Paper accepted for presentation at 2009 IEEE Bucharest Power Tech Conference, June 28th - July 2nd, Bucharest, Romania

Energy Services as a tool to promote energy efficiency in the Health Sector

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***Abstract*-- This work presents the results and conclusions of a survey of energy efficiency practice in the health sector carried out in Portugal. According to the survey in most situations there is the interest and willingness for improving energy efficiency in the hospitals and health centers, but in many facilities the daily practice is really far from a rational behavior regarding the efficient use of energy.**

The results of the survey show that there are some effective organizational barriers to the dissemination of energy efficiency: despite costs, in general, are a concern of management, the costs with energy are many times viewed as a fixed cost to be paid without being questioned; knowledge and expertise about energy efficiency cost money and despite the potential savings, investing in energy efficiency is seen by the management board as an extra cost which associated with budget constraints contributes for a low level of commitment with efficiency; there is no current practice in making the employees' part of the equation promoting energy efficiency; most times people care about the efficacy of the equipment but do not care about its efficiency. The survey also showed that there is the potential for promoting energy efficiency in the sector

***Index Terms*-- Energy efficiency, ESCOs, Energy services.**

I. Introduction

There are some issues making hard the promotion and the dissemination of energy efficiency in the buildings sector and in particularly in public buildings sector. Different studies show that there are many situations in which cost-effective energy efficient measures are not implemented [1][5]. Some causes/ barriers are usually identified for such difference between the opportunities for effective investment in energy efficiency and the levels of actual investment in practice- the so called energy efficiency gap. Lack of information, budget constraints or organizational behavior are some of the barriers usually identified as obstacles to higher dissemination of efficient use of energy [2][3][4][10][11]. Besides, there are some current practices inside organizations worsening the situation. For instance, the separation of budgets for acquiring equipment and for using equipment makes it difficult to invest in new energy efficient equipment. Also, in buildings, in general, if who buys the equipment is not who uses it or if who pay the energy bills is not who uses energy services, becomes harder to deeper disseminate energy efficiency, because the correct stimulus for being efficient does not exist. Also, aspects related with the behavior of people using energy services [8][11][12][13], or aspects related with the "behavior of hospitals" while organizations not providing information and training for energy efficiency to their employees or while organizations not continually advocating for the importance of energy efficiency in the organization may also prevent improvements in energy efficiency. And many times in this kind of organizations energy costs are often viewed as a fixed cost to be paid and not as a possible opportunity to save money in the immediate or near future by using energy more efficiently. Small budgets do not allow investing in some energy efficient measures because the payback period may not be attractive for management board more interested in "good financial results" and when competing with other "more interesting" goals, energy efficiency looses. Usually administrators have to manage tight budgets and despite the potential of the energy efficiency for reducing energy bills, efficiency is not a top issue and the decision-makers are more concerned with many other issues, thus revealing a lack of understanding the opportunities that energy efficiency offers as a tool for reducing costs. Very often, when major energy policies are at stake, the public sector in general is viewed as a target that should behave like a model in regarding those policies and should be leader by example. Again, according to the EU 2006/32/CE [7] directive on energy efficiency and energy services public sector should play an exemplary role in the context of the directive. However, there is a long way to go through yet.

This paper presents the main results of a study carried out in 2007 [9] in the health sector in Portugal aimed at to characterize some aspects of the current energy management practice and to identify eventual barriers to energy efficiency in the sector. The study also aimed to identify tools that could be used to overcome or, at least, reduce those barriers in the sector, and also to assess the awareness for the usefulness and the need of energy services as tool to disseminate energy efficiency.

The paper is organized as follows. In section II a brief overview of the healthcare sector in Portugal is presented. Follows some results of the study carried out in section III, while in section IV some conclusions are drawn.

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978-1-4244-2235-7/09/$25.00 ©2009 IEEE

II. Brief Overview of the Sector

The health sector is a highly diversified sector in terms of activities developed and in terms of size of facilities, ranging from large central hospitals to very small clinics. In 2007 there existed 198 hospitals, about 400 health centers and a very large number of other small health units. This study focused only in hospitals and clinics since empirical evidence shows that technical and economic savings in those buildings is higher. The analysis is done separately once the size and some electrical characteristics of hospitals and clinics are really different (Table I). A first conclusion to be drawn from this study is that it is not easy to get data on total or specific energy consumption in the healthcare sector in Portugal. There is not a systematic and detailed collection and analysis of data about energy consumption and energy costs in this sector. However, the detailed knowledge about the energy consumption is the first step towards an efficient use of energy.

TABLE I
SOME CHARACTERISTICS OF HOSPITALS AND CLINICS,

	Average contracted power (kW)	Average electricity monthly consumption (kWh)	Yearly average number of patients getting treatment
Hospitals	653	1 077 332	73 418
Clinics	16	17 107	3 922

The total energy consumption in the services sector in Portugal in 2006 was 2264 ktoe which is about 13% of total energy consumption, while electricity consumption in the services sector is about 33% of total electricity consumption. In the healthcare sector, energy consumption (73,3 ktoe) represents about 3,3% of the services sector total energy consumption. Between 2002 and 2006 natural gas consumption increased 56% while electricity consumption increased 29% (Table II). In 2006 the electricity consumption in hospitals was about 396 210 MWh, resulting in average consumptions of 11,8 MWh per bed per year and about 42,6 kWh per day of patient stay per year.

TABLE II
FINAL ENERGY CONSUMPTION IN THE HEALTH CARE SECTOR (TOE).

	Data sources	2002	2003	2004	2005	2006	Variation
Natural Gas	DGEG	19753	22742	23485	25668	30797	55.9%
Electricity	EDP	32938	35174	38098	40850	42484	29.0%
Total final energy consumption		52691	57916	61583	66518	73281	39.1%

DGEG - General Directorate of Energy
EDP - portuguese electric utility

III. Some Results of the Survey

This study focused on the hospitals (185 hospitals were targeted for study) and on the clinics sub-sector, and was an attempt to get information about both the current energy management practice and the receptiveness for energy services. The questionnaire used to collect data was divided into three parts. Part A was about the present situation in terms of energy consumption and costs, contracted power, current energy management practice and information about electric maintenance. Part B was focused on the characterization of the receptiveness for energy services aiming at identifying most attractive energy services and the existence of eventual barriers to an efficient use of energy. Part C attempted to identify possible scenarios and tools to be used in the promotion of energy efficiency. The survey response rate was about five percent, after the outliers have been removed. Some of the reasons why the responses were cleaned up were the size (too big/small energy consumption and/or too big contracted power when compared with the average) and a high number of answers missing in the questionnaire.

Some of the results obtained with the survey are presented now. In about 60%(60%) of hospitals (clinics) there is not an energy manager and in the last two years it was not carried out any characterization of energy consumption or energy audit in 70% (100%) of the hospitals (clinics). Being the knowledge about consumption characteristics (different forms of energy, shape and patterns, major consumers –equipment and subsector-) essential for promoting efficiency, the absence of energy audits is not a good indicator about the energy efficiency practice. Moreover, in most facilities there is not an energy manager. In 90% of hospitals (64% for clinics) there is no training or information provided to employees about efficient use of energy – behaviour and best practice. These results are interesting since the responses to the questions about current practice show a low level of commitment with energy efficiency, however the responses shown in Table III also indicates an high level of willingness about the need for a more efficient use of energy and a high level of receptivity to energy services related with energy efficiency. For instance, despite it is not a current practice provide information/training to the employees, most of hospitals (80%) are interested in this kind of service, if it is provided by an external entity (only 10% of clinics are interested in such services). Most hospitals and clinics, when buying new equipment always use the criteria “energy performance” in the decision process (Fig. 1).

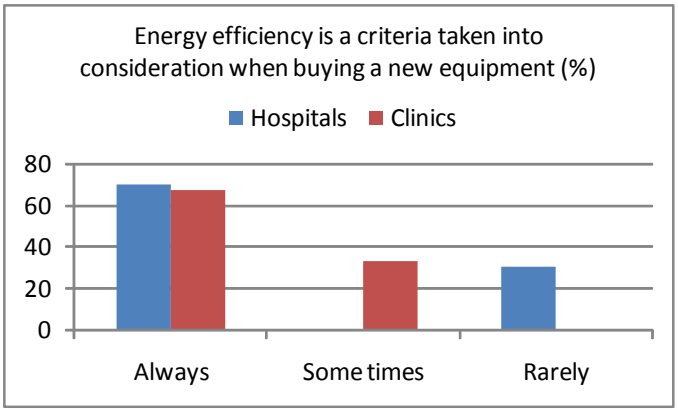

Fig. 1. Using energy efficiency as a criterion when buying new equipment.

However, for 89% of hospitals the most important characteristic to take into consideration when buying the

equipment is the performance on the task to be carried out by the equipment. This is the major concern for about 50% of clinics (Fig. 2)

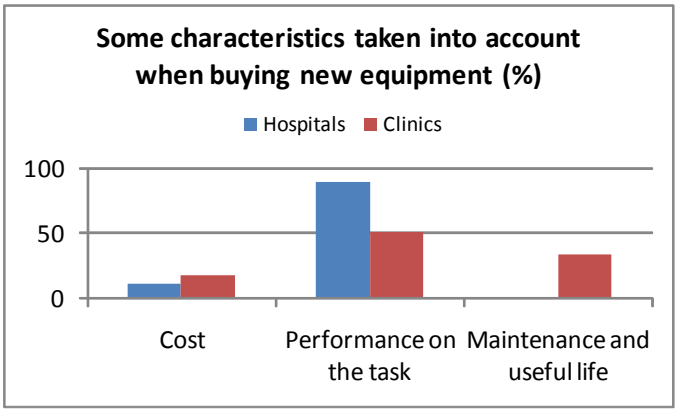

Fig. 2. Characteristics of equipment taken into consideration in the acquisition process.

About 62% of hospitals carried out a life cycle analysis when, in the acquisition process, they have to chose among different equipment costing different amount of money. This analysis is carried out in about 40% of clinics. When buying new equipment, the entities ask for information about the technical characteristics of the equipment, and most of them said it is easy to find such information, namely with the supplier (Fig. 3). Most of times is the supplier who provides information about the equipment (Fig. 4).

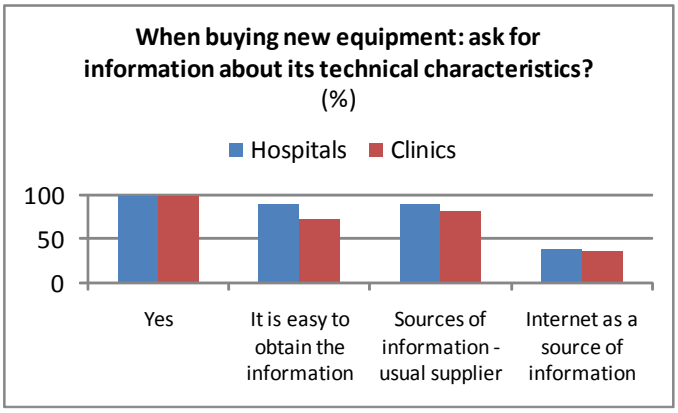

Fig. 3. Searching for information when buying new equipment.

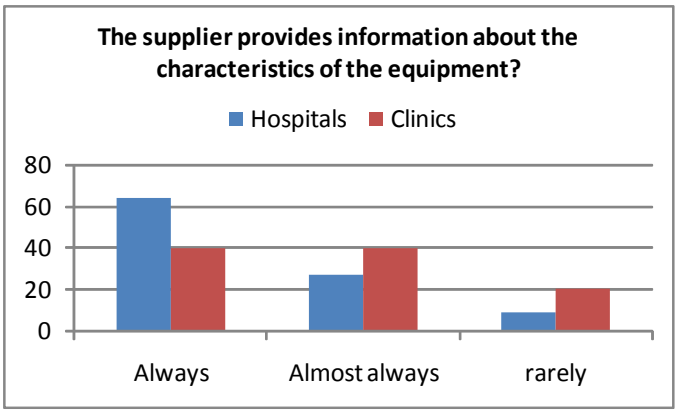

Fig. 4. Supplier providing information about the equipment.

Typically the more efficient equipment is seen as a more expensive equipment (Fig. 5).

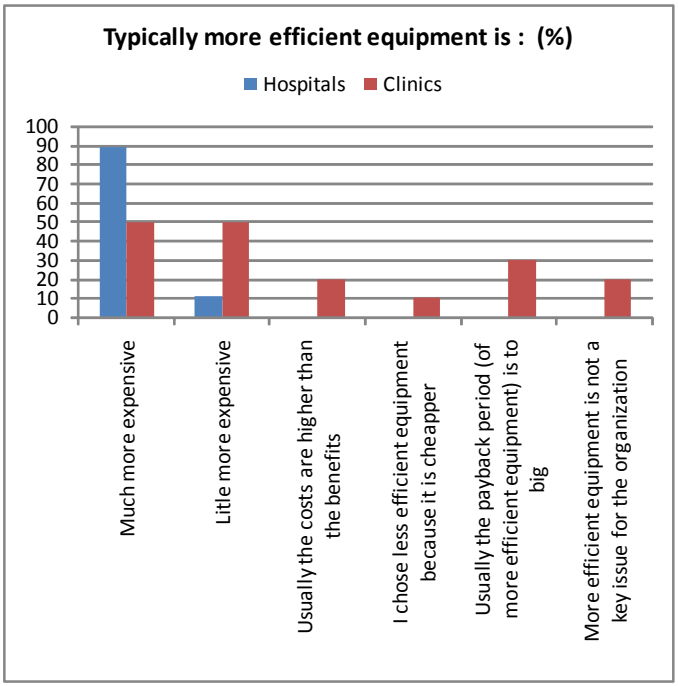

Fig. 5. Characteristics of more efficient equipment.

According to the results of the survey, in all hospitals there are some maintenance tasks carried out frequently, while there is some kind of maintenance process implemented only in 18% of clinics. On the other hand in about 56% (10%) of hospitals (clinics) there is already some kind of specific energy management systems, such lighting control. What about the receptiveness and interest in energy services? It seems there is a high degree of interest in some energy services.

As already referred to above, most hospitals are interested in buying training about energy efficiency to their employees. About 82% of hospitals (73% of clinics) are interested in energy audits (despite most of them did not carried out a energy audit in the last years). And 73% of hospitals (64% of clinics) are interested in energy management systems, while 70% of hospitals (55% of clinics) are interested in services aiming at improving the quality of energy. The consultancy on energy management and efficiency is appreciated by 91% of hospitals (82% of clinics), while 82% of hospitals (100% of clinics) are interested in analyzing alternatives to purchase energy (Table III). Also interesting are the measures related with optimization of energy usage that these entities point out as attractive measures (Table IV). There are some specific measures that seem very attractive for hospitals. Thus, specific energy management systems are referred to by 90% of hospitals, follows energetic rehabilitation of buildings (70%) and maintenance (60%). For clinics, the most attractive measures are the designing and assessment of energy management programs (80%), the power factor compensation (71%), and the energetic rehabilitation of buildings and

specific energy management systems (57%).

TABLE III
INTERESTING MEASURES ACCORDING TO THE HOSPITALS/ CLINICS.

HOSPITALS	YES	NO
Energy use characterization (energy audits)	81,8%	18,2%
Energy management systems ?	72,7%	27,3%
Training for energy efficiency to employees?	80,0%	20,0%
Services for energy quality?	70,0%	30,0%
It is important to have only one bill (electricity, gas, …)?	36,4%	63,6%
Advise on alternatives to purchase energy?	81,8%	18,2%
Consultancy on energy management and energy efficiency?	90,9%	9,1%
CLINICS	**YES**	**NO**
Energy use characterization (energy audits)	72,7%	27,3%
Energy management systems ?	63,6%	36,4%
Training for energy efficiency to employees?	10,0%	90,0%
Services for energy quality?	54,5%	45,5%
It is important to have only one bill (electricity, gas, …)?	45,5%	54,5%
Advise on alternatives to purchase energy?	100,0%	0,0%
Consultancy on energy management and energy efficiency?	81,8%	18,2%

TABLE IV
SOLUTIONS FOR ENERGY OPTIMIZATION

Estaria interessado em Soluções de Optimização Energética?	Energetic rehabilitation of buildings	Dedicated energy management	Power factor compensation	Maintenance : power transformers and electrical instalations	Designing and assessing the implementation of energy management programs
HOSPITALS	70,0%	90,0%	40,0%	60,0%	50,0%
CLINICS	57,1%	57,1%	71,4%	42,9%	85,7%

The survey also revealed that under certain circumstances hospitals are willing to switch from energy supplier. For instance, about 91% of customers (hospitals) could change if electricity costs are lower; 27% change if consultancy in energy management is provided; 46% could change if some payment alternatives/facilities are provided. Clinics probably switch from supplier if prices are lower (100%), if energy services are made available (64%) (Fig. 6).

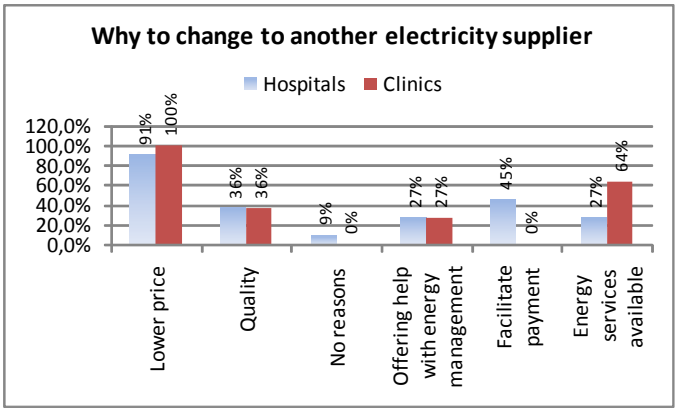

Fig. 6. Reasons to switch from electricity supplier.

Apparently there is some knowledge about ESCOs, and in about 55% oh hospitals an ESCO has already established some kind of contact (Fig. 7).

These results are interesting since 100% of respondents agree that some entity able to provide energy efficiency services should exist. But at the same time there are some reservations about the implementation of measures and about possible energy audits/services at no cost for consumer. In the Fig. 8 the answers for the question: "If an ESCO give the possibility of doing an energy audit at no direct cost for your organization, being paid by the savings achieved through the implementation of some measures that had been identified during the energy audit, what did you do?" are shown.

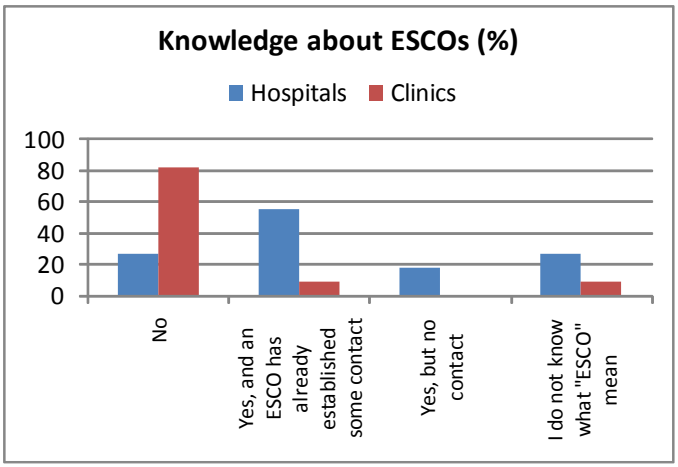

Fig. 7. Knowledge about ESCOs.

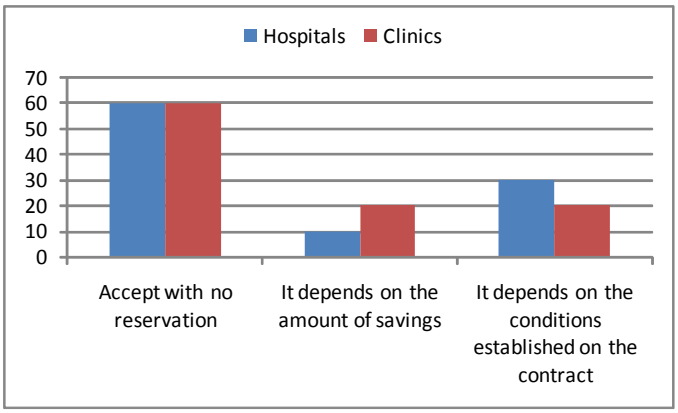

Fig. 8. Energy audits at no direct cost for consumer.

All the respondents said they would implement all the measures identified during an energy audit if they cost no money. Also interesting is the payback period that is considered acceptable (Fig. 9). For most hospitals (82%) a payback up to years is satisfactory, while for most clinics (78%) an acceptable payback should be less than one year.

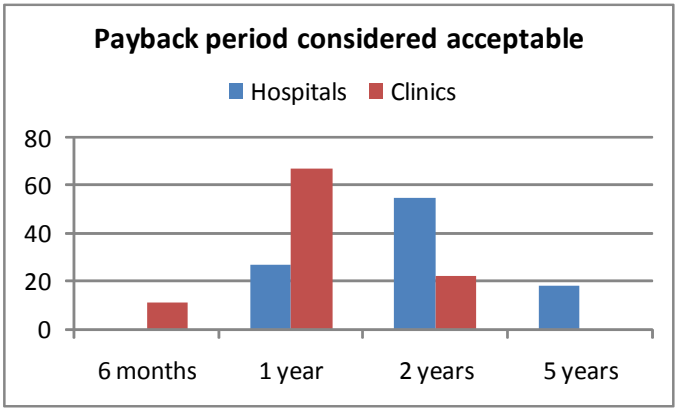

Fig. 9. Acceptable payback period.

In conclusion we can say that the survey revealed that energy issues (consumption, costs and quality) are in the top concerning of management board; there is a strong willingness and receptivity to energy services, despite some basic activities, like energy audits, are not included in the current practice.

IV. Conclusions

The survey, carried out in the health care sector in Portugal, revealed that some barriers to the dissemination of energy efficiency do exist, but it also showed that there is the potential for promoting energy efficiency in the sector. The willingness and the receptiveness to energy services are huge and energy services provided by ESCOs can play an important role in delivering energy efficiency to hospitals.

It seems that most energy efficiency actions in which hospitals are interested seem suitable for being provided by energy services companies (ESCOs). This in accordance with the EU Directive on Energy Efficiency and Energy Services that estimated potential of energy savings in EU is about 20%, indicating some energy savings potential can be realized through energy services. There are already some ESCOs acting in Portugal, so the question is why there is not higher involvement of ESCOs with energy management in hospitals? It seems ESCOs needs to be tuned to the hospitals needs in the sense that services provided by ESCOs need to be tailored according to specific needs of hospitals. This way ESCOs can play a very important role in overcoming some of the barriers to a higher penetration of energy efficiency in the health sector.

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VI. Biographies

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