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Energy efficiency and use of renewable solutions of small and medium enterprises

***Abstract**. Increasing energy efficiency and the development of renewable energy resources has a positive impact on economic growth. Energy efficiency offers a powerful and cost-effective tool for achieving a sustainable energy future and it can actually be pursued by a virtuous combination of a wide range of initiatives involving a growing number of public organisations together with service and industrial companies. This article summarizes a part of the work within the CO-EFFICIENT project and highlights the main methodologies and approaches for evaluating energy efficiency, its improvement and use of renewable resources. The project will also assist small and medium enterprises with limited R&D capacities and develop customized energy efficiency solutions.*

***Streszczenie.** Wzrastająca sprawność energetyczna i rozwój odnawialnych źródeł energii mają pozytywny wpływ na wzrost gospodarczy. Jakość energii oferuje efektywne narzędzie w osiąganiu zrównoważonej energetycznie przyszłości a to może być wykonane przez wirtualna kombinacje wielu inicjatyw, włączających wzrastającą liczbę organizacji publicznych razem z usługowymi I producyjnymi podmiotami gospodarczymi. Artykuł podsumowuje część prac wykonanych w ramach projektu COEFFICIENT i podkreśla główne metodologie i podejścia dla oceny sprawności energii, jej polepszania oraz użycia źródeł odnawialnych. Wspomniany projekt asystuje również małym I średnim przedsiębiorstwom z ograniczoną bazą naukowo-badawczą oraz rozwija rozwiązania sprawności energetycznej.(**Sprawność energetyczna i użycie źródeł odnawialnych w małych I średnich przedsiębiorstwach**)*

Keywords: energy efficiency, energy audit, renewable solutions, small and medium enterprises**.**
Słowa kluczowe: sprawność energetyczna, audit energetyczny, źródła odnawialne, małe i średnie przedsiębiorstwa

Introduction

The purpose of CO-EFFICIENT project is to set-up a permanent collaborative framework for energy efficiency innovation in operations and production processes of small and medium enterprises (SMEs). The project will also assist SMEs with limited R&D capacities and develop customized energy efficiency solutions. Collaboration between SMEs will be strengthened. Innovative technologies will be promoted. The aim of the project is to demonstrate how to achieve a significant change as the sum of small savings by a large number of SMEs in their daily activities as members of supply chains.

One of the main objectives of CO-EFFICIENT project is the identification of Energy Service Companies (ESCO's) and energy consulting companies (on national level) and their advisory services. The emphasis is done on the main methodologies, approaches and tools used by ESCO's and energy consulting companies for evaluating energy efficiency, its improvement and use of renewable resources in production and operations. Energy efficiency can actually be pursued by a virtuous combination of a wide range of initiatives involving a growing number of public organisations together with service and industrial companies. The CO-EFFICIENT project proposes a classification grid that is useful for establishment of a common understanding of the problem and to drive analysis and characterisation of the ESCO's and energy consulting companies [1].

Approaches and tools for evaluating energy efficiency

In this section the main methodologies and approaches for evaluating energy efficiency, its improvement and use of renewable resources are described. Each of the companies acting in the energy efficiency field adopts and develops one or more of the following basic approaches [1]:

- Awareness: This approach deals with informing the energy consumer company about its present efficiency level and the technical, organisational and financial opportunities that are available to reduce consumes and optimise resources.
- Management: This approach deals with supporting the energy consumer in the daily activities that are required to use energy at best by applying the established policy often derived from previous awareness-increasing activities.
- Renovation: This approach deals with addressing the energy consumer to improve its energy-fed devices and plants by taking advantage of new technologies thus applying the knowledge coming from awareness-increasing activities.

Going deeper into the classification of the energy efficiency sector, it can be easily shown that the development of every approach implies the execution of a number of interrelated activities forming classes of operational functions. By analogy with the terminology of the object-oriented paradigm, an activity class can be named “method” or “methodology” to emphasise its role in the implementation of the related approach. Table 1 summarises the main and most widespread methodologies realising the above-mentioned approaches.

Table 1: The main approaches and associated methodologies

Approach	Methodology
Awareness	Energy audit, Energy consulting
Management	Energy management, Energy contracting
Renovation	Energy restoration, Engineering and control

It is worth observing that, depending on objective conditions, these activities can be performed internally by the energy consumer company or provided as services by external companies. In fact, many large energy consumer companies are endowed with resources and skills to carry out internally the devised activities, while smaller companies are normally forced to search for external support at specialised service companies.

A relevant example of external service company is the so-called Energy Service Company or ESCO whose mission is replacing the energy consumer company in the role of energy management for some years. After an initial awareness-raising analysis, the ESCO invests in renovation and optimised management, and creates revenues from the difference between the previous energy cost and the obtained savings.

The energy performance of buildings has become increasingly important in the general strive to reduce the overall energy use, which is manifested in the Energy Performance of Buildings Directive launched by the European Union. An important first step is of course to identify and address buildings that have an energy saving potential. In order to achieve this goal, robust methods for evaluation as well as reliable energy key figures are needed and these methods and energy key figures must probably also be adapted to the different prerequisites in different EU-countries. For finding energy key figures of a building, there are a number of different approaches. These approaches could be categorized according to primary reliance on: design data, data from short/long-term in situ measurements and aggregated consumption data, such as utility bills, meter readings and building energy management systems (BEMS) [1].

There are many different tools that ESCO's and energy consulting companies use to evaluate energy efficiency of a building, to evaluate the energy consumption or to evaluate measures for energy rehabilitation, before actually implementing them on a real building. Generally speaking, each of the companies acting in the energy efficiency field adopts and develops on one or more of the following basic tools for evaluating energy efficiency and energy savings:

- Questionnaires and surveys: ESCO's and energy consulting companies use online surveys, which can be free or they can charge you a small fee to see the result. Surveys are very useful because they reach a big number of customers; they take a short amount of time and give automatic results. In this way companies are informed about current condition of the building, furthermore on the basis of this results they can prepare a report about energy restoration and tips to reduce energy consumption. An Example of a questionnaire for energy consumption analysis is shown in Appendix A.
- Energy savings calculators: Energy savings calculators give you an approximate cost savings for home energy efficiency improvements and energy efficient home appliances.
- Brochures: Brochures are intended for customers to inform and advise them on different possibilities for efficient use of energy, renewable energy sources and reducing energy consumption. Brochures also inform customers about different products that ESCO's and energy consulting companies offer to their clients.
- Computer software: There is a large number of different computer software. CAE and CAD computer programs are useful because different measures that will be taken in the process of energy rehabilitation of a facility can be simulated. Therefore, a provider can decide, which is the best solution, for their customer. Other software programs can calculate the optimal thickness of the building envelope, proper roof insulation, heat transfer through windows, total energy consumption, insulation of thermal bridges and many more.
- Thermographic camera: A thermographic camera or infrared camera is a device that forms an image using infrared radiation. With this camera an image is formed where the actual temperatures of the building are seen or can be obtained with compatible computer software. Such an image tells an ESCO or energy consulting company where the most of heat energy is lost and where the temperature bridges are. According to this image, companies can decide and advise customers on the best possible solution for energy rehabilitation and reducing heat energy consumption.

In next section the analysis of a sufficiently large number of ESCO's and energy consulting companies is presented. The overall analysis was made on a total of 96 ESCO's and energy consulting companies and has shown many similarities between these companies.

The results of the overall analysis of ESCO's and energy consulting companies

The analysis was done over the whole examination. The analysis derives general indications from the data collected by all partners. The collected data were analysed for all participating countries (Slovenia, Italy, Spain, Croatia and France) and regions. This section presents an analysis for each activity separately. The analysis derives general indications from the data collected by all partners in each country.

The analysis of companies was made in five countries (Slovenia, Italy, Spain, Croatia and France), so on the pie chart below, 20% belongs to each country. Figures 1-3 are showing a graphical presentation of ESCO's and energy consulting companies that perform energy audits in public, industry and service sector.

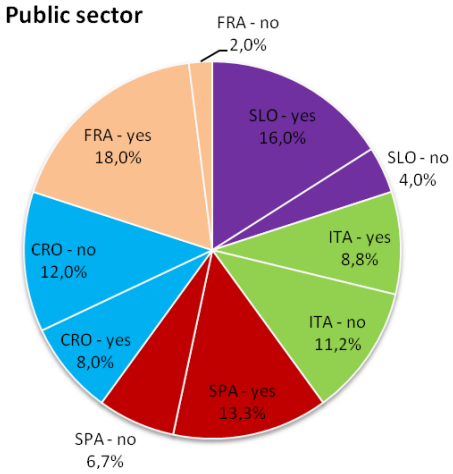

Fig 1: ESCO's and energy consulting companies that perform energy audits in public sector.

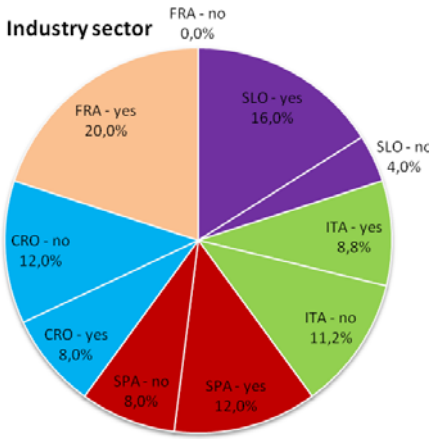

Fig 2: ESCO's and energy consulting companies that perform energy audits in industry sector.

More than half of analysed ESCO's and energy consulting companies in Slovenia, Spain and France are performing energy audits in public, industry and service sector. The implementation of energy audits by analysed companies in Italy and Croatia are not so common than in companies of other countries. Figure 4 and figure 5 are

showing a graphical presentation of ESCO's and energy consulting companies that perform energy consulting and energy restoration. Energy consulting has the highest percentage value in relation to other activities. The percentage of companies that are performing energy restoration is below 50% in Slovenia, Italy and France. Larger number of companies that perform this kind of activity are in Spain and Croatia [1].

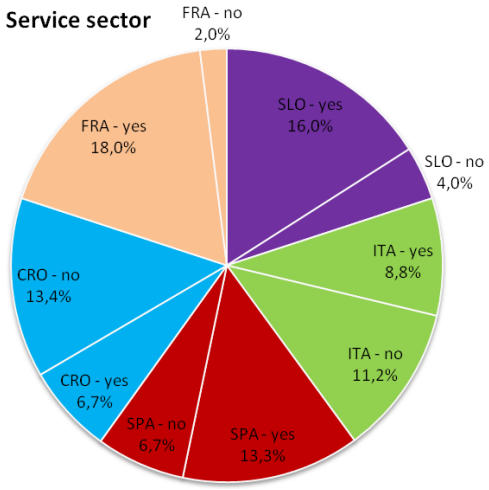

Fig 3: ESCO's and energy consulting companies that perform energy audits in service sector.

The same is with the implementation of energy management and energy contracting. Less than half of analysed companies in Croatia and France are implementing energy management, and approximately half of analysed companies in Spain, Italy and Slovenia. Less than half of analysed companies in Slovenia and Italy are implementing energy contracting, and more than half of analysed companies in Spain, Croatia and France. Figure 7 and figure 8 are showing a graphical presentation of ESCO's and energy consulting companies that perform energy management and energy contracting.

In France, the significance of energy audit and counseling tasks is not the same for big and small and medium enterprise, since, where big companies are concerned, those two tasks are not something strictly separated from the other tasks, but rather a necessary preliminary phase to the following services that will be the heart of their work, while, concerning the smaller ESCO, audit and counseling represent the core of their work

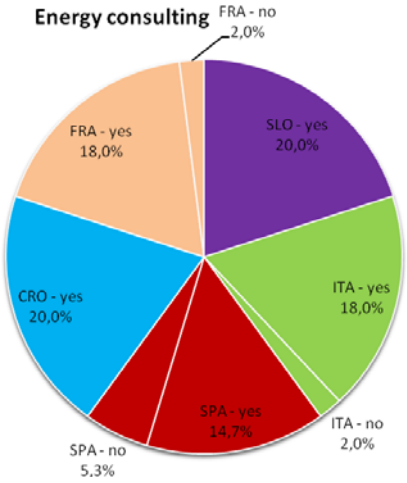

Fig 4: ESCO's and energy consulting companies that perform energy consulting.

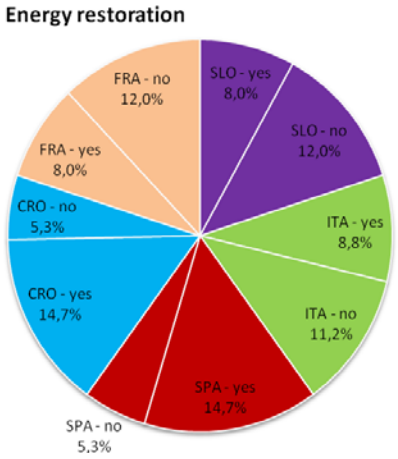

Fig 5: ESCO's and energy consulting companies that perform energy restoration.

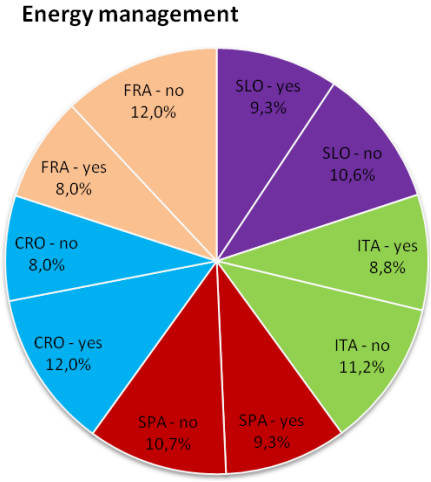

Fig 6: ESCO's and energy consulting companies that perform energy management.

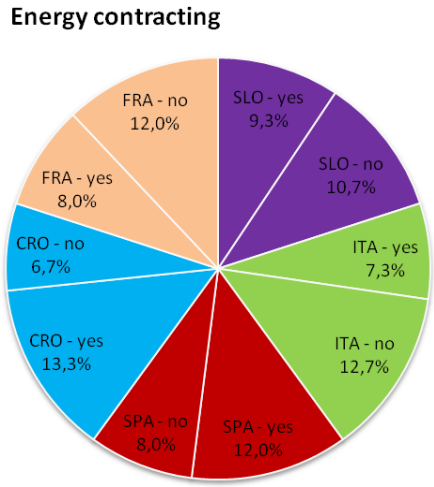

Fig 7: ESCO's and energy consulting companies that perform energy contracting.

The implementation of engineering and control also has a bigger percentage value than other activities. Most of analysed companies are performing engineering and control. Figure 8 is showing a graphical presentation of ESCO's and energy consulting companies that perform engineering and control.

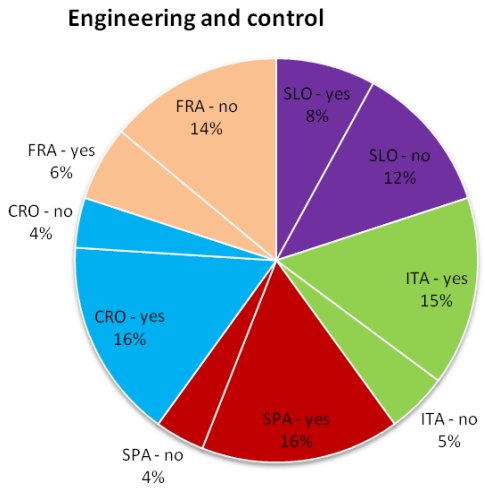

Fig 8: ESCO's and energy consulting companies that perform engineering and control.

Conclusion

Most of the analysed companies are using similar methodologies, approaches and tools for energy efficiency improvement and use of renewable resources in production and operations, depending on the size of the company and its location. Some of the analysed ESCO's and energy consulting companies indicated that are using their own tools while working with energy efficiency. The most common activity that companies offer is energy consulting. The percentage of companies that perform energy consulting is similar in all countries. In addition, the implementation of engineering and control has a bigger percentage value than other activities.

The analysis has shown that the implementation of energy management, energy restoration and energy contracting activities by ESCO's and energy consulting companies is not so common. As mentioned before energy efficiency can be pursued by a virtuous combination of activities. All the activities that are being left out by ESCO's and energy consulting companies are equally important for evaluating energy efficiency and its improvement. For optimal evaluation of energy efficiency it would be recommended that ESCO's and energy consulting companies include such activities in their business offer.

Energy efficiency can actually be pursued by a virtuous combination of a wide range of initiatives involving a growing number of public organisations together with service and industrial companies. Small and medium companies are slow to adopt energy efficient solutions especially if compared to large companies. One of the problems is that there is not enough communication and coordination between the R&D sector and SME systems, which evidently prevents technology and know-how transfer. Consequently, the development of a frame of reference for energy efficiency and use of renewable resources in production and operations is required. It will support SMEs in the identification of key production processes and operations that could be improved as far as energy efficiency or the use of renewable resources is concerned.

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