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# Evaluation of the energy impacts of the Energy Efficiency Law in Brazil

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ABSTRACT

Minimum energy performance standards (MEPSs) have been adopted in several countries to promote energy efficiency. This study evaluates the impacts of Law 10.295/2001 which regulates the efficiency of equipment in Brazil. This impact assessment was based on estimates of the amount of equipment in operation and the effect of MEPS on a representative model of equipment, in some cases considering efficiency degradation and operation conditions different than those assumed in efficiency measurement. Setting MEPS for refrigerators, air conditioners, and electric motors resulted in an estimated 182.8 GWh savings and 70 MW demand reduction in 2010, which is relatively low due to the limited number of models removed that are affected. The energy saved due to MEPS adoption for gas stoves and water heaters was estimated at 9575 toe (401.0 TJ)[1] in 2010. The projections for 2030 indicate a more substantial impact.



## Introduction

Since the eighties, actions have been implemented in Brazil to reduce energy losses and promote efficiency in the end use of energy. Some programmes, including adjustments in the legal framework, were created to foster energy efficiency and were mainly oriented towards the residential and industrial sectors. Among these programmes are the efficiency labelling programmes, which have been implemented to inform consumers about the energy performance of equipment, and the Energy Efficiency Law, which establishes the minimum levels of efficiency for appliances and energy equipment (e.g., motors and lamps), in both cases promoting the introduction of efficient equipment to the market and reducing energy losses.

In 1984, the Brazilian Labelling Program (PBE in Portuguese) was created, founded by an agreement between the Ministries of the Industry and Trade, Minas and Energy and the Brazilian Association of the Electric and Electronic Industry (ABINEE in Portuguese). This programme is coordinated by the National Institute of Metrology, Normalisation and Industrial Quality (INMETRO in Portuguese) and managed in cooperation with two other programmes: the National Program of Electric Energy Conservation (PROCEL in Portuguese), for equipment that uses or substitutes the use (as solar collectors) of electric energy, and the National Program of Rational Use of Oil Products and Natural Gas (CONPET in Portuguese), for equipment that uses fuels. Depending on its energy performance, equipment is classified by the National Label of Energy Efficiency (ENCE in Portuguese), usually into five classes of efficiency (A to E), with the A class attributed to the most efficient models, adding value to better technology and driving the market towards more efficient models. The information available on the label varies according to the labelled product, but it always includes the energy consumption and its layout is similar to those adopted in many other countries. Fig. 1 presents the label used on roof fans. Currently, this labelling programme covers approximately 48 different types of equipment marketed in Brazil, from hydromassage bathtubs to solar collectors.

In 1993, the PROCEL Label of Energy Economy, or simply the PROCEL label, was introduced with the objective of informing the consumer about better equipment and reinforcing the value of more efficient products. Complementary to the qualifying labels of PBE, this endorsement label emphasises the most efficient products which means class A equipment, according to the efficiency label and presents additional quality attributes, such as safety, low noise, and lower water consumption.

The concession of this label is the responsibility of PROCEL, which essentially uses the same equipment performance database as PBE. According to the Catalogue of the PROCEL Label 2011, this label covers 31 different categories of products and has been granted to more than 2400 equipment models that provide most of the energy savings associated with the PROCEL Label programme (PROCEL, 2011). Adopting the PROCEL Label as a model, in 2005, the CONPET Label was created,

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[1] 1 toe = 41.9 GJ.

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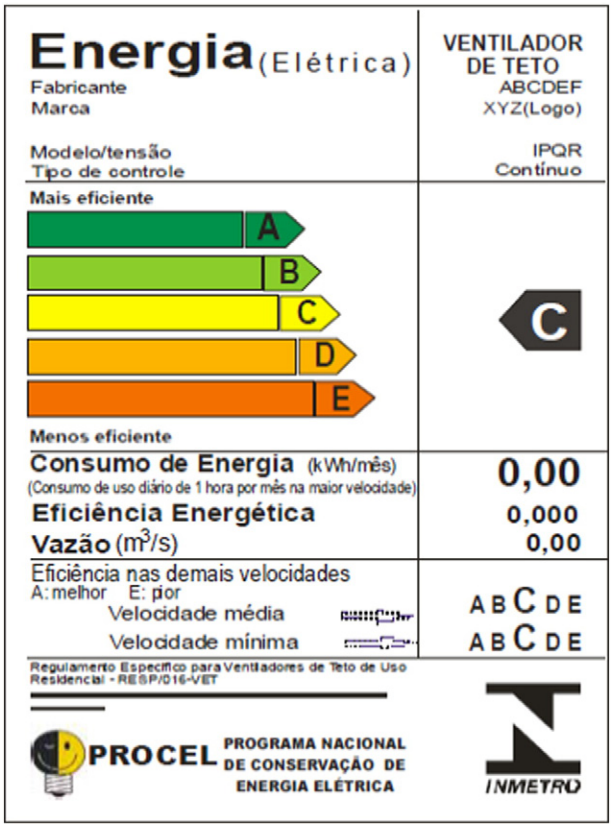


**Fig. 1.** National Label of Energy Efficiency for roof fans.

which is now granted to gas water heaters and stoves of several types. Fig. 2 presents the PROCEL and CONPET Labels.

The ENCE Label, which is more informative, and the PROCEL and CONPET Labels, which are more direct and easy to understand, were applied initially on a voluntary basis under the manufacturer's and importer's criteria. However, the regulation has been progressively adjusted, and now, applying these labels is largely mandatory.


**Fig. 2.** PROCEL and CONPET Labels of Energy Saving.

In 2001, Federal Law 10.295, known as the Energy Efficiency Law, was approved to reinforce those programmes, allowing the Brazilian government to establish minimum energy performance standards (MEPSs) for energy using equipment to prohibit the commercialisation of low-efficiency models and promote the progressive withdrawal of low-efficiency models from the market. The MEPS implementation, in the framework of this law, was recognised as one important measure to foster energy efficiency in Brazil (Volpi et al., 2006).

Considering this gradual evolution of instruments of public policy to promote energy efficiency in Brazil by market improvement through the awareness of equipment performance of consumers and traders, this study evaluates the energy impacts of the Energy Efficiency Law in terms of energy savings and peak demand reduction by considering the equipment currently regulated by the law: refrigerators, air conditioners, electric motors, compact fluorescent lamps, gas stoves, and gas water heaters. These impacts were assessed in the period from 2001 to 2010, corresponding to the first ten years of implementation, and projections for the impacts up to 2030 were made.

In several countries, studies have been developed to evaluate MEPS's impacts and results, such as those developed by Nadel (2002) for the United States, Lockerbie and Ryan (2005) for Canada, Fridley et al. (2007) for China, Lane and Harrington (2010) for Australia, and Tathagat et al. (2011) for India. In exploring the Brazilian reality, the present work has a similar aim and is part of a broad study undertaken by the Center for Strategic Studies and Management, an agency of the Ministry of Science and Technology to assess the quantitative and qualitative results of the Energy Efficiency Law.

## Basic concepts on the evaluation of the energy impact of energy efficiency measures

In essence, assessment of the energy saving from measures of energy efficiency is based on the comparison of the market previous to implementation (baseline) and the subsequent condition after the implementation of those measures, in terms of their impact on the system of energy supply. Therefore, the energy impact of the mandatory adoption of efficiency limits in appliances can be estimated by the difference between the original consumption of the stock of equipment with lower efficiency that is replaced by more efficient products and the consumption of this portion after the introduction of more efficient products.

In the case of MEPS applied to electric appliances, the impact to be evaluated involves the energy that was not consumed in the equipment over a period (for instance, the energy saved over one year, in GWh) and the capacity installed that was not required in the peak of the load curve of the system (capacity saved, in MW) as a direct consequence of the substitution of the less efficient products with more efficient ones.

A conceptual model of equipment sales involving the introduction of measures to increase consumer awareness about equipment efficiency and the establishment of efficiency standards is represented in Fig. 3, as suggested by the Collaborative Labelling and Appliance Standards

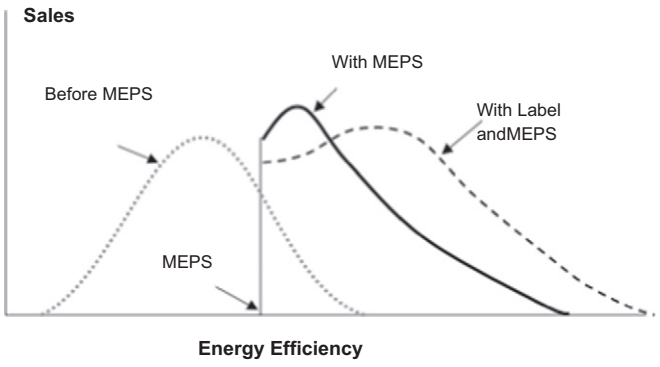


**Fig. 3.** Impact of efficiency standards and labels on the market of energy equipment.