

FACTORS FOR THE SUCCESS OF ISO 50001

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Overview

ISO 50001 is recognized as the latest certification in structuring the best energy management practices in organizations. Although this norm has been in place worldwide since 2011, its penetration in the countries has been drastically unequal. Data from 2015 indicate that a group containing only five countries concentrates 73% of the certifications in the world.

Which reasons better explain the success of the five countries with the highest number of certifications? Is energy price, or even the weight of energy costs on the revenue of the largest industrial sectors in each country, really the biggest impetus for adopting energy efficiency and energy management measures in organizations? This article investigates these questions by analyzing the group of the five countries with the highest number of ISO 50001 certifications under three aspects: the price of energy, the characteristics of the local industry and the existence of legislation to encourage certification and environmentally correct practices.

The price analyzes presented quite different characteristics in the universe of the evaluated countries. The overwhelming country with the highest number of certifications, namely Germany, has one of the lowest energy tariffs in Europe, as opposed to the fact that Italy, which is also among the countries with the highest number of certifications, has one of the largest energy tariffs of the European continent.

As for the weight of energy in local industry costs, it has been verified from the data gathered that, in the leading countries, both the occurrence of heavy and consequently electro-intensive industry, such as the steel industry present in Germany, Italy and especially in India, as well as the presence of the fine chemical industry in Germany and United Kingdom.

Regarding the aspect of the incentives given to actions of sustainability and energy efficiency, it is highlighted in the data of the research that Germany has some of the most ambitious goals of climate policy in the European continent, being the leader in number of certifications ISO 50001.

As a conclusion drawn from the analyzes presented in this article, it was pointed out that a national policy aimed at containing the environmental impacts of the organizations, with goals, incentives and legislative rigor in a combined form, such as the one existing in Germany, is presented as The best way to induce actions of energy efficiency and energy management in the organizations of a country, increasing its participation in the number of ISO 50001 certifications. However, one can not ignore the role that the cost of energy acts as an inducer of actions in the area. Since countries in which an absence of more aggressive environmental policies has been identified, the high price of energy pushes organizations to invest in this area because of the potential economic benefits of implementing ISO 50001.

Keywords – Energy Management; Energy Efficiency; ISO 50001; Certification.

1. Introduction of ISO 50001 standard

Efforts to restrain the environmental impact of human activities have become increasingly prominent in the discussion forums, whether at the local or global level. With the deepening of these discussions, numerous and ambitious targets, established by countries and blocks, emerge for the reduction of greenhouse gas emissions. In this context, it is well known that the use of traditional energy sources, such as coal-based or petroleum-based thermoelectric plants, has a great impact on the generation of these gases and the aggravation of other environmental problems.

In addition, it is known that the mere replacement of energy from fossil fuels and other non-renewable sources by renewable energies, such as wind and solar, will not be sufficient action to reach the goals established by the countries subscribing to the Paris Protocol for the reduction of greenhouse gases. In order to achieve this objective, a significant improvement of energy efficiency in industry and other buildings is of great importance, and this issue has been on the agenda of companies around the world (FIEDLER; MIRCEA, 2012).

According to Fiedler and Mircea (2012), studies indicate that constructive aspects and reforms can bring reductions of around 80% in the energy consumption of air conditioning systems and of the order of 50% in lighting systems.

The use of such economic opportunities is not only due to the investment in more efficient technologies, but also to management practices aimed at reducing the energy consumption of organizations. In order to meet this need, ISO 50001 (ISO, 2011), which deals with energy management systems, has emerged.

ISO 50001 resembles in some respects the procedures provided for in other ISO certifications, such as ISO 9001 and ISO 14001. However, it has some peculiarities, either because it is more recent than the others or because of its orientation to the energy consumption. One of the most important aspects of ISO 50001 is the construction of baselines, indicators and goals based on the operation of the organization and defined by itself. This makes the management system effective and adaptable to the most varied types and sizes of organizations.

In Figure 1, the advantages of adhering to ISO 50001 by organizations are listed. In the field of management, organizations that certify themselves in ISO 50001 now have greater control of energy costs, which increases their profitability, as well as leading to image gains in the environmental area and greater involvement of employees. Regarding legal aspects, in adopting ISO 50001, the organization is more informed about the legislation of the energy sector and its impact on the operations and costs of the company. In sales and marketing, the organization now has a strong image of a company with environmental awareness, which connects with the increasing yearnings of consumers in this area of development. The organization will also get to know better the uses of energy present in its operation and how to manage its consumption. Finally, in finance the organization will gain a lot of information about the use of energy and its effect on company costs.

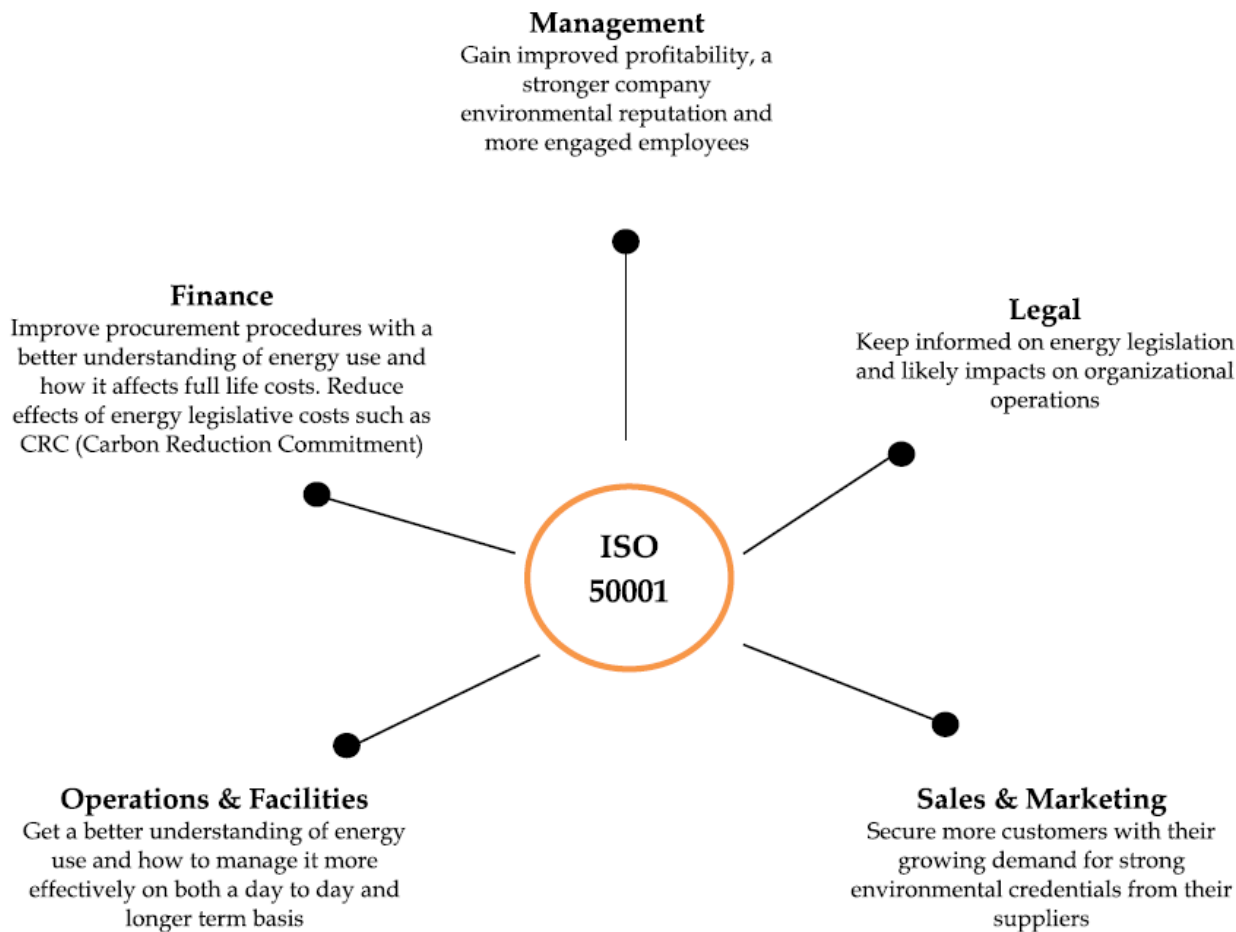


Figure 1 – Expected benefits of adopting ISO 50001. Source: PHAM, 2015.

There are not many examples around the world of organizations that have achieved great results when using ISO 50001.

South Korea's LG, for example, has been awarded ISO 50001 certification at its plant in Cheongju-si, South Korea, whose activity is focused on the design of acrylic films for LCD modules and lithium-ion batteries, achieving an

improvement in energy performance of 9.39% considering its energy sources, namely, electricity, natural gas and steam. The annual savings on this project surpassed US \$ 9.4 million in 2014, the year of the implementation of the energy management system based on ISO 50001, with implementation costs of US \$ 3.4 million, with little more payback Of 4 months (CEM, 2014). The main points pointed by the company to the success of the energy management system deployed at LG were:

- ✓ Support and encouragement on the part of the high management and formation of a conscience in all the collaborators on the importance of the energy efficiency;
- ✓ With the adoption of the energy management system, the organization has been able to more reliably assess what leads to wasted energy and find greater savings opportunities;
- ✓ Gains on the organization's image of its environmental responsibility, increasing its competitiveness in the markets to which it is inserted;
- ✓ Economy with energy influencing the cost of production, and consequently the price for the final consumer, making it possible to offer more competitive products globally.

Another good example of results in the application of ISO 50001 occurred at the Cummins engine manufacturing plant in the city of Columbus, United States. In the process of obtaining the certification, a series of energy efficiency improvements were observed, such as the replacement of 4000 luminaires and air-handling units for steam heating by more efficient models, as well as insulation and increased efficiency of air compressors . One of the factors pointed out by the company that contributed to the certification and engagement process of top management was the pre-existence of other ISO certifications in the plant, such as ISO 14001 and ISO 18001 (CUMMINS, 2017).

Having emerged in 2011, ISO 50001 achieved a total of 11985 certifications by the end of 2015, according to information available through the ISO Survey (ISO, 2015). The way these certifications are distributed across continents is quite uneven, as can be seen in Table 1.

Table 1 - Continental distribution of ISO 50001 certifications. Source: ISO, 2015.

Year	2011	2012	2013	2014	2015
TOTAL	459	2236	4826	6765	11985
Africa	0	13	36	18	40
Central / South America	11	10	34	63	92
North America	1	9	34	77	77
Europe	364	1.919	3.993	5.526	10.152
East Asia and Pacific	49	191	478	693	1.035
Central and South Asia	26	76	189	299	459
Middle East	8	18	62	89	130

It is noted in the above table that since the beginning of the ISO 50001 standard there was a great concentration of certifications in the European continent, reaching in 2015 84.7% of the total certifications in the world. On the other hand, East Asia and the Pacific account for 8.6% of global certifications. Still in Table 1, the low number of ISO 50001 certifications in the North American region, composed by the United States and Canada, is striking, contrasting with the region's economic power and strong industrialization. In addition to the continental distribution question presented above, there is a very uneven distribution within countries.

Table 2 presents the ranking of the 10 countries with the highest number of certifications. There is a huge role for Germany in terms of the number of certifications, since only Germany represents 49% of the world's certifications.

Table 2 - Ranking of the 10 countries with the highest number of certifications. Source: ISO, 2015.

1	Germany	5931
2	United Kingdom	1464
3	France	500
4	Italy	470
5	India	405
6	Spain	390
7	China	262
8	Taipei, Chinese	262
9	Austria	220
10	Thailand	138

In Figure 2, the high concentration of ISO 50001 certifications in few countries is even more evident. It is noted in this figure that the group of the five countries with the highest number of certifications, which are the subject of a study of this article, namely Germany, the United Kingdom, France, Italy and India, account for 73% of world certifications.

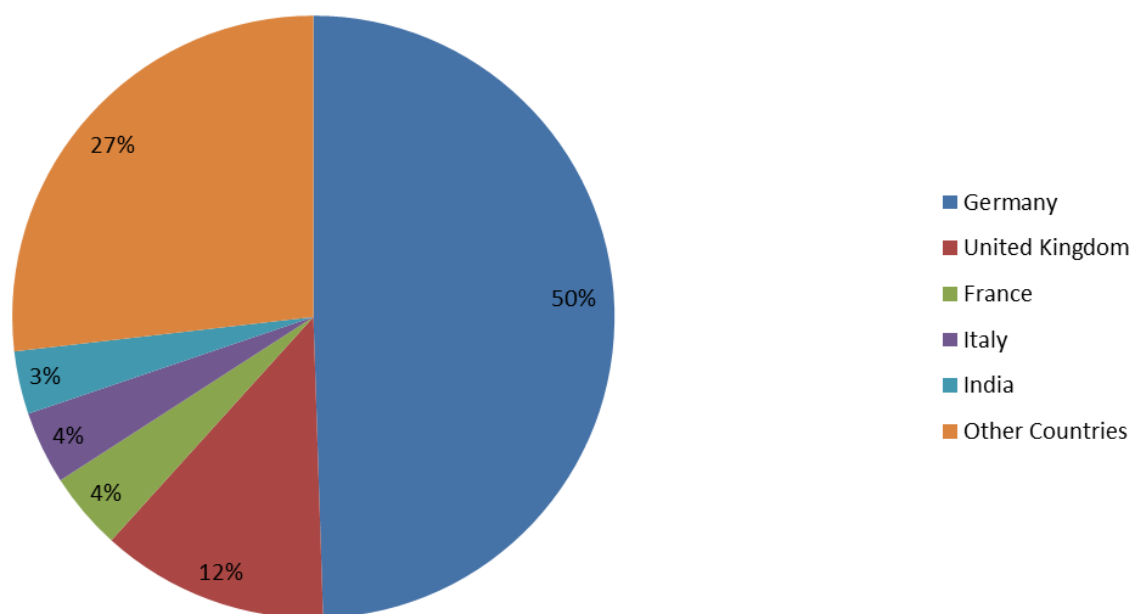


Figure 2 - Concentration of ISO 50001 certifications. Source: adaptado de ISO, 2015.

2. Price analysis

The expected behavior for an energy consumer is to adopt more strongly consumption containment measures, or even management of energy expenditures, in proportion to the fact that the price of this input has higher values.

However, this behavior does not necessarily reproduce in reality since, in the case of the adoption of ISO 50001, or even other energy management measures, other factors with potential of greater influence for the analyzed set can manifest themselves. In order to analyze the influence of the price of energy on the number of ISO 50001 certifications in each country, since the validity of the norm, the behavior of each of the two variables was raised, explaining it in Figures 3 and 4.

Looking at the average prices of electric energy during the period of ISO 50001, for industrial consumers in the 5 countries with the highest number of certifications, it can be seen from Figure 3 that there are countries with relative tariff stability, presenting prices which varied little over the period analyzed (2011-2015), such as India, France and Germany. In addition, there is a reduction of prices in Italy within the analyzed period, causing that

country to stop being the greater tariff between the analyzed set. And finally, there was a substantial increase in energy prices in the UK, especially between 2013 and 2015, making this the country with the highest tariff of the whole analyzed.

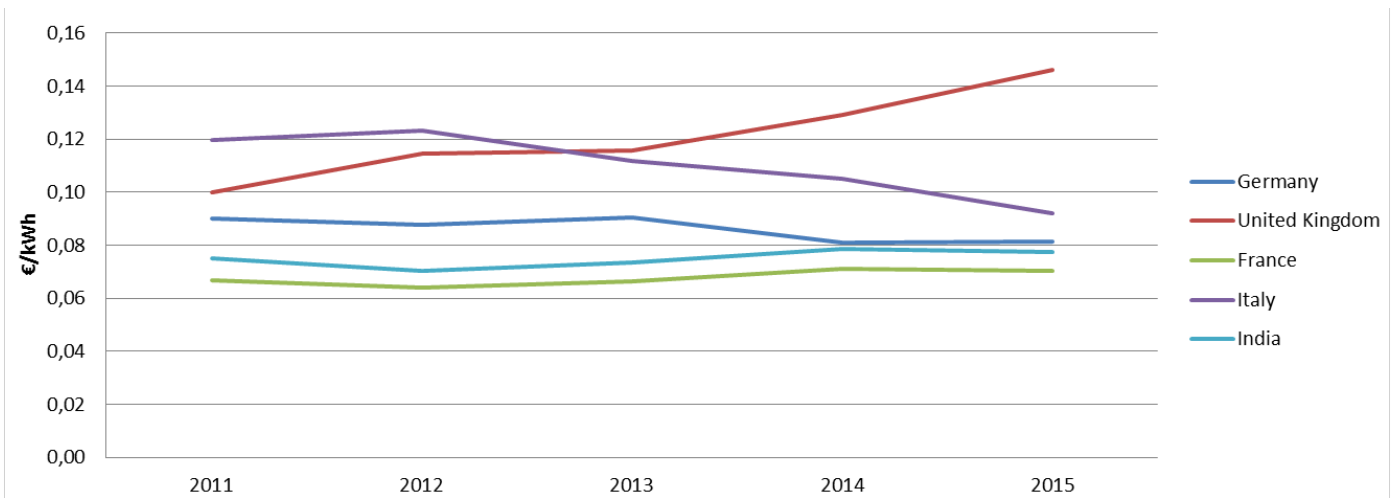


Figure 3 - Energy prices in the 5 countries with the most ISO 50001 certifications between 2011 and 2015. Source: adapted from EUROSTAT, 2017; IEA, 2017.

Already observing the behavior of the number of certifications during the period of validity of ISO 50001, Figure 4 shows countries with moderate growth in the number of certifications over the years of observation, such as India, France and Italy. In addition, there has been strong growth in all observed years of the number of certifications in Germany, making that country consistently remain the leader of the ranking. And finally, a substantial increase in ISO 50001 certifications in the UK, especially between 2014 and 2015, consolidating that country to the second place in the ranking.

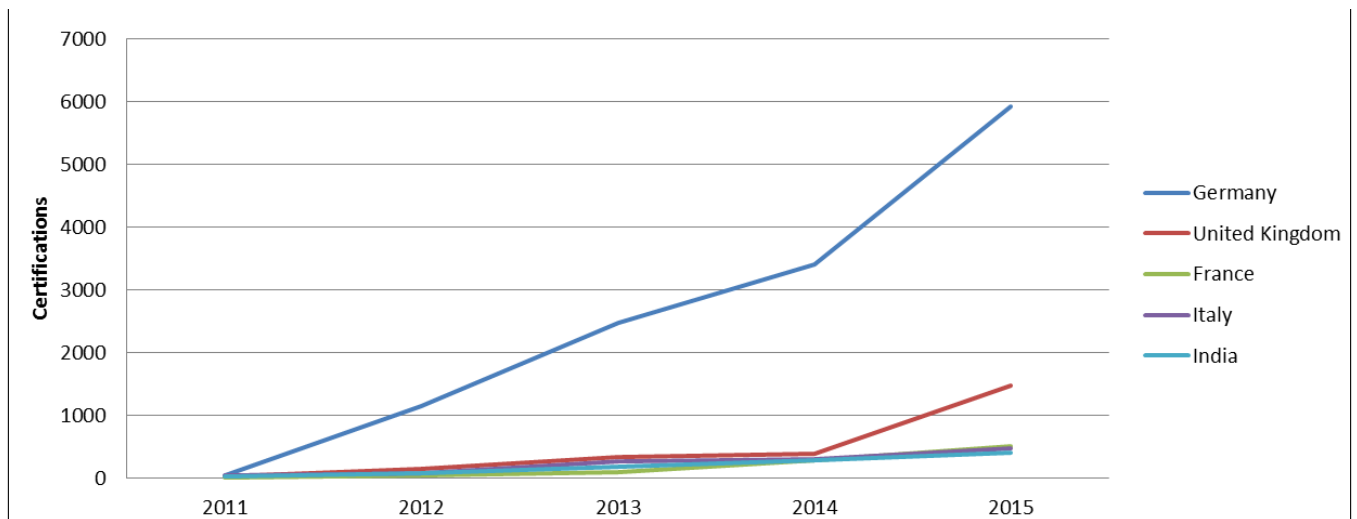


Figure 4 - Number of certifications in the 5 leading countries in the ranking. Fonte: adapted from EUROSTAT, 2017; IEA, 2017.

On the basis of data for Germany, it is noted that the growth in the number of certifications is consistent across the analyzed period and therefore has been insensitive to the price changes of the energy for the industrial consumers of that country. Still on the data for Germany, there is an acceleration in the growth of the number of certifications between 2014 and 2015. Such a move, if only the price of energy influenced the number of certifications, would be the opposite of what was expected, since there were a fall in the energy tariff in the period 2013-2014.

Of the five countries analyzed, there is a stronger relationship between energy prices for industrial consumers and the number of ISO 50001 certifications in the UK alone. In the data for this country, it can be inferred that the increase in the energy tariff between the years of 2013 and 2014 has led to an increase in the number of certifications between the years 2014 and 2015. These data indicate a possible relationship between the Two variables observed in the United Kingdom. However, such behavior was not repeated throughout the period, given the existence of a stable electricity tariff period and a slight increase in the number of certifications.

In the other countries analyzed, namely France, Italy and India, there were no major changes in the price of electricity for industrial consumers between 2011 and 2015. Nevertheless, in some periods there was a considerable increase in the number of certifications, such as Detailed in the following case-by-case description.

In France, the behavior of the number of certifications did not show any relation close to that expected with the price of energy in the analyzed period. As an example, there was a 132% increase in the number of certifications between 2012 and 2013, and in the period between 2011 and 2012, which could induce the behavior of companies in the subsequent period, there was a fall in the electricity prices of 4,2%.

In Italy, the number of certifications also did not show any relation close to that expected with the price of energy in the analyzed period. In the period between 2012 and 2013, the number of certifications grew 248%, against a fall in energy prices.

3. Characteristics of the local industry analysis

Taking into account the characteristics of the local industry of each country analyzed and its possible relation with the number of certifications in these countries, it is expected that the greater the incidence of electro-intensive industries in a given country, the higher the energy costs of the industry and , So the greater the interest in energy management policies, such as ISO 50001.

In order to subsidize this analysis, the participation of each industrial sector in the electricity consumption of the industries of Germany, the United Kingdom, France, Italy and India can be observed in Figure 5.

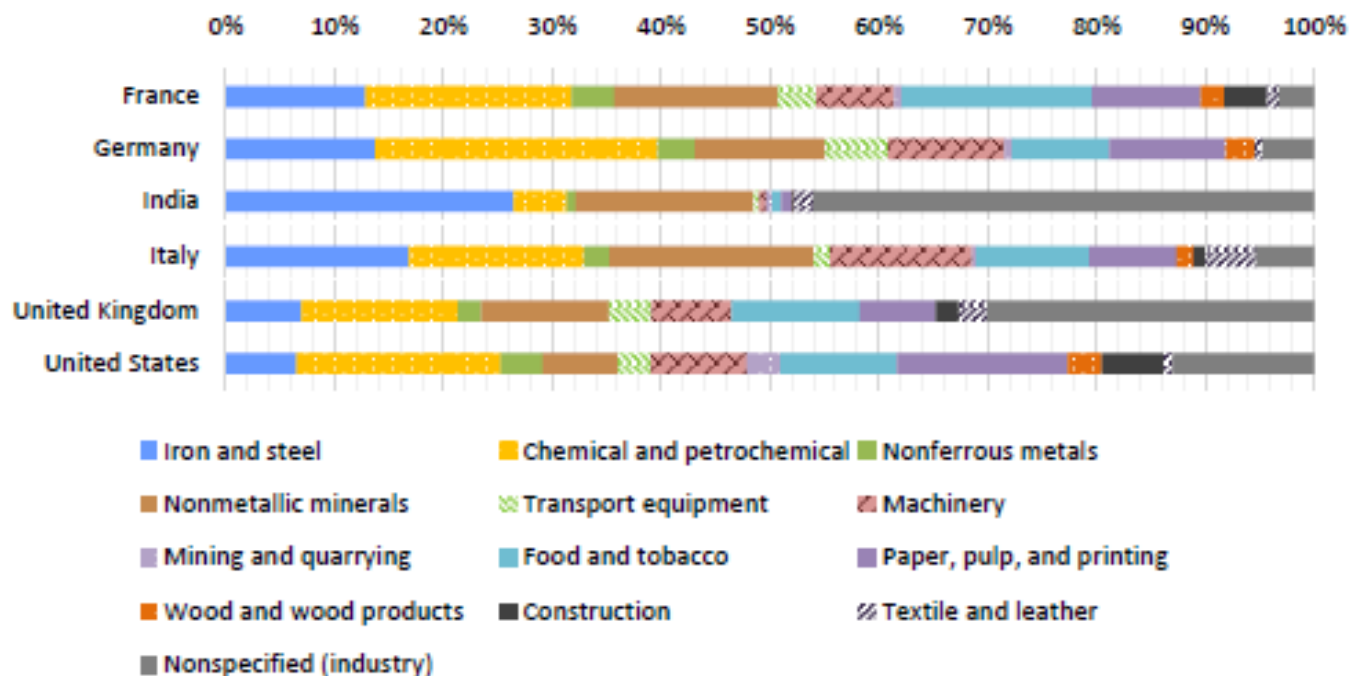


Figure 5 – Industry groupings and respective shares of energy consumption by industry in countries. Source: IEA 2017b.

Given the data for Germany, there is a large share of iron and steel, chemical and food and tobacco industries. These industrial sectors have a considerable weight of electricity in the final costs, besides being included in the ranking of the five areas with the highest number of ISO 50001 certifications, as can be seen in Table 3. The high incidence of these industrial sectors is compatible with the leadership of Number of certifications.

The United Kingdom data shows a significant number of industries not specified in the country's electricity consumption, which significantly reduces the share of the five most with ISO 50001 certifications in the world. In addition, a sector that does not have a large number of certifications in the world has a large consumption of electricity in the United Kingdom, namely non-metallic minerals. In addition, in the United Kingdom, the incidence of iron and steel, chemical and food and tobacco industries, which are in the ranking of the five sectors in Table 3, is less significant than in Germany.

In France, the industrial electricity consumption division, shown in Figure 5, is similar to data for Germany, ie large share of iron and steel, chemical and food and tobacco. These industrial sectors have a considerable weight of electricity in the final costs, besides being in the ranking of the five sectors that have the highest number of ISO 50001 certifications.

In Italy, the sector with the highest percentage of industrial electricity consumption is the non-metallic mineral sector, which is not included in the group of sectors with the highest number of ISO 50001 certifications in the world. However, there is also a good participation of iron and steel, chemical, food and tobacco industries.

Finally, in India, there is practically the predominance of three industrial sectors, namely iron and steel industries, of non-metallic and unspecified minerals. It should be noted that two of the three sectors that summarize the consumption of industrial electrical energy in India, non-metallic and unspecified minerals, are not considered as major inductors of ISO 50001 certifications according to Table 3. The iron and steel industry, Number of certifications in the world, is, according to Figure 5, the second most important industrial sector in India.

Table 3 - Ranking of the 5 industrial sectors with the highest number of certifications. Source: ISO, 2015.

1	Basic metal & fabricated metal products	919
2	Food products, beverages and tobacco	876
3	Rubber and plastic products	672
4	Chemicals, chemical products & fibres	583
5	Electrical and optical equipment	312

4. Existence of legislation to encourage certification analysis

As for the existing incentives in the countries analyzed, it is noted that Europe has been working very effectively in this area. In 2012, the European Parliament issued a directive to the member states of the European Union, encouraging them to draw up incentive programs to encourage small and medium-sized enterprises to draw up energy audits in line with European standards and ISO 50001. In addition, Directive indicated that energy audits should be compulsory and regular for large companies, since the possibilities for energy savings in such companies could be significant.

This European record regarding the incentives and programs to encourage certification in its member countries has had an effect throughout the years of ISO 50001, making this continent the region with the largest part, equivalent to 84, 7%, of world certifications, as already mentioned above.

Table 4: Existence of Energy Management Policy. Source: adapted from ACEE, 2016.

Country	Energy Management Policy	Policy refrence to ISO 50001
Germany	yes	yes
India	yes	yes
UK	yes	yes
France	yes	No
Italy	yes	No

According to a survey carried out by ACEEE (2016), and shown in Table 4, all five countries with the highest number of certifications, four of them from the European continent, have energy management policies in place,

three of which are Germany, the United Kingdom United Kingdom and India, do so in accordance with ISO 50001.

In order to obtain an international picture, the American Council for a Energy Efficient Economy (ACEEE), a non-profit organization that encourages the promotion of energy efficiency policies, programs, technologies, investments and behaviors, conducts a study each year attributing Scores in line with each country's efforts to implement programs related to energy efficiency and energy management. This study, called the International Energy Efficiency Scorecard, has four criteria in which countries are evaluated:

- ✓ National efforts;
- ✓ Buildings;
- ✓ Industry;
- ✓ Transportation.

The last published study (ACEEE, 2016), shows a good performance of the five nations analyzed:

- ✓ Germany - 1st Place;
- ✓ Italy - 2nd Place;
- ✓ France - 4th Place;
- ✓ United Kingdom - 5th Place;
- ✓ India - 14th Place.

The detail of the performance of these countries and their peculiarities are as follows.

Germany stood out in 2016, scoring 73.5 points in 100 possible points, and remaining the country with the best performance in the evaluation. According to the ACEEE (2016) this good performance is due to the implementation of a comprehensive energy strategy known as Energiewende, making Germany one of the most energy efficient economies. Another important point is the establishment of a target of 20% reduction in primary energy consumption by 2020 and a reduction of 50% by 2050 compared to 2008 levels. Thus, to achieve these targets the German Government has been making a strong Incentive policy funded by the KfW Development Bank, leveraging the country to a high score in terms of national efforts in the evaluation of ACEEE.

Another highlight of the German performance is the industrial sector, which, thanks to agreements for the annual reduction of energy intensity, has been significantly better than other countries for this item.

As points that need improvement, the ACEEE pointed to the efficiency in buildings, given the great untapped potential in the area of standardization of appliances for improvement, as well as transport, given that despite the good availability of public transportation, the German protagonism in the production of cars has led to the use of personal vehicles as the main means of transportation, without the Government showing great interest in acting in this area. The graph that shows the scores for Germany is shown in Figure 6.

GERMANY, #1

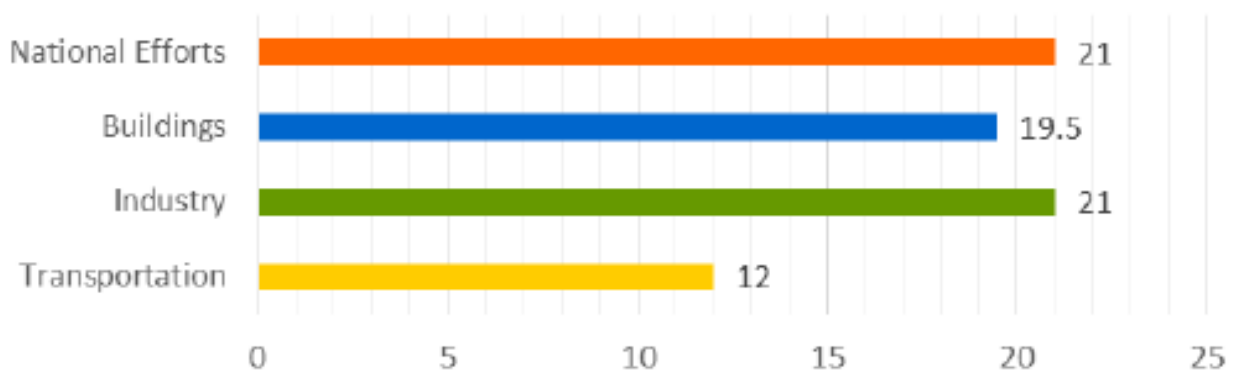


Figure 6 – Germany scores. Source: ACEEE (2016).

Italy reached 68.5 points in 100 possible points, ranking second. The highlight of Italian performance was, according to the ACEEE, the transport sector, with 16 points. This performance stems from participation in the European Union's vehicle standards program, achieving average fuel economy data for passenger cars of 38.6 mpg. In addition, the high proportion of investment in rail transport in relation to investment in roads stands out.

Another success factor for Italy was the industry, setting energy-saving targets, requiring plant energy managers to meet those targets and requiring periodic energy audits. A market-based energy efficiency certification policy was critical to the achievement of industrial sector objectives. The Italian policies for buildings are also among the best.

As points for improvement the ACEEE highlighted the need for greater investment in energy efficiency programs in addition to research and development. Scores from Italy can be seen in Figure 7.

ITALY, #2

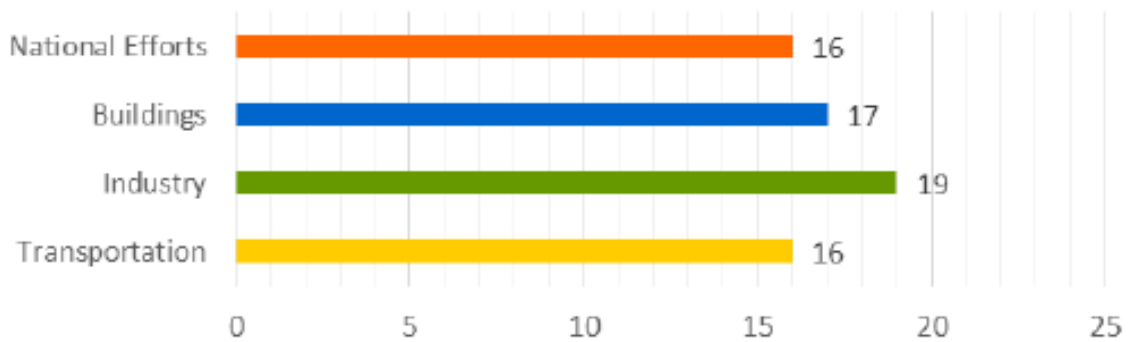


Figure 7 – Italy scores. Source: ACEEE (2016).

The performance of the UK in 2016 due to a series of energy and climate policies contrary to its evolution in the ranking, such as the 33% reduction of the country's energy efficiency obligations target, the 20% Future Energy Efficiency expenses and the cancellation of the Green Deal. Such facts made the country fall to fifth place, with 65 points out of 100 possible.

Compared with other countries, the UK still has some good policies and programs in place. However, these practices lost strength with the result of the country's vote to leave the European Union.

As areas for improvement, ACEEE presented the transportation sector, whose performance in goods handling is very poor and there is a very small percentage of daily trips using public transportation. The UK scores can be seen in Figure 8.

UNITED KINGDOM, #5

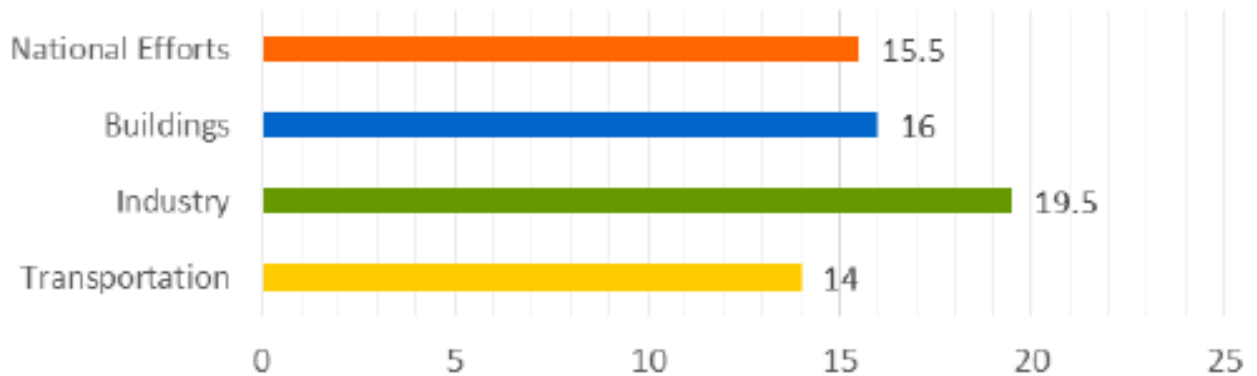


Figure 8 – UK scores. Source: ACEEE (2016).

France won the fourth place with a score of 67.5 points, out of 100 possible. The highlights were the performance in the area of buildings, driven by the Energy Efficiency Action Plans, committing to renew 500 thousand houses per year.

In addition, France has scored well in national efforts and transport, largely because of its commitment to the European Union's energy and climate policies.

As a point of improvement, the industrial sector stands out due to the absence of major incentives for energy efficiency and energy management in this area of the French economy. Another point in need of evolution is the transport sector, due to the high energy intensity of the movement of goods and the low investment in railways as compared to roads.

FRANCE, #4

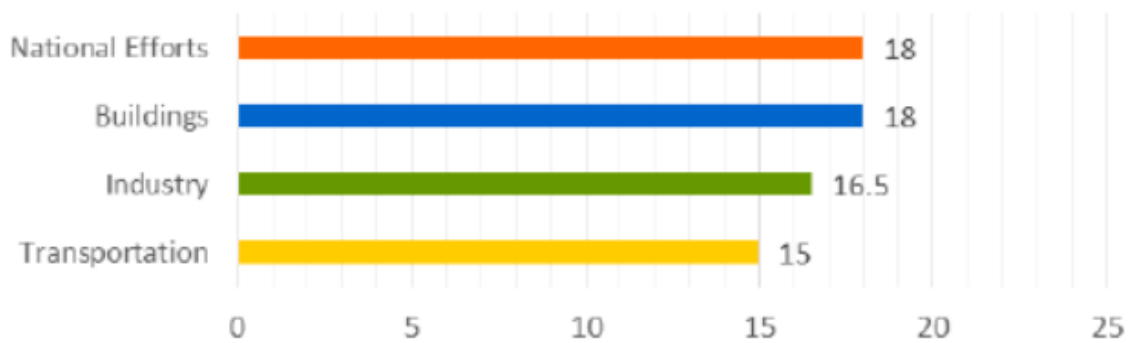


Figure 9 – France scores. Source: ACEEE (2016).

Finally, India totaled 48.5 points out of 100 possible. As a positive point, the transport sector is highlighted, driven by the high 65% percentage of passenger travel done by public transport, even though the level of investments in railways is considered only moderate. Thus India's success in the transportation sector can be credited to the status of its economy, not its efforts to reduce energy consumption.

On the points for improvement, India still needs to evolve a lot in the national efforts. The country's thermal plants have very low operating efficiency due to the aging of the energy production park. Greater investment in energy efficiency is needed as well as research and development so that India in fact demonstrates interest in improving its indicators.

Another area to improve is the building sector, highlighting the need to strengthen their voluntary energy codes for residential and commercial buildings by adding requirements for existing residential and commercial buildings. In addition, India has equipment and equipment standards for only seven products.

Finally, the industrial sector lacks a serious incentive program to improve its energy performance.

INDIA, #14

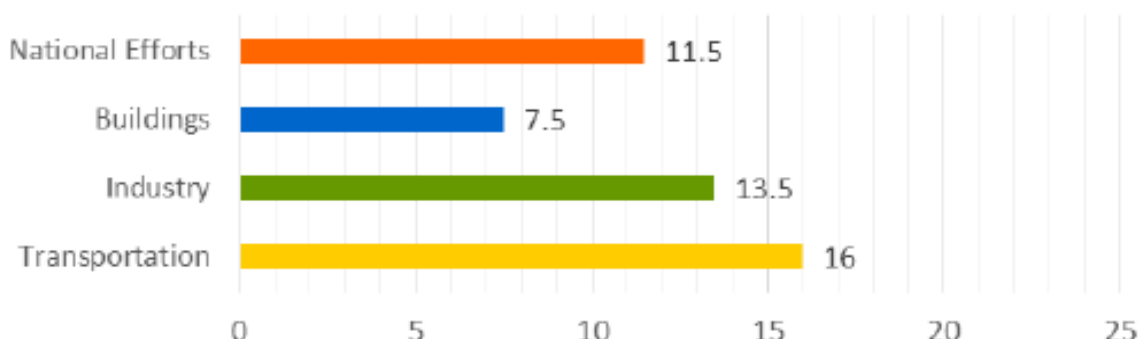


Figure 10 – India Scores. Source: ACEEE (2016).

5. Conclusions

In this article, it has become clear that government incentives and legislation focused on energy efficiency and energy management are more effective in inducing a greater number of ISO 50001 certifications in a given country. National efforts, such as Germany and regional, with the European Union as a great example, create a favorable environment in the countries for the emergence of incentive programs, targets for reducing environmental impacts and energy intensity, and actions of the initiative Private partnerships that contribute to the increase in the number of certifications.

It was possible to verify that government engagement is capable of overcoming even an environment of energy price reduction, causing organizations and individuals to become interested in ISO 50001 certification even in the face of a scenario of falling energy as a cost item in their Budgets.

However, the economic benefits obtained through the implementation of energy efficiency and energy management actions bring greater competitiveness to certified organizations in their respective markets. Such benefits still continue to internally influence the engagement of such organizations in certifiable energy efficiency and energy management programs.

Other internal aspects end up inducing the certifications of some organizations such as the possibility of linking their image in the market to the engagement in environmental and energy management issues, increasing their market value through this strategy. This aspect is explored in PHAN (2015).

In this respect, it should be emphasized that the present article focused on the analysis of the external environment to the organizations and their influence on the number of certifications of each country. Thus, there is much room for future work that investigates the pre-existence of an internal environment favorable to this type of certification, as explored in JOCHEM (2015).

At the national level, it was evident from the research carried out that countries engaged in energy management policies reap short and medium term benefits in order to increase the competitiveness of their industries and control the demand for energy.

These benefits reinforce the importance of governments' actions in energy management and international cooperation efforts and agreements in the sector.

Other evidence of prominence in this article is the leading role of the industrial areas in terms of engagement in ISO 50001 certifications, both in terms of the existence of greater savings opportunities and in the fact that the organizations are certified in search of greater market value.

Finally, international benchmarking, such as the annual ACEEE and ISO Survey studies, are a good starting point for countries to evaluate their policies to encourage certification and other energy efficiency and management programs power. Such an assessment can both engage countries that traditionally do not have major incentives in these areas and have the best-evaluated countries continue to improve their existing policies.

As an example of the effects of these international comparisons, we note the recent joint effort of the North American, Canadian, Mexican and United States countries announcing the involvement of nine companies in the North American Energy Management Pilot Program to promote implementation Of ISO 50001. The companies involved, namely: 3M, ArcelorMittal, BMW, Cargill, Cummins, Ingersoll Rand, Polymer Intertape Group, New Gold and Titan America, will receive training and technical assistance to obtain certification.

The Pilot Program was the result of cooperation between the energy efficiency agencies of the three countries, and the number of ISO 50001 certifications of the North American region will certainly contribute to the upcoming surveys.

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