



New approaches for improving energy efficiency in the Brazilian industry



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ABSTRACT

The Brazilian government has been promoting energy efficiency measures for industry since the eighties but with very limited returns, as shown in this paper. The governments of some other countries dedicated much more effort and funds for this area and reached excellent results. The institutional arrangements and types of programmes adopted in these countries are briefly evaluated in the paper and provide valuable insights for several proposals put forward here to make more effective the Brazilian government actions directed to overcome market barriers and improve energy efficiency in the local industry. The proposed measures include the creation of Industrial Assessment Centres and an executive agency charged with the coordination of all energy efficiency programmes run by the Federal government. A large share of the Brazilian industry energy consumption comes from energy-intensive industrial branches. According to a recent survey, most of them have substantial energy conservation potentials. To materialize a fair amount of them, voluntary targets concerning energy efficiency gains should start to be negotiated between the Government and associations representing these industrial branches. Credit facilities and tax exemptions for energy-efficient equipment's should be provided to stimulate the interest of the entrepreneurs and the setting-up of bolder targets.

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1. Introduction

Energy efficiency policies have been seen recently by the Energy Ministers from the International Energy Agency (IEA) countries as having a critical role in addressing energy security, climate change and economic objectives.

Within this context, the Agency recommended 25 energy efficiency policies to the G8 in Hokkaido-Toyako Summit in 2008 in seven priority areas: buildings, appliances, lighting, transport, industry, energy utilities and cross-sectoral issues (Jollands et al., 2010). The recommendations regarding industry and the cross-sectoral ones are discussed in this paper, in what concerns their application to Brazil.

The aim of this paper is to carry out a review of Brazilian industrial energy policies. To begin with, the main approaches the governments and other stakeholders use worldwide to promote energy efficiency gains in industry are presented. A synthetic critical appraisal of the Brazilian government policies and programmes in this area follow next. The little progress observed so far in several industrial energy-efficiency indicators in the country contrasts with large energy conservation technical potentials of energy-intensive industrial branches estimated by Bajay et al. (2009). Based then on comparisons between the Brazilian experience with energy efficiency programmes in industry and successful experiences of several other countries with such programmes, the authors of this paper propose a new energy policy mix for Brazil's industry.

2. The main instruments employed worldwide to foster energy efficiency gains in industry

Energy efficiency can be improved at site level in three main ways: employing more efficient technology, changing to more efficient behaviour, and converting to alternative fuels or production/transport/consumption routes that provide the same service

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consuming less energy. In order to achieve this, the governments address energy policies. According to [Thollander et al. \(2012\)](#), these policies can be categorized as administrative, economical and promoting R&D. The governments of many countries have often fostered the market for energy services through energy service companies (ESCOs) or let the market be ruled via demand side management (DSM) involving energy supply utilities. For energy-intensive industries voluntary agreements, coupled with energy audits, have played a major role. Energy audit programmes offering energy audits for small- and medium-sized industry and energy efficiency networks are also common ([Thollander et al., 2012](#); [Anderson and Newell, 2004](#); [Bertoldi, 2001](#); [Backlund et al., 2012](#); [Bertoldi and Rezessy, 2011](#); [Stenqvist and Nilsson, in press](#); [Lindén and Carlsson-Kanyama, 2002](#); [Tanaka, 2011](#); [Koewener et al., 2011](#); [Price and Lu, 2011](#); [Thollander et al., in press](#)).

[Bajay and Sant'Ana \(2010\)](#) found out the following approaches as the main instruments the governments and other stakeholders of 13 countries, plus the European Union as a whole have been using to promote energy efficiency gains in their industry:

- Diffusion, for industry staff, of technical, economic and financial information about efficient equipment and practices, through leaflets, booklets, books, handbooks, data bases and softwares;
- Providing courses about energy management and energy conservation measures in industry;
- Total or partial financing, through public funds or tariff rebates, of energy audits in industrial premises;
- Credit facilities for efficient industrial equipment;
- Setting-up of minimum energy performance standards for some general-use equipment in industry;
- Mandatory utility end-use energy efficiency schemes, including industrial consumers, with targets to be reached and verification procedures for the energy savings achieved;
- Fostering the participation of Energy Service Companies (ESCOs) and their performance contracts in industrial energy efficiency programmes;
- Licensing ESCOs and allowing them to issue certificates, recognized by the government, concerning the energy savings actually obtained in their performance contracts;
- Tax incentives for efficient industrial equipment;
- Diffusion of technical, economic and financial information about efficient industrial processes for some products (benchmarking);
- Voluntary agreements between government and industrial associations to implement energy efficiency programmes in industry, particularly in the energy-intensive branches;
- Funding of research and development projects concerning efficient industrial equipments and processes;
- Adoption of energy management codes in industry, compatible with the quality code ISO9000 and the environmental code ISO14000; and
- Legislation and regulation regarding mandatory energy efficiency programmes in industry.

Most of the countries studied by [Bajay and Sant'Ana \(2010\)](#) have industrial energy efficiency programmes for the energy-intensive branches and for small and medium companies and, usually, different approaches are used for each of them.

The great majority of the energy efficiency programmes for industry evaluated by [Bajay and Sant'Ana \(2010\)](#) were conceived by government bodies. The most successful of them have partnerships with industrial associations.

3. Government actions to promote energy efficiency in the Brazilian industry and the limited results obtained so far

The National Programme for Electricity Conservation (Procel) was the first systematic initiative to promote the efficient use

of electricity in Brazil. The objectives of Procel's industrial programme are: (i) the support for the various industrial branches in improving their energy performance; (ii) the selection of industrial plants to carry out new, energy-efficient, projects and; (iii) the dissemination of information regarding successful projects, aiming their multiplication. No tax and credit incentives for the interested companies are available within this programme.

The Conpet programme was created on July 18, 1991, by a Presidential Decree with the aim of promoting the efficient use of petroleum and natural gas in the whole chain of the oil and gas industries, including both public and private premises.

The budgets and staffs of Procel and Conpet dedicated to their industrial activities are very small and there are very few people responsible for energy efficiency policies and coordinating Procel and Conpet at the Brazilian Ministry of Mines and Energy.

In spite of these government initiatives to foster energy efficiency in the Brazilian industry, the results obtained so far have been very limited, as shown by some energy efficiency and CO₂ emissions indicators in [Table 1](#).

This table shows the values of the same indicators for Brazil, United States, France and China from 1990 to 2010. The United States and France were chosen because of the remarkable improvements the industry of these countries achieved in several of the indicators of [Table 1](#), while in China, the fastest growing industry of a developing country also reaped substantial energy efficiency gains, according to some of these indicators. Different from what happened to most of the energy intensity, unit energy consumption and specific CO₂ emissions indicators for these three countries, the values of the corresponding indicators for Brazil either increased or did not decrease significantly over the last three decades.

4. Technical energy saving potentials in the Brazilian industry

Contrasting with the little progress observed so far in the energy efficiency of the Brazilian industry, there is a lot of room for future advances in this area. [Table 2](#) shows both the absolute and relative electricity and heat conservation technical potentials of energy-intensive industrial branches in Brazil. They were estimated by [Bajay et al. \(2009\)](#), in a project carried out by the Interdisciplinary Centre for Energy Planning, at the State University of Campinas, for the Brazilian Confederation of Industry (CNI). The second column of the table indicates the years for which the energy saving potentials were estimated.

This table reveals that the iron and steel industry is the branch with the highest absolute conservation potentials. It also has the highest relative electricity conservation potential.

Iron and steel, Ceramics, Chemicals, Pulp and paper, Cement, Non-ferrous metals, Food and beverage are consume more energy in the Brazilian industry. The producers of non-ferrous metals, food and beverage, iron and steel, and pulp and paper are also large consumers of electricity.

5. New approaches for energy efficiency programmes in the industrial sector in Brazil

Brazil never had a broad and long-term public policy for energy efficiency, with agreed on energy savings targets with key stakeholders. The targets should be based on the results of cost-benefit analysis of efficient technologies and good practices. Deadlines to reach the targets and the responsibilities of each stakeholder should be outlined in the plan detailing the policy ([Bajay and Sant'Ana, 2010](#)).

The development of such a policy, with a chapter devoted to energy efficiency gains in the Brazilian industry, is a task for the National Council for Energy Policy (CNPE), the government multi-

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