

# Household-electric equipment diffusion and the impacts in the demand of residential electric energy in Brazil

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## Abstract

The sizing and the distribution of the circuits, equipments of illumination and wall sockets of a household building are planned to offer a certain comfort to the users. The comfort is associated to a psychological state of welfare and depends on an ample amount of factors. The residences consume about 26% of the total electric energy in Sao Paulo state and the tasks aimed to the optimization of the energy use must consider the household use. Currently, the Brazilian market of electric energy grows to a tax of 4.5% per year and during the last decades, the consumption of electrical energy presented superior tables of expansion to the gross domestic product (GDP). This growth showed up larger the household, commercial and agricultural consumers. The standards of comfort and performance change as the time goes by, with the incorporation of new technologies. The number of household appliances has been increased by the years, as well as the use of new equipments, demanding alterations in the electric projects to attend to this comfort of use.

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## 1. Introduction

The comfort is associated to a psychological state of welfare and depends on an ample amount of factors. Many studies have been elaborated in the field of the civil construction, about thermal and acoustical comfort, which aim to the rise of quantified values of the variables connected to these factors. In the connection of electrical comfort, we are trying to quantify the need of power, illumination and wall sockets of a household construction in order to attend the need of the users to promote their comfort.

The standards of comfort and performance also change up to the time (with the incorporation of new technologies) and up to the place. This way, a rural house has different necessities of a house in the great urban centers.

The need of bigger quantities of wall sockets and illumination in the great city are larger and because of that, more studied. The way of use of the household electrical energy has been always subject of study and this represents a considered slice of the energy market, assuming an important paper in the studies of energy efficiency. In the situations of energy crisis, as the current one, these studies can supply data to define changes in worldwide the energy matrix.

For understanding the use of the energy in a way that it can optimize its use in a long and average period, we cannot just study the way of current use of the energy as there is also a need of checking in the evolution of this type of consumption and its growth up to the time, looking for data analyses from the past, comparing them to the present ones searching for evolutions standards and even submit them to a verification of the future predictions researches in this type of use.

As the history of the use of the household electricity is considered recent, so we can trace an evaluative profile, considering the technology alterations, habits, necessities

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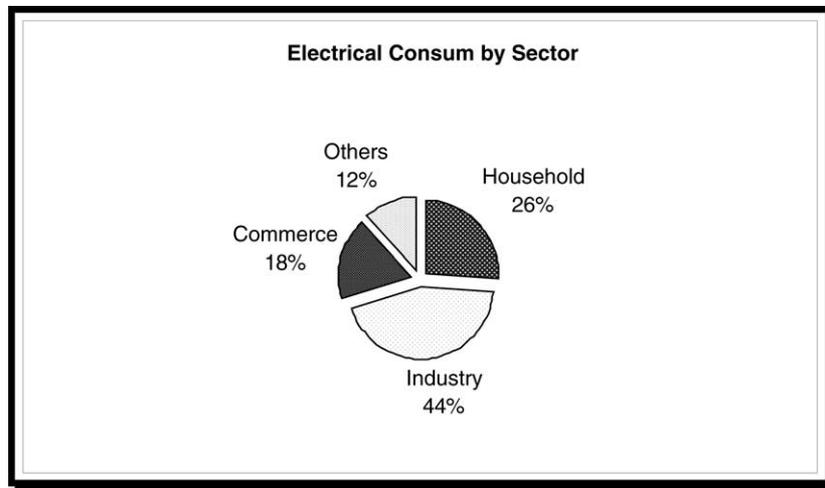


Fig. 1. Consumption of Energy for sectors. *Source*: CSPE.

and behavior of the families, which have made the use of the energy to modify in order to warrant the standards of performance necessary to the comfort of the users.

Thinking about the future predictions, many technologies have been studied in the building systems in a systematic way with the advent of the intelligent buildings that take an important place in the commercial constructions. This type of construction has been constantly studied in the academics places for adding in its concept the possibilities of rational use of energy, with use of technologies that learn users behavior and make possible these constructions to be considered sustainable from the energy point of view.

We can expect then that the technologies, the processes and the concepts developed in these intelligent buildings that are target firstly in the commercial constructions can move to the household constructions, promoting the same benefits according to the comfort and the efficiency.

This study makes a verification in data that turns up some predictions about the intelligent buildings to make possible tasks of future diagnosis related to the use of the household electric energy.

## 2. Importance of the evaluation in the household energy consumption

With the energy crisis and the fact that the conventional power sources used in its majority to be able to add polluting agents, contaminants or some form that provoke some type of environment degradation, the evaluation of the use of the energy use is one of the ways of preventing collapses and looking for solutions that prevent the aggravation of the situation. Also the rational use of energy can postpone the necessity of new investments, being these resources applied in other areas besides contributing with the environment question.

The consumption of energy for sectors is represented in Sao Paulo state, in accordance to the CSPE (State

Commission of Public Services) and the secretariat of state energy, as Fig. 1, in percentage of the total [2].

The household consumption in the Sao Paulo state is about 26% of the total. The evolution of the consumption above also shows the effect of the rationing of energy occurred in 2001 that it provoked a lightness alteration in the consumption standards, being that apparently the predictions for the year of 2003 point to a recovery of the previous standards to the rationing.

This way, any action that influences the household consumption goes to provoke a direct impact in the total energy consumption, since this value is significant.

## 3. Evolution in the use

### 3.1. Description of the use of the electricity in Brazil

In accordance to the Eletrobrás data, a government organization, the use of the electricity was initiated in Brazil in 1879, at the same time where it occurred in the Europe and United States, soon after the invention of the dynamo and the electric light bulb. Therefore, the initial use was linked with the railroad nets and public illumination [1].

The Brazilian law text approved by the National Congress for regulation of the use of electricity in Brazil was made in 1903. By this way, the use of the electricity has about 100 years in the country, and the great investments in energy generation are registered in the beginning 20s, when about 300 companies served the 431 localities of the country, making use of 354,980 kW of installed capacity, being 276,100 kW in hydro power plants and 78,880 kW in thermal plants. After the second world war, the demand started to exceed the offer of electric energy, in result of the growth of the urban population and the consequent advance of the industry, commerce and services, initiating a period of energy rationing in the main Brazilian capitals [3]. During the 1970s, due to the “economic miracle” the consumption

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