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Energy efficiency labeling program for buildings in Brazil compared to the United States' and Portugal's

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ABSTRACT

Regulations are being promulgated and reviewed in order to achieve the maximum energy savings in buildings, both in developed and in developing countries. One important strategy employed to turn these laws and regulations effective is through building certification. The benefit of such practice may reflect in energy savings, reduction of carbon dioxide emissions, to end-users and real estate owners. The objective of this study is to make a literature review concerning energy efficiency policies and regulations for buildings, highlighting how the Brazilian labeling program can be improved compared to the United States and Portugal programs. It is important to point out that the Brazilian program is under consolidation in comparison with the Portuguese and American ones. Furthermore, the assessment shows that: (i) although it is an initiative in the interest of society and it is meant to several types of buildings, the Brazilian labeling program does not inform suggestions for the building improvements; (ii) it is not mandatory; (iii) it does not value net-zero energy building; (iv) it does not inform the CO_2 emissions savings; and (vi) it is not sufficiently stringent to challenge the building industry to improve the efficiency levels.

Contents

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1. Introduction

Electricity is essential to economic progress and quality of life of humankind. Linked to social mobility and human development, energy consumption is growing every year in Brazil and worldwide. Statistics indicate that China is now the world's biggest energy consumer, overtaking the United States in 2009 [1]. In this year, of the world primary energy consumption, China's share was about 18.7% compared to 17.8% of the United States [1]. Nevertheless, the China's GDP per capita is only one-eighth the U.S.; and the residential energy use per capita in China is about one-ninth the U.S. [1]. Fig. 1 shows the accelerated energy growth by China over time compared to Unites States and Brazil.

While the U.S. primary energy consumption in buildings accounted for about 41% of total energy consumption [2], in China this figure was estimated around 23% [3]. On the other hand, in Brazil, this value represents around 14% [4]. Nevertheless, almost 50% of the Brazilian electricity consumption is building related [4]. Furthermore, a building labeled can stimulate a reduction of 50% in the final energy consumption [5].

International Energy Agency (IEA) developed a set of 25 energy efficiency policy recommendations, in order to help its members to promote energy efficiency measures across their countries. These policies are oriented towards the following seven priority areas: Cross-sectoral; Transport; Buildings; Industry; Appliances and Equipment; Energy Utilities; and Lighting. In regarding to buildings, IEA recommends: (i) mandatory building codes and minimum energy performance standards; (ii) net-zero energy consumption in buildings; (iii) improved energy efficiency in existing buildings; (iv) building energy labels or certificates; and (v) energy performance of building components and systems [6].

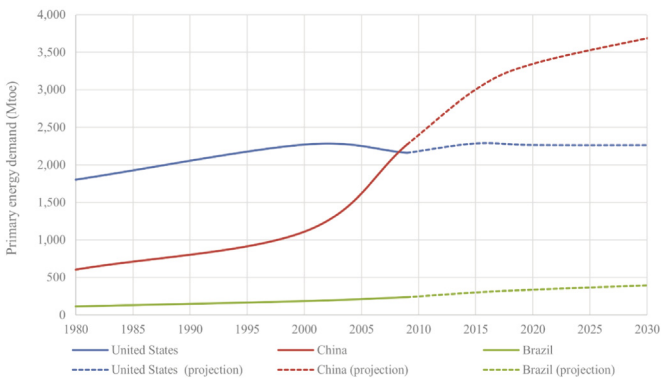

Fig. 1. Primary energy demand in Brazil, China and the United States, from 1980 to 2010, measured data and from 2010 to 2035, projected data [1].

The major contributors to energy consumption in buildings are HVAC (Heating, Ventilating, and Air Conditioning), water heating, lighting, and appliances [7]. One of the measures applied to reduce appliances energy consumptions is the 4E Program, Energy Efficient End-Use Equipment, which is implement by the International Energy Agency (IEA) and aims to support policy towards the promotion of energy efficient appliances worldwide [8]. The importance on energy efficiency policies implementation relies on energy security, economic development and greenhouse gas emissions reduction. Moreover, energy efficiency measures on appliances result in important energy savings, around 56 EJ, or around 1340 Mtoe in 2011 by member countries of the IEA [9] and savings about as €4 for each €1 invested [10].

Further, Ürge-Vorsatz and Novikova [11] argue that CO_2 emissions related to buildings is over a third of the world energy emissions. These authors conducted a study about CO_2 emissions potential reduction related to buildings over 80 countries. They found out a feasible potential of around 29% cut in emissions related to buildings by 2020, which means 3.2 $GtCO_2eq$ emission reduction.

In the United States, the building-related emissions is about 776,090 thousand tons of CO_{2eq} per year [12]; while in Brazil and Portugal, these emissions are circa 19,923 thousand tons of CO_{2eq} per year [13] and 3292 thousand tons of CO_{2eq} per year [14], respectively. However, when analyzing these figures in terms of primary energy, Brazil contributes less, with 1.54 tCO_{2eq}/toe in comparison to the United States, 2.34 tCO_{2eq} /toe, and Portugal, 2.06 tCO_{2eq}/toe [15]. The reason for the smaller Brazilian contribution on CO_2eq emissions lays down on its higher share of renewable energy on the total primary energy consumption. The share of renewable energy sources in Brazil, Portugal and USA is 39%, 24% and 6%, respectively [15].

In this context, energy conservation in buildings has great relevance. Moreover, with climate changes in the top of global agenda, the inclusion of higher efficiency regulations applied to the construction industry may contribute to a more sustainable development.

Energy consumption in buildings is gaining a wider scale. According to Pérez-Lombard et al. [7], the growth rate in energy consumption by buildings exceeded those of industry and