Energy Monitoring and Management Methodology for the Banking Sector
Portuguese Case Study

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Keywords: Energy Efficiency, Smart Buildings, Monitoring & Control.

Abstract: This paper addresses the problem of the worldwide electricity consumption increase, namely in the building sector, with the focus on the office (banking) market segment. Buildings are dynamic entities, with constantly changing needs and occupancy. An energy audit shows only a snapshot of the building profile because it is driven at a specific time, and utility bills can be viewed as “rear-view mirror” since they only show past consumptions and not real-time consumptions. In this way, this paper presents an energy monitoring and remote management methodology for the banking sector and the case study accomplished in one of the most well established Portuguese banks. The presented methodology reached measured annual savings of 18,5% of the total consumption of the 19 central buildings and the 358 branches involved in the project.

1 INTRODUCTION

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was an environmental treaty with the goal of preventing "dangerous" anthropogenic (i.e., human-induced) interference of the climate system. As part of the Kyoto Protocol, many developed countries agreed to legally binding limitations/reductions in their emissions of greenhouse gases (Walker et al., 2007).

Cities play a crucial role in sustainable development. According to the United Nations, global population will reach 9 billion in 2050, of which majority will live in cities. The majority of European cities have already been acting to increase their energy efficiency. Continuing improvements will require strong actions, in particular through improving the existing building stock.

According to IEA’s World Energy Outlook 2008, 67% of global energy is used in urban areas, and cities are responsible for 76% of energy related CO2 emissions. Furthermore, cities play an essential part in sustainable development; with UN estimates of global population reaching 9 billion from 2050, of which the majority will live in urban areas. The majority of European cities have already been acting to raise their energy efficiency. Ongoing developments will require solid actions, in particular through tracking the current building stock (International Energy Agency, 2008).

According to Eurostat, the annual energy consumption in EU27 countries is about 3 400 TWh of electricity and 2 600 000 TJ of heat. Of these, about 25% of electricity and 10% of heat is consumed in the Commercial and Public Service sector, mostly in buildings (Eurostat, 2009). A saving potential estimated in nearly 28% of Europe’s total energy consumption has been recognized as being accessible through increasing in energy efficiency (Eurostat, 2009). The European Union has specified that Public Building must lead the way in cultivating energy efficiency habits which have an unquestionable role in motivating savings.

Bank facilities – both buildings and branches – are nowadays subject to intense energy usage, because they operate many hours a day, and include an increasing number of equipment and systems. Bank branches can be responsible for up to 50% of total consumption in a retail bank since they are attended by multiple users, with different habits and customs, different terms of services in facilities and inefficient behaviors in energy usage users (characteristic user that don’t pay the electricity bill) (Evo-world).

M. Carreiro A., Estima J. and Bernardes A..
Energy Monitoring and Management Methodology for the Banking Sector - Portuguese Case Study.
DOI: 10.5220/0004860501570162
In *Proceedings of the 3rd International Conference on Smart Grids and Green IT Systems* (SMARTGREENS-2014), pages 157-162
ISBN: 978-989-758-025-3

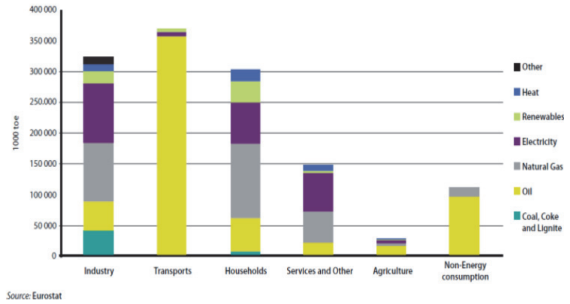

Figure 1: Europe’s energy consumption by fuel and end-use sector (CEC, 2010).

Banks can seek in this reality an opportunity to reduce thei0r energy consumptions and respective costs. Advanced metering and management solutions can enable banks to identify energy, cost and carbon savings by providing detailed information about the way in which they use their energy.

In this way, and under a policy of continual sustainability, was designed a project and developed a real-time energy monitoring and management methodology for an international Portuguese bank, which covered 19 buildings and 358 selected branches in a total of 830 facilities. The main objectives were:

- Reduce energy consumption in office buildings and branches;
- Centralize the energy management information;
- Introduce and establish policies of energy consumption;
- Change employees behavior for proper use of energy resources at their disposal;

This paper will present in section 2, the global architecture, the energy monitoring and management solution developed for the banking sector. In section 3 will be presented the methodology of the project, following by the section 4 where will be presented the case study results, and finally in section 5 the main conclusions.

2 GLOBAL ARCHITECTURE

This section will show the global solution architecture, as well as, the main components that constitute, as can be seen in Figure 2 and 3. This solution methodology allows gathering detailed information, realize where energy is being consumed (remotely and in real time), and identify anomalous situations of energy consumption is shown in the figure below:

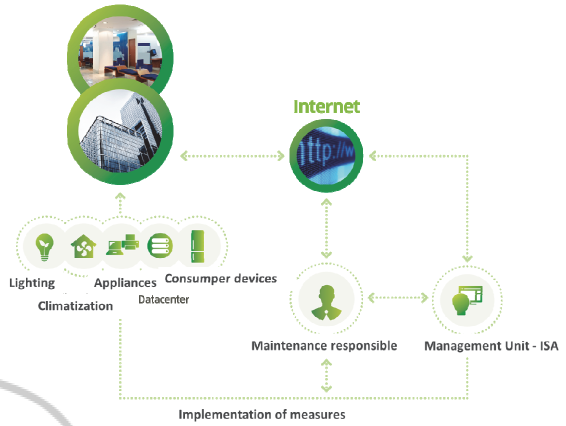

Figure 2: Scheme of the methodology implemented in the bank facilities, the flow of the information and the relation between the components

Figure 3: Global solution architecture.

The solution is divided in three main components: Hardware, Middleware and Software.

Hardware. The iHub is multifunctional data logger and gateway equipment used in energy monitoring and management solutions, which enables to collect data and remotely manage other equipment. One of the main advantages of this device is that it doesn’t require permanent connection to the internet. The iHub has the ability to store collected data during a variable time period and send it to server when at programmed time frames our when network is available. This gateway receives data from two different protocols:

- RS 485 MHz (Modbus RTU) - from the iMeter Rail, which enables awareness in consumption, since it includes a LCD display providing the consumer with power status and the reading regarding specific circuits within an electrical switchboard. The single phase and three-phase mounted meters are integrated in a standard meter and are widely used in small enclosure and switch gears.

- RF 868 MHz – from the iPoint, a comfort sensor that measures different environmental variables, such as, temperature and relative humidity, and communicate using wireless technologies to the iHub.

Middleware. The middleware is a management and communication platform (iEnergy). iEnergy is a middleware platform that can be used to remotely monitor electrical consumptions. The platform is able to receive data readings from thousands of units of hardware placed in several different geographical locations. The kinds of readings that are received vary from device to device. For example in the case of electricity one could expect to receive readings regarding the energy consumed (kW) among others. iEnergy receives these data, stores it and processes it providing its clients with higher level analytics. Besides calculating and storing these analytics, the platform also provides a web interface that allows other systems to import these data into their domain.

Software. The end-user software, KiSense, is monitoring software for energy management, designed to help companies reduce energy consumption and associated costs. It consists of an integration platform for all energy consumption data, with a simple and intuitive interface. Accessible anywhere, KiSense supplies and analyses energy consumption, in real time, offering to end-users relevant information and knowledge for appropriate decision-making regarding energy consumption in the bank, in order to influence energy behaviour transformation.

Some of the main functionalities of KiSense are:

- Data explorer – Analyse and perform operation on energy consumption data, knowing when, how and where energy is consumed. It is possible to compare consumption of different areas and installations.
- Alarms – Define when and how to be warned of anomalous occurrences, such as excessive consumption, consumption out of defined timetable and consumption exceeding defined objectives.
- Events – Signal the key moments of energy consumption by scheduling relevant behaviours.
- Savings – Define saving goals and permanently keep up with its evolution, using alerts when they are not being achieved and it is possible to visualize the gains obtained through specific implemented measures.
- Reports – Obtain periodic reports for a better monitoring of energy consumption.
- Tariff rates - Analyses consumption patterns by periods of time and obtain fundamental data, in order to choose the best tariff plan, reports of consumption according to period of time.
- Control – Remotely control equipment and circuits, scheduling periods and parameters, switching on and off remotely.

3 METHODOLOGY

To meet the needs and challenges of the bank, it was developed an energy efficiency project focused on the architecture explained above which enabled the maintenance responsible of the bank to:

- Know when, where and how energy is consumed;
- Define KPI (Key Performance Indicators) regarding their business;
- Estimate energy costs;
- Analyse consumption values;
- Define measures and actions in order to achieve savings;
- Check the effects of implemented measures;
- Compare areas and facilities;
- Define alarm mechanisms for anomalous situations, excessive consumption or underachievement of reduction goals;
- Remotely control equipment (in real time or scheduled);
- Integrate systems installed in a single energy management platform (HVAC, GTC, BMS, etc.);

In this way the project was developed in six main stages:

1st Stage – Detailed specification of the EMS (Energy Management System)

2nd Stage - Installation of the monitoring and management solution

In this stage the monitoring and management solution was installed in all 19 office buildings and 358 selected branches. The solution was composed by:

Meters and sensors to monitor the energy consumption and environment parameters (temperature and humidity), with the capacity to control and actuate remotely over the equipment;

3rd Stage – Energy Auditing. In this stage an energy survey was executed for all office buildings and representative branches. The energy survey resulted in audit reports, with conclusions to reduce energy consumption, carbon footprint and costs.

4th Stage – Design of the best practices guide and the communication program to the bank employees

5rd Stage – Energy Data analysis. In this stage, the data collected by the energy monitoring system were analyzed, in order to, identify opportunities for energy savings based on the electricity bill provided by EDP – Energias de Portugal.

6rd Stage – Energy Management. The implementation of the actions indicated in the audit reports were implemented, managed and supervised, and mensal reports of activities and energy savings and cost saving were delivered.

Besides that, training was given to the maintenance responsible of each building and branches, and a behavior campaign was created in order to promote energy behavior changing in each user of the building and branches.

4 RESULTS

Before the project and in order to define this baseline, the meter of the power distribution company was used as a start point. The use of this meter is a requirement of the IPMVP – EVO (International Performance Measurement and Verification Protocol), once in the reference period is the only existing meter (Evo-world).

The International Performance Measurement and Verification Protocol (IPMVP) is the widely referenced framework for measurement and verification (M&V). M&V activities include site surveys, energy metering, monitoring of independent variable(s), calculation, and reporting.

During the 5rd and 6rd stage of the project, it was possible to conclude that simple measures, such as, remote control in HVAC system allowed energy savings of 32% in this circuit, and approximately 7% in the total consumption. Measures related to good practices, energy behaviour, allowed to achieve average savings of around 15%.

The baseline of 2010 (year before the project), based on the energy bills, for the 345 branches, can be seen in Figure 4, and in central buildings, can be seen in Figure 5.

The total annual consumption of the branches of the bank in the year of 2012 was 17.325.406 kWh, with a total cost of 2.746.514 €. The average consumption per branches was 50.219 kWh with a cost of 0,16 €/kWh.

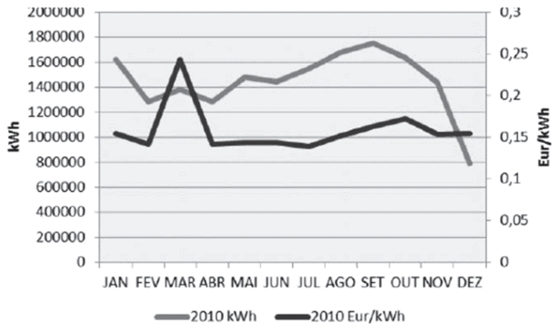

Figure 4: Energy consumption and energy cost – Branches.

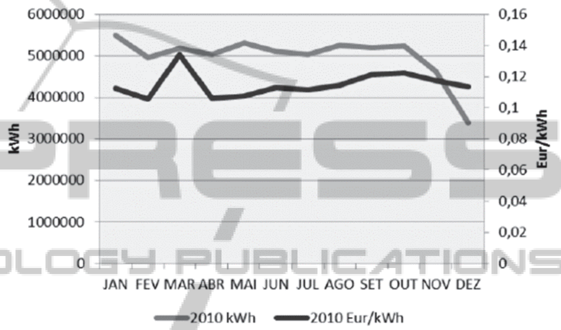

Figure 5: Energy consumption and energy cost – Central Buildings.

The total annual consumption of the central buildings of the bank in the year of 2010 was 59.794.853 kWh, with a total cost of 6.877.587 €. The average consumption per central building was 3.321.936 kWh with a cost of 0,11 €/kWh.

In the year of 2011, after the 3st stage of the project, it can be seen a reduction of the energy consumption equivalent to 26%:

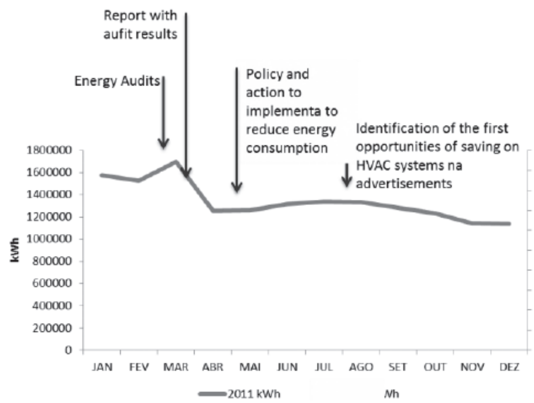

Figure 6: Energy consumption of branches in 2011.

The total annual consumption of the branches of the bank in the year of 2011 was 16.085.602 kWh, with a total cost of 2.643.174 €. The average consumption per branches was 3.885kWh with a cost of 0,16€/kWh.

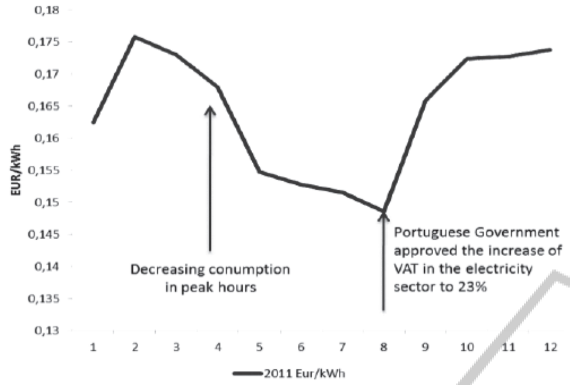

Figure 7: Cost of energy spent in branches in the year of 2011.

In the year of 2012 (until September) was clearly identified the consumption reduction, as can be seen below:

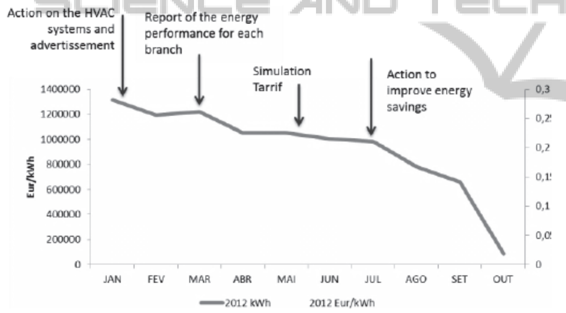

Figure 8: Energy consumption on branches in 2012 (until September).

The total annual consumption of the branches of the bank in the year of 2012 was 9.271.562 kWh, with a total cost of 1.939.632 €. The average consumption per branches was 2.986kWh with a cost of 0,18 €/kWh.

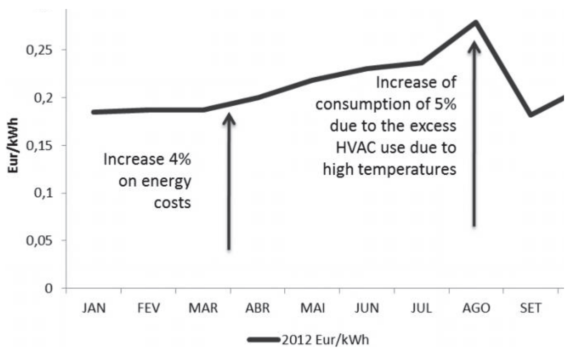

Figure 9: Cost of the electricity bill for branches in 2012.

At the end of March 2012 the Portuguese regulator for the energy services approved a gradual increase of 4% in costs with active energy consumption. This is the reason for the increasing average cost of the energy despite of the consumption reduction.

The Figure 10 represents the reduction on the energy consumption along the three-year project. Comparing 2010 to 2011 the energy saving was 1.239.804 kWh (7,16%) with a cost saving of 103.341 €, equivalent to 3,76%, including the increase of VAT on the electricity tariffs.

Comparing 2 years, from 2010 to 2012 the energy saving was 4.192.089 kWh (31%) with a cost saving of 183.062 €, equivalent to 8,6%, including the increase of VAT on the electricity tariffs.

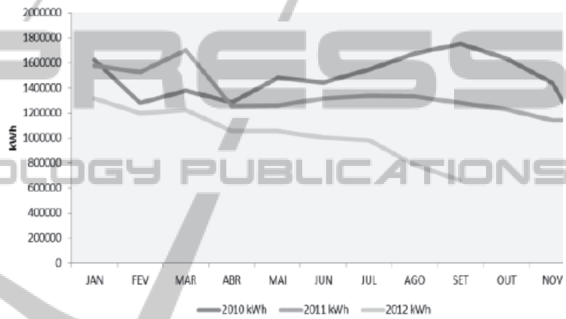

Figure 10: Energy consumption of the branches in 2010, 2011, 2012.

With the implementation of this solution it's possible to achieve direct benefits and indirect benefits.

The direct benefits are:

- Energy cost reduction;
- Central management of all facilities;
- Greater efficiency in management of maintenance equipment, and consequent increase of its lifetime;
- Definition of energy regulations, according to consumption profiles;
- Reinforcement of sectors sustainability policies along energy efficiently and carbon footprint reduction
- The indirect benefits are:
- Improved corporate image with stakeholders – corporate sustainability and eco brand;
- Improve working conditions for staff: air quality, lighting conditions, etc;
- Improve ecological awareness of staff.

5 CONCLUSIONS

Monitoring energy use can provide up-to-date information on energy use and carbon emissions so companies can identify energy conservation measures, adjusts usage quickly, and reallocate savings where needed. The solution for energy monitoring and remote management presented in this paper can monitor building energy efficiency and actively look for opportunities to further energy saving opportunities.

Evaluate and measure continuously the energy consumption in the banking sector to know how much, where and how energy is consumed, it is essential to evaluate waste properly, the inefficiencies and priorities, in order to reduction the energy consumption.

The geographical dispersion and diversity of bank facilities was a pressing concern. It prevented a correct vision of reality, whether in branches, whether in headquarters, particularly regarding the value of energy consumption, the terms of supply contracts, disparities in consumption patterns, peaks of consumption, etc.

In order to meet the different needs identified, ISA installed equipment's network and energy consumption monitoring and management software.

The results obtained increased efficiency significantly and enabled the implementation of measures that, without further investments, led to a major reduction in consumption and an investment payback of less than 2 years.

ACKNOWLEDGEMENTS

This work has been partially supported by FCT under project grants PEst-OE/EEI/UI0308/2014 and MIT/SET/0018/2009. Also, it has been framed under the Energy for Sustainability Initiative of the University of Coimbra and supported by Energy and Mobility for Sustainable Regions Project CENTRO-07-0224-FEDER-002004.

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