



The relationship between the execution of an electrical project and energy efficiency through a quality installation and the operation of its equipment and apparatus

A relação entre a execução de um projeto elétrico e a eficiência energética por meio de uma instalação de qualidade e funcionamento dos seus equipamentos e aparatos

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ABSTRACT

Energy efficiency is an activity that seeks to improve the use of energy sources. The rational use of energy, sometimes simply called energy efficiency, consists of using energy efficiently to achieve a certain result. By definition, energy efficiency consists of the relationship between the amount of energy used in an activity and that made available to carry it out.

Keywords: Electrical Project, Energy.

RESUMO

Eficiência energética é uma atividade que procura melhorar o uso das fontes de energia. A utilização racional de energia, às vezes chamada simplesmente de eficiência energética, consiste em usar de modo eficiente a energia para se obter um determinado resultado. Por definição, a eficiência energética consiste



na relação entre a quantidade de energia empregada em uma atividade e aquela disponibilizada para sua realização.

Palavras-chave: Projeto Elétrico, Energia.

1 INTRODUCTION

Energy efficiency is an activity that seeks to improve the use of energy sources. The rational use of energy, sometimes simply called energy efficiency, consists of using energy efficiently to achieve a certain result. By definition, energy efficiency consists of the relationship between the amount of energy used in an activity and that made available to carry it out.

Efficiency means doing more (or at least the same thing) with less, while maintaining comfort and quality. When discussing energy, energy efficiency means generating the same amount of energy with fewer natural resources or obtaining the same service ("doing work") with less energy, thereby reducing consumption and, in a way, saving money.

In the context of everyday household appliances, improving energy efficiency not only helps to reduce electricity bills, but also contributes to preserving natural resources and reducing greenhouse gas emissions. This article will discuss the importance of energy efficiency in the use of the most common household appliances and provide practical tips for optimizing energy consumption at home.

2 OBJECTIVE

The main objective of this study is to expose technical and scientific knowledge through a literature review, in order to help the reader understand how a well-executed and designed electrical installation can be directly functional to electricity consumption. The efficient use of energy can generate savings, reduce costs and, above all, contribute to the preservation of the environment, thus improving people's lives in relation to energy consumption.

3 METHODOLOGY

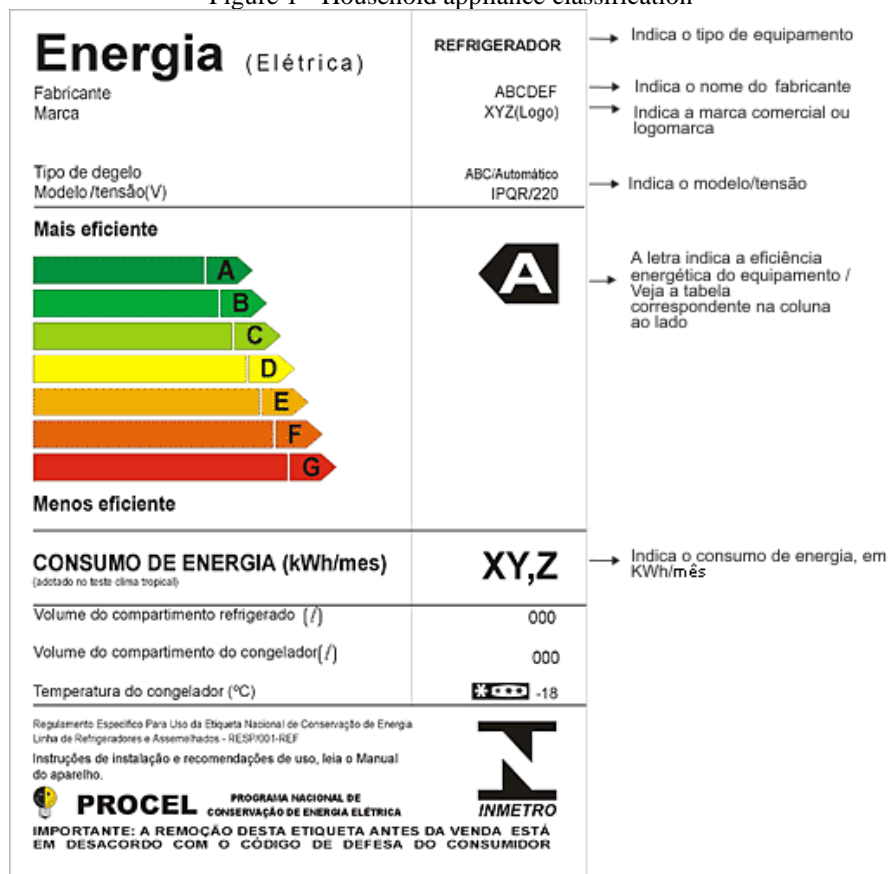
The literature review was carried out in different stages according to the study plan, gathering information on the proposed topic, proposing average figures obtained by the research, to create general information by means of various tables and graphs presented in this study, a particular stage of the study was to search for information on the average consumption of household appliances and on electrical and building installations.



4 ENERGY EFFICIENCY IN HOUSEHOLD APPLIANCES

Energy efficiency is a practical and effective way of reducing energy consumption and minimizing the environmental impact associated with the use of household appliances on a daily basis. Small changes in usage habits and the choice of more efficient appliances can result in significant savings and contribute to a more sustainable future. By adopting energy efficiency practices at home, each individual can play an important role in conserving natural resources and protecting the environment. Energy efficiency is the ratio between the energy consumed by a device and the energy it converts into useful work. The more efficient a household appliance, the less energy it uses to perform its function. This is measured by energy efficiency labels, usually represented by a rating scale ranging from A (most efficient) to G (least efficient) as shown in figure 1 below. When buying a new appliance, give preference to those with an A rating, as they consume less energy than those with a lower rating.

Figure 1 - Household appliance classification



Source: <https://sites.google.com/a/engenharia.ufjf.br/cidade-sustentavel/energia-letrica/eletrodomesticos-mais-eficientes>

The labels indicate the energy rating of the products, calculated based on their level of efficiency in relation to the amount of energy they consume. In practice, they show how much energy the fridge uses to freeze, the stove (measured by gas consumption) to cook and the light bulb to illuminate, for example.



The labels were created in the 80s to provide information on the fuel consumption of vehicles, as the world had just gone through an oil crisis in the 70s. Over time, they evolved and today measure various electrical appliances.

The following table lists the equipment most commonly used in a single-family home and aims to provide approximate power ratings for each of them, as well as the average time each appliance is used and the average consumption per time used.

Table 1 - Average consumption of household appliances

Aparelhos	kWh	Utilização= tempo/mês	Potência
Ar-condicionado	192	usado por 8h	800W
Geladeira	180	usado 24h	250W
Máquina de lavar	75	usado por 5h	500W
Chuveiro elétrico	63	usado por 30min	7.000W
Televisão	36	usado por 6h	200W
Micro-ondas	13,5	usado por 30min	1.500W

Source: The authors

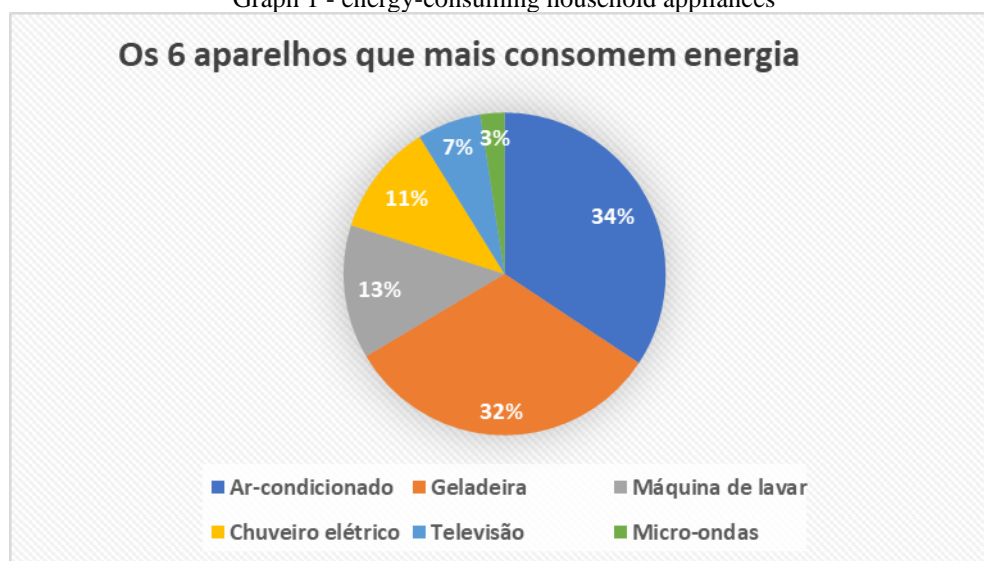
5 WAYS TO PREVENT HIGH CONSUMPTION

- Air conditioning:
 - Keep the thermostat at a comfortable temperature, but not too low; most air conditioners have an energy-saving mode.
 - Activate this mode to reduce energy consumption, keep doors and windows closed while the air conditioning is on.
 - Carry out proper maintenance on your air conditioning unit, such as cleaning the filters and checking for leaks.
- Refrigerators and freezers:
 - Check the door seal to avoid cold air leaks.
 - Adjust the temperature as necessary, avoiding excessively low temperatures.
 - Avoid opening the door too often and don't keep it open for too long.
- Washing machines:
 - Use the machine's maximum capacity to optimize the use of water and energy.
 - Prefer washing cycles at room temperature or low temperature.
 - Clean the filter regularly to ensure the machine works properly.
- Electric Shower:
 - Reduce shower time: The time you spend in the shower directly affects energy consumption. In warmer climates, try using the "summer" or "warm" position in the shower.



- Carry out regular maintenance and check that your shower is working properly. Leaks or insulation problems can lead to higher energy consumption.
- Televisions and electronics:
 - Use energy-saving mode or switch off appliances completely when they are not in use.
 - Avoid leaving the TV on stand-by, as it continues to consume energy.
 - Group electronic devices together in a power strip and unplug them when not in use.
- Microwave:
 - If your microwave has power setting options, choose the lowest setting to heat food that doesn't require full power. This will reduce energy consumption.
 - If possible, plan the defrosting of foods such as meat or bread by letting them defrost naturally at room temperature or in the fridge. That way, you avoid using the microwave for this purpose.
 - When you're not using the microwave, turn it off completely. Many models consume energy in standby mode, so unplugging it will save energy.

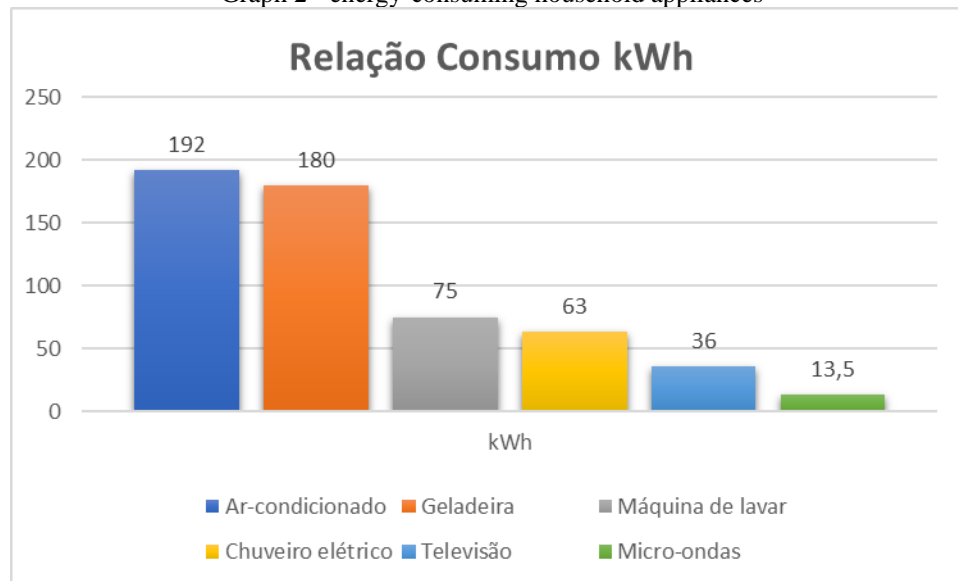
Graph 1 - energy-consuming household appliances



Source: The authors.

The graph above shows the proportional relationship between the highest consumption of electricity absorbed by each appliance and its average time of daily use. The information contained in graph 1 was obtained by reviewing the literature and compiling the information to create table 1 and graphs 1 and 2, to make them easier to understand.

Graph 2 - energy-consuming household appliances



Source: The authors.

Technological advances and economic development have led to an ever-increasing use of electronic devices on a daily basis, increasing electricity consumption. Brazil has a predominantly hydroelectric matrix and with the worsening climate crisis making rainfall more scarce or irregular, it is necessary not only to diversify energy generation sources, but also to increase energy efficiency. In Brazil, the residential sector still has many irregularities and can therefore offer significant gains in the area of energy efficiency.

According to the National Energy Efficiency Plan, in the residential sector it is not planned to make it compulsory to certify the energy efficiency of buildings until 20 years from now. However, it has become necessary to encourage the adoption of energy efficiency measures as early as possible, especially in the construction of new residential buildings, whether multi-family or single-family.

Some measures stand out for their low cost and ease of implementation when they are planned from the start of the project. These are pre-automation and the implementation of solar water heating. Pre-automation aims to prepare the installation for partial or total automation in the future by separating the piping from the loads and drives and using impulse relays for control. These impulse relays are powered by 0.5mm² cables, which makes them more economical than the 1.5mm² cables that would be used in conventional installations.

The electrical installation project for a home is based on the technical specifications for the electrical elements of an installation, i.e. it plans the entire safety of the installation by sizing all the wiring and protections, facilitates future expansions and produces comfort and personalization of the environments. In addition, planning this project generates savings in execution time and in the quantification of materials that will be used, thus avoiding waste.



6 BENEFITS OF GOOD ELECTRICAL DESIGN:

By carrying out an electrical installation project, we can be sure that we can safely and effectively use all electrical and electronic equipment without fear of any problems or accidents occurring with the electrical network. In addition, the electrical project contains basic information that is very important during the execution of the work. For example, we can use the materials list, which contains all the materials that will be used in the work, as well as the length of the conductors that will be needed for the installation.

This allows us to plan ahead for the prices available on the market by doing some research, which will save money. In addition, the electrical project also specifies where the sockets, switches and light points will be located, among various other pieces of information, making it easier to carry out and avoiding problems such as:

Forgetting to put sockets in some rooms;
Not putting enough sockets in the room for it to be functional;
Placing sockets at the wrong height;
Poor distribution of conductors to switchboards.
Among other problems.

We can also see that by carrying out the project, we can avoid accidents and problems with the home's electrical installations.

7 MAIN ADVANTAGES OF CARRYING OUT THE PROJECT:

The main advantages of carrying out an electrical project include:

A project carried out in accordance with ABNT standards (NBR 5410) prevents incorrect sizing of the installation's cabling, avoiding possible extra costs on electricity bills and safety problems;

- Ensuring that the sizing of the materials used is accurate, avoiding possible expenditure on under- or oversized materials;
- It ensures that your installation has the correct electrical infrastructure, avoiding possible power outages due to switches being turned off in the main switchboard, as well as preventing accidental shocks, sometimes even fatal ones, through DR devices;
- Versatility in the allocation of sockets, lighting and conduits, so that any changes can be made in the future without harming the client;
- Guarantees protection against mains voltage surges, such as lightning strikes and switching overvoltages through the use of SPD devices.

All these points speed up the execution of a project and avoid possible problems such as those mentioned above. Therefore, electrical design is of the utmost importance for both large and small construction projects, as it guarantees a safe and effective service, as well as representing considerable



savings when carrying out the work. Currently on the market we have professionals responsible for drawing up electrical projects, electrical engineers, and professionals responsible for carrying out the entire project, electrical technicians.

8 FINAL CONSIDERATIONS

The proposed content provides technical knowledge on the importance of properly sizing an electrical installation. This project can be carried out by technically qualified professionals who have been trained for this purpose. An electrical project brings numerous benefits to the owner of the property, such as a reduction in energy bills, etc. The electrical project involves the entire process of forecasting the load to be installed in the property, sizing the type of installation to be carried out, which can be: single-phase, two-phase or three-phase, and also dividing the installation into terminal circuits, which can facilitate the process of dividing and maintaining the planned installed load. With a state-of-the-art electrical installation, it is possible to reduce costs by up to 40% of energy consumption, when the sections of each conduit to be used in the installation are planned. Energy efficiency is directly linked to the execution of a good electrical project followed by its design, thus ensuring the proper functioning of all the equipment connected to the conventional distribution network. This study makes a direct link between both contents in order to analyze the importance of everything that is necessary for a perfect match between project and equipment.



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