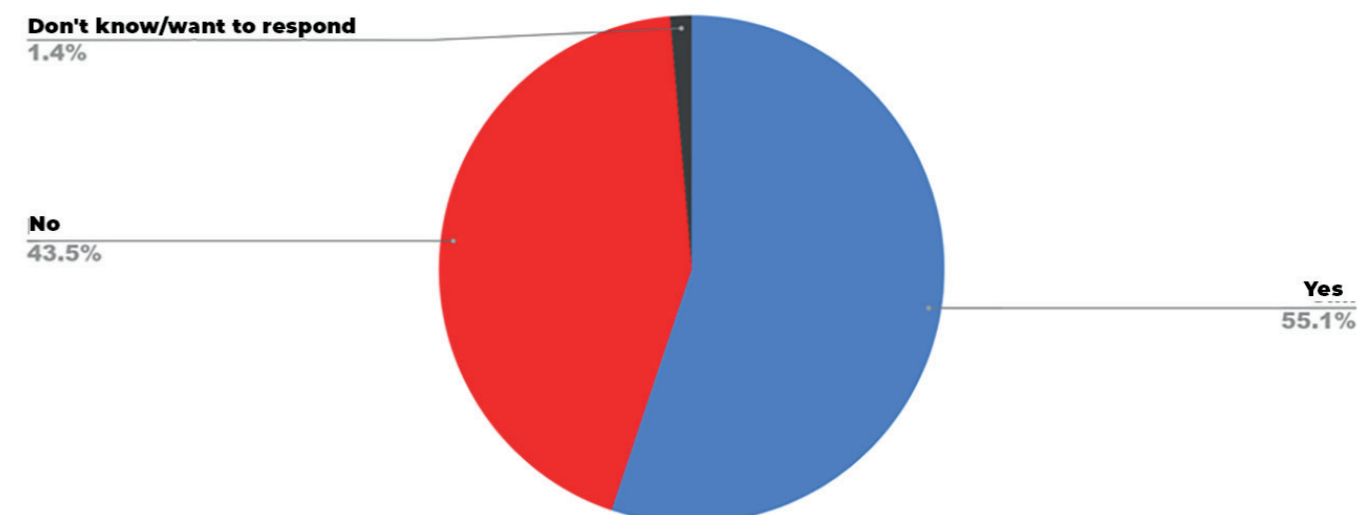
- Owning an air conditioner presents the greatest challenge for a household to make the electricity bill fit into the family budget. However, 47.8% of households say they do not have air conditioning.
- For these families, it is possible to lower the bill to the cost of the average maximum payment capacity in three ways: (1) investing just in the efficiency of other appliances, (2) getting a discount through the electricity tariff, or (3) a combination of both.
- For families that own one air conditioner, it is unlikely that the increased efficiency of appliances alone would be enough to lower the electric bill to a cost considered accessible. So, for those families that own an air conditioner the most viable strategy seems to be a combination of the social tariff discount and household appliance efficiency.

## Research findings regarding appliances

Have you ever lost an appliance due to power cuts?

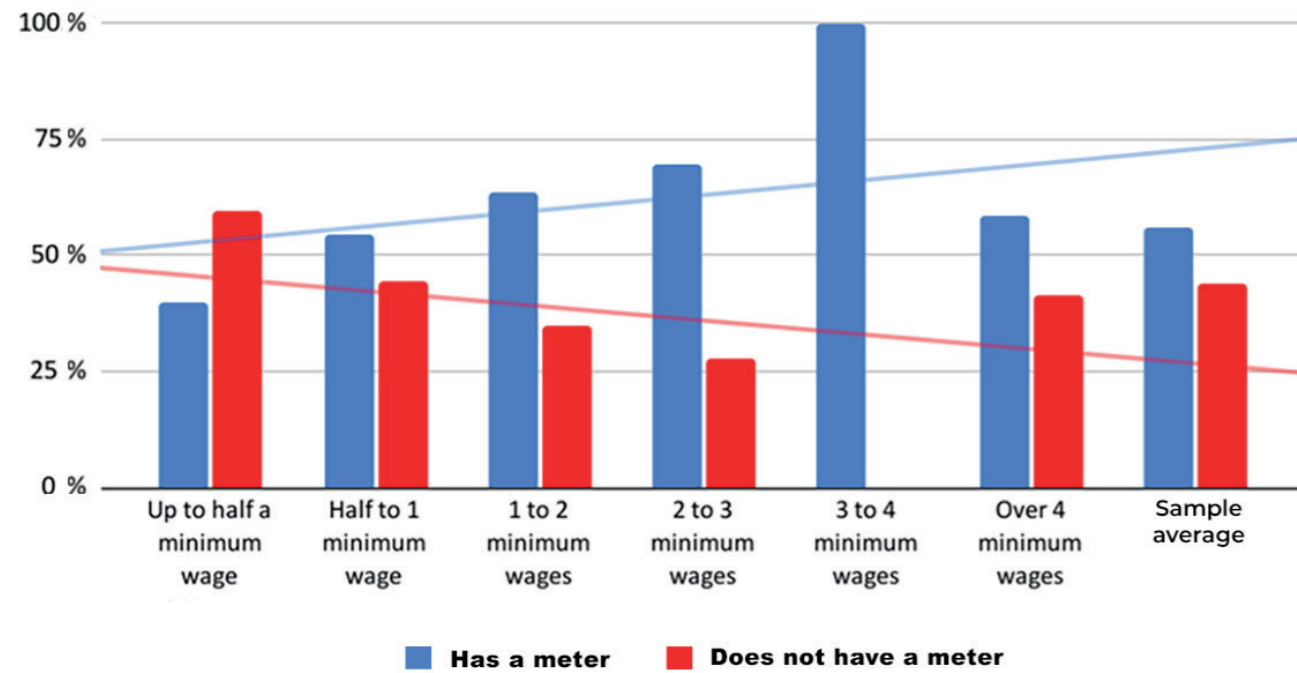


Does your house have an electric meter?



## Research findings on prevalence of electric meters

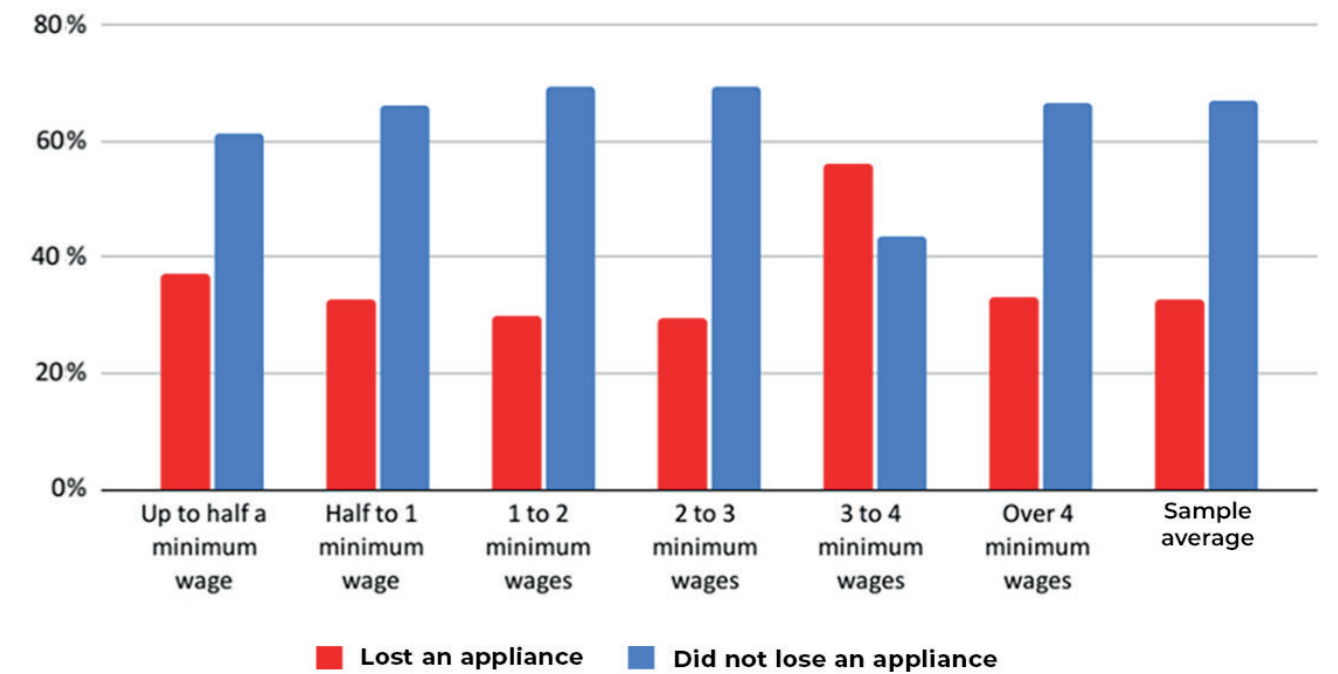
Electricity meter prevalence by income bracket



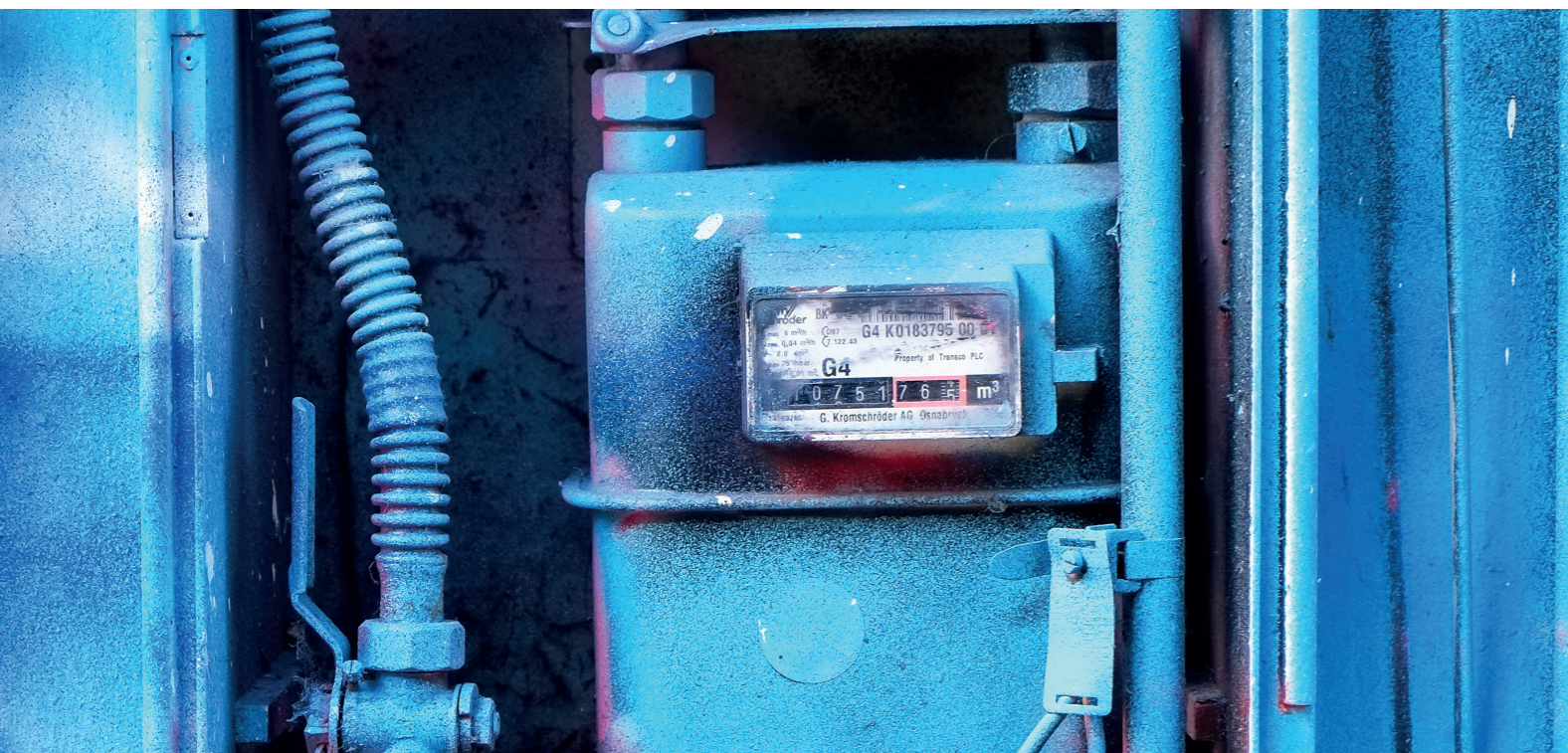
**Considerations:** Among those that answered the question (98.5% of the total), the only income bracket that stated not having an electric meter was the income bracket of up to half a minimum wage. This suggests that the most affected by a lack of this equipment are the poorest. As incomes increase, the proportion of those who have a meter compared to those who don't increases.

## Research findings on loss and damage

Proportion of electrical appliance losses due to power grid failures (by income bracket)



**Considerations:** Across the lowest four income brackets, as incomes increase fewer people describe having lost an appliance due to grid failure. The greatest disadvantage is experienced by the lowest income bracket. However in general, the most proportionally affected class are those that earn 3-4 minimum wages, being the only ones where the majority (almost 60%) stated having lost an electrical appliance due to power grid failures.





## ***Main Conclusions and Trends Identified***

### **The Benefits of Energy Efficiency Are Valued by Respondents**

In terms of the energy efficiency benefits valued by the research participants, first of all, it should be made clear that this question was not asked directly to participants. Therefore, this conclusion is based on an analysis of the data presented in this report, the context of the communities and the residents' complaints.

Lack of financial accessibility is a primary challenge of the communities surveyed. The high cost of electric bills, especially when compared to family income, plunges the lowest income population in these territories into energy poverty. This ends up having an impact on their financial means, or pushes them towards illegality since a clandestine electric connection becomes their only means of accessing electricity. With this in mind, it is believed that the most valued benefit brought by energy efficiency would be a reduction in electric bills.

In addition to this general context, another point that supports this hypothesis is that, in their habits, people seek to save energy through energy conscious habits with a view to reducing their bill. A cheaper electric bill means, for many families, more food in their homes, which only corroborates the importance of energy efficiency as a means to reduce billing costs and improve livelihoods.

#### **Respondents Lack Knowledge About the Energy Efficiency of Household Appliances**

When it comes to a concern with increasing the energy efficiency of household appliances, it can be argued that there is a considerable level of unfamiliarity regarding the energy efficiency of household appliances. This was evident in the fact that almost 50% of the sample does not know what the ENCE label means. If almost half of the people interviewed do not know the meaning of the label responsible for indicating the efficiency of household appliances, it can be garnered that concerns about increasing this efficiency are a great challenge.

Given this unfortunate reality, there is educational work to be done with the potential to transform this situation. The more people know about energy efficiency and its impacts, for example, on the reduction of electricity bills, the greater the possibility they will mobilize in the direction of seeking more efficient household appliances. The fact that the percentage of people who buy household appliances based on their efficiency category according to ENCE is higher among people who know what the label means supports this argument.

A factor that must be taken into account when considering the search for more efficient household appliances, besides education on the benefits of reduced electricity bills, is the purchase price. As already demonstrated, financial aspects have a strong impact in the favela, so the accessibility of buying new, efficient appliances for this population should be considered and addressed, such as by providing forms of payment that encourage or make their acquisition easier like subsidy programs.



## Due to Social Vulnerability, Energy Efficiency Considerations Do Not Fit the Overall Priorities of Residents

The overall priority of the participating sample becomes clear with the answer given to the question “if your electricity bill were halved, what would you spend your extra money on?” 69% of people responded “food.” For families, the priority is to lower their electricity bills and buy more food for their homes. If there were a policy capable of convincing the population that the increase in energy efficiency—either through the use of more efficient appliances, or through more economical energy habits, or even through discounts on the electricity tariff—could resolve financial concerns, the issue might become a priority for favela residents.

In addition to an educational policy capable of communicating the link between energy efficiency and its effect on the family budget, mechanisms which support this need to be easy and practical so as to engage the population. Otherwise, without information and without ease, people will not participate, as the case of the TSEE showed.



## ENERGY EFFICIENCY IN THE FAVELAS

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