



# Motivating towards energy efficiency in small and medium enterprises



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## ABSTRACT

Industry is responsible for about 50% of world energy consumption and therefore for a big impact concerning greenhouse gas emissions and climate change. An important strategy to achieve the target of energy policies in Europe, of reducing the energy consumption by 20% by 2020, must consider reducing energy consumption in industry. When talking about industry, it must be remembered that small and medium-sized enterprises are a central part of economies worldwide, comprising 99% of enterprises and providing about 60% of employment. Increasing their energy efficiency represents considerable value for economies, societies and the enterprises themselves. Together with cost savings, energy efficiency can deliver other benefits that can help those companies grow and develop, for example by improving productivity, profitability and competitiveness and product quality. By reducing reliance on energy imports, and lowering environmental impacts, it increases value, not only to business, but also to society. Despite the benefits resulting from energy efficiency measures, their implementation in companies is not an easy task, due to existing barriers that must be identified in order to define motivation strategies that can fight those obstacles. A project, aiming to identify the situation in medium-sized enterprises and to provide them the necessary conditions to adopt energy efficiency improvements, was developed in Portugal. It enabled to conclude about best practices and technological solutions that answer the energy efficiency problems and to identify the main barriers that prevent that adoption, and measures that can contribute to overcome them. The research within the sectors studied showed that changing individual energy behaviors requires strategies that address both internal and external influences on behavior change and not simply new technologies, price incentives or information campaigns.

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## 1. Introduction

Small and medium-sized enterprises representing 99% of enterprises and providing about 60% of employment are a central part of economies worldwide and therefore in Portugal too. They contribute around 50% of global gross value added and from 16% to around 80% of gross domestic product (GDP), depending on the country's economic structure (IEA, 2015).

Small and medium-sized enterprises are important drivers of economies around the world. In the European Union, they employ almost 90 million people, generate about 1.1 million new jobs per year and contribute to almost 30% of GDP. Despite limited resources they also drive innovation by carrying out nearly 20% of research and

development (R&D) in the United States and the European Union, and they account for more than half of R&D in some OECD countries such as Iceland, Norway, Poland and Portugal (OECD, 2013).

Even if individually small and medium-sized enterprises' energy consumption is not high, when considering them as a whole, their energy demand is considerable and according to IEA estimates, they consume more than 13% of total global energy demand.

With the rising price and the threat of exhaustion of energy and resources, energy management became one of the main worries of industrial management (Petrecca, 1992; Rohdin and Thollander, 2006), and the interest in analyzing and improving the impact of energy consumption of products and processes has been stated by different stakeholders (Thiede et al., 2013). Another important aspect to be considered has to do with consequences in greenhouse gas emissions and climate change (Chai and Yeo, 2012) and the targets that several countries including Portugal are committed to attain by 2020. Therefore the important part played by energy efficiency in industrial enterprises (Worrell et al., 2009), and in a

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special way in small and medium-sized enterprises, considered at the same level as conventional fuels in the global energy balance (Fleiter et al., 2012).

The conclusions of several recent studies on this subject show that the potential for improvement in energy and resources efficiency in manufacturing companies varies in an interval from 10 to 40% concerning possible energy savings (Thiede, 2012; Thiede et al., 2013), and it is higher when considering small and medium-sized enterprises due to its number and to its state of the art concerning energy efficiency (Trianni et al., 2013a, b).

By improving small and medium-sized enterprises' energy efficiency their profitability and competitiveness will increase. By reducing their energy costs, product quality and output can be improved, risks and liabilities reduced, resilience enhanced and new business opportunities enabled. It also contributes to wider policy objectives, such as boosting employment opportunities, expanding the market for energy efficient goods and services, improving energy security, reducing greenhouse gas (GHG) emissions and local air pollution, and enabling investments in additional power generation to be deferred.

The result of increasing small and medium-sized enterprises' energy efficiency will then be translated into value increase for economies, societies and the enterprises themselves. Energy efficiency, besides providing many economic, social and environmental benefits, plays an important part in tackling climate change problem (IEA, 2015).

The Portuguese situation is not quite different from the one presented in the studies at European level: more than 90% of Portuguese industrial companies are small and medium-sized ones and the level of entrepreneurial culture in what concerns energy efficiency aspects is low (Catarino et al., 2015). Portugal is committed, due to European agreements, to reduce energy consumption by 20% by 2020 compared with the baseline modeled scenario (1990 levels) in order to achieve the target of energy policies in Europe.

Although energy efficiency measures are recognized as an important matter and the possibilities of application are wide-ranging, it is still hard to convince companies' top management about the benefits of their implementation. This is not an easy task due to many identified barriers.

According to Sorrell et al. (2000), a barrier is defined as a postulated mechanism that inhibits a decision or behavior that appears to be both energy and economically efficient. The barriers prevent the adoption of energy efficient technologies and practices in the industrial sector, and limit opportunities to attain additional energy savings (US Department of United States Department of Energy, 2015).

As important as to identify and discuss those barriers, which impede deployment of energy efficiency in the industrial sector, is to find measures to overcome them (Trianni et al., 2013a, 2013b), and so a deep discussion about them is an important subject if it can lead to solutions to the problem.

This paper, supported by the Portuguese experience lived in Efinerg project (Catarino et al., 2015), intends to identify the main barriers and also possible ways to overcome them, namely those related with behavioral ones in a small and medium-sized entrepreneurial scenario. It is structured as follows: an introduction presents the problem and its context as well as a summary of existing studies about the subject; identified barriers and possible ways of motivating entrepreneurs to overpass them are then analyzed; the Portuguese experience is referred through the presentation of the methods used and during the development of Efinerg project in Portuguese small and medium-sized enterprises; finally, results are discussed and some conclusions and items for future research and development are presented.

## 2. Barriers versus motivation

### 2.1. Barriers

Energy as a resource has not been used as efficiently as it should and could be and there are cost-effective technologies that could improve energy use and are not implemented yet. This happens in all sectors of society: households, public buildings, institutions and private industries.

The factors that contribute to the non-adoption of energy efficiency measures are referred to as barriers (Apeaning and Thollander, 2013). It is recognized that the potential for energy efficiency improvements in the industry is significant specially in what concerns small and medium-sized enterprises but the implementation of energy efficiency measures is not always possible owing to various barriers to energy efficiency (Paramonova and Thollander, 2016).

Different authors have been identifying barriers to industrial energy efficiency, even if this concept of a barrier to energy efficiency is not always clear. Different taxonomies and different approaches to classify barriers appear in literature, some of them based in statistical methods (Giacone and Mancò, 2012).

An important barrier to investing in energy efficiency, which is often referred, has to do with the restricted access to capital markets and investments which may not be profitable because they imply a high price for capital. As a result, only investments with an expected return that exceeds this (high) hurdle rate will be accomplished (Schleich and Grubber, 2008). Furthermore if improving energy efficiency comes at the cost of other more cost-effective opportunities, the firm will give energy efficiency a low priority.

When speaking about management, some of the barriers included in this item have to do with information problems, and, according to Golove and Eto (1996), they can fall into three categories: lack of information, cost of obtaining information and accuracy of information.

Other barriers faced by small and medium-sized enterprises that make it difficult for them to adopt energy efficiency measures are the lack of time and resources to explore energy efficiency options, the lack of information about where and how energy is used in their companies and the lack of internal capacity to develop and implement energy efficiency projects. Therefore energy efficiency is rarely viewed as a priority.

Another important aspect that may fall into behavior aspects has to do with inertia, which means that both individuals and organizations are creatures of habits and established routines (Andrews and Johnson, 2016). They do not welcome changes in their environments and avoid or ignore problems, which may make it difficult to create changes to such behaviors and habits (Thollander et al., 2010). Those difficulties in getting people to change their behavior are also present in relation to environmental responsibility namely what concerns energy aspects (Bradley et al., 2016).

Small and medium-sized enterprises' managers are focused on their daily business and on solving problems and have little time to develop expertise beyond the essentials, thus often ignoring profitable efficiency opportunities. The Observatory of European small and medium-sized enterprises found that fewer than 30% of small and medium-sized enterprises in Europe had implemented any measures for conserving energy and resources, and only 4% had a comprehensive approach to energy efficiency (European Commission, 2014).

Lack of experience with energy efficiency also gives rise to concerns that energy efficiency measures may disrupt the production process and lead to revenue losses or affect product quality

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