

# Home users as a Facility Managers

## How is automation helping?

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**Abstract.** In the current economic setting companies are required to the operation of their facilities therefore making a growing use of technology supported Facilities Management and Energy Management activities. The same holds true for home owners. In fact we assist to an increasing adoption of Building Management technologies, most notably Energy Management by households. Therefore, it is expectable that other aspects of facilities management will end up being adapted to homes in the near future. In this paper we briefly discuss into what extend FM activities can be applied to homes and what is the technological support that can be found for them.

**Keywords.** Facilities Management, Building Automation, Dwelling Environment, Sustainability

## 1 Introduction

The main challenge that the built environment faces today is that of improving its effectiveness toward efficient usage of resources, among which energy comes first, while meeting crucial flexibility requirements of living environments towards contemporaneous dynamics of functionalities, occupancies and users' expectations.

The monthly budget expenditure with home facility is one of the major expenses to the traditional familiar core. The inhabitant, as the one who experiences the built environment continuously is best positioned to manage it. For organizations alike, facilities are among the major fixed costs [1], therefore prompting for professional management. In this context Facilities Management is gaining increasing acceptance worldwide as discipline and grounding upon a range of specialized tools and techniques. If this is true for the facility supporting the operation of a company, an interesting question is whether it is also significant for the facility that supports the home environment owned by the individual that inhabits it. Can the Facilities Management concept be applied to home environment to optimize the functionality of the spaces and equipment while increasing the user quality of life? Rational choices of areas to develop activities, due to the available space, light features, electric outlets to plug in different apparatus, and equipment usage are ways to optimize the usage of a facility. The human life style and the use of buildings do not remain static, users' requirements and expectations change, technology change, the way we perform daily routines change, the facility manager has to monitor and apply the corrective actions to bal-

ance human and building demands [2]. The sustainability of the built environment is based on its location, geographic orientation, conceptual planning and construction process. Overlooking these premises will stimulate uncomfortable environments and the need of correcting technology to minimize, to the extent possible, the inherent energy costs.

The contemporaneous social and economic context motivates new approaches to home environment based on users' needs and expectancies. The modern lifestyle demands comfort and the possibility of new functions within home environment considerably supported by technology.

## **2 FM in the Home**

In order to balance individual and/or familiar budgets it is important to manage the equipment that supports human routine activities and the sense of comfort. The monitoring and management of the equipment such as appliances, computers and multimedia apparatus can be helped by technology development such as basic home automation. To promote facility management for housing demands to understand the type of occupant – tender or owner or social housing – the type of the building, flat, detached house, different sizes, locations, and access to different facilities [3]. This paper's discussion is focused on dwelling environment occupied by the owners, particularly to existing buildings which require more attention to their sustainable performance. As an owner the occupant wants to minimize costs without compromising the value of the building as a profitable asset, or its personal sense of comfort. This reality depends on owners' voluntary work, competencies and budget. However, once dwelling environments belong to buildings with different storeys, some transformations require the validation of the condominium administrative core, which by different factors can interfere in the desired and proposed initiatives.

### **2.1 Energy management**

The parameters that contribute to the levels of energy demand in residential buildings, are related with behavioural determinants (concerning occupancy patterns, use of domestic appliances and users sense of comfort) and physical determinants (dependent on the type of building, flat, semidetached house, size, formal configuration, constructive process, etc...) [4]. The regular parameter of successful energy management is occupants' commitment. The daily routines must be planned to achieve continuous improvement. It is important to define the objectives to attain and observe behaviours to comprehend and establish the best practices [5]. This observation will help to gather data which must be detailed to permit an accurate analyses to understand objectives' accomplishment or by antithesis the need of objectives redefinition to ensure a successful solution. A system for tracking facility performance can range from a notepad, a simple spreadsheet to a detailed database and IT systems; in all the available solutions is important to define a method that is possible to continue and define

the type of data to be gathered and analysed. The data can be based upon periods of time, and equipment usage.

## 2.2 Policy enforcement

Some considerations can be raised to improve home energy performance to a sustainable solution. Windows and doors must be insulated to minimize thermal exchanges, as well as chimneys; old appliances, lighting and HAVAC systems should be upgraded by new high-efficiency ones that are more environmental friendly, without questioning their functionality and the sense of comfort. Green electric outlets and different hours' rates can contribute to the difference. Furthermore, to increase the home's efficiency the inhabitant can decide for adding renewable energy systems such as solar electric (photovoltaic) or solar hot water, to increase the reduction of the bills and the ecological footprint.

**Household routines.** Home routines concern individual and familiar activities plus professional and leisure ones [6]. Home gained new activities to be performed within; if individual and familiar activities demand appliances technologies and functional environments the professional and leisure activities motivated the spreading of technology aiming for different ambiances, where lighting – which intensity, chromatic reproduction index, and distribution [7] are crucial to guaranty visual acuity [8] and functionality of the spaces – and temperature promote interiors quality of life. The dependence from technologic apparatus demands more devices such as electric outlets and electric power.

**Automated control.** The majority of today's home automation solutions present the same set of ranging from security control to the possibility to create different scenarios based on luminic contrast where the intensity and the CRI of the light are the major issues to manage.

The possible scenarios created based on artificial light, intensity and CRI can perform scenarios oriented to work and to relax. For example, it has been demonstrated that intensity and CRI can contribute to balance the circadian cycles, can ameliorate the visual acuity, and promote warm and relaxing interior environments or by opposite more cold and concentrative working environments. The intensity of the artificial light can be related with the intensity of the natural light and then contribute to the rationalization of the energy use and costs. These scenarios can strongly improve human quality of life. Beyond the quality of life is important to manage the energetic resources towards lower consumption and smaller ecological footprint. The automatic harvesting of natural light to minimize artificial light a way of doing it. Another use of automation is in green sockets, which are programmable schedule switches. The control of different devices like luminaires can be performed by remote control and from a central digital panel where the information can be presented in different modes such as daily control, equipment control. Ubiquity of control helps occupants to make more adjustments leading to higher comfort levels and lower energy consumption. The integration of data in the same device can be interesting to understand the functioning of the facility and enable the creation of interfaces with higher usability therefore being comprehensible by a major number of individuals. The control of equip-

ment audio-visual can improve the different scenarios; moreover, the equipment remote itself may control other devices. A unique remote control can minimize a set of required remote control contributing to the usability of the system and the inclusion of individuals' with some technologic difficulties and people with special requirements.

Security solutions deal with the control of the main entrance as well as the windows. The quality of the equipment can present video surveillance where the quality of the image, the capacity of the buttons and the connection with security entities may contribute to the sense of security. On the safety side the prevention of flood or smoke detection with automatic cut of electric energy is another interesting feature.

In a new construction, these items can motivate the choice of the future owner. The inherent costs related with the equipment and the employment of domotics can be recovered by the energy savings and an increase in the comfort for the inhabitant. This equipment can be dissimulated within constructive process, guarantying the sense of home and comfort for the inhabitant. However current wireless technologies are becoming mature enough to install these solutions in every environment without any cables and/or constructive work, thus without compromising the existing interior layout.

### **2.3 Maintenance**

The maintenance of the building is responsibility of the owner and/or landlord. The objective of maintenance is to avoid any kind of facility's obsolescence and promote occupants quality of life. There are different types of maintenance ranging from the reactive to the planned one. Both attitudes require knowledge and financial resources. Dwelling environment is sustained mainly by reactive maintenance, the immediate solution to emerged problems, mostly the ones related with infrastructures and constructive process diagnosis, neglecting repeatedly the ones related with the update of the facility to user's requirements and expectancies.

Equipment and plant installed within a building or dwelling environment require regular servicing and the replacement of consumables to keep them in working order. Usually, they have particular servicing and maintenance requirements, which are provided through a service contract, usually with the supplier. Planning maintenance requires the understanding of the problems and the schedule of the required actions to achieve their resolution. Planned maintenance is better as it can anticipate diagnosis and resolution, thus minimising costs. Providing maintenance is a way to ensure the functionality, the perceived image and the value of the facility. Planned maintenance can also minimise subjective decisions due to required emergency decision making. Facility performance by systematic monitoring and assessment can also be performed to some extent by current home and building automation systems. These automation solutions already are capable of counting the number of operating hours and to track the number of starts of several types of devices.

### **3 Discussion and open issues**

Facilities management is not a common resource applied to home environment; however, each occupant aims to ensure its best performance, being unconsciously a facility manager.

A sustainable solution has economic and social responsibility; the rationalization of the inherent costs associated to home while supporting human occupancy patterns cannot question the feeling of functionality, security, safety and comfort.

Besides all the technology apparatus that contribute to daily routines, home automation is a new paradigm to handle the home environment, particularly in energy management, security and the possible scenarios to respond to user preferences. At the limit these technologies can be complemented by renewable energy systems to optimise energy consumptions. These technologies can be implemented upon new and existing buildings. However, the total costs required by these technical solutions are prohibitive for most homes' owner, and if chosen based on a condominium decisions positive decision is hard, sometimes impossible, to be reached. A paradox emerges because if these technologic systems can be useful and required to promote an effective and efficient dwelling management, their costs of acquisition and maintenance are too high to be spent by an individual or even by the association of owners, such as condominium. Yet, the dwelling environment ought to be managed to maximise its performance by answering to the user's occupancy patterns, and to achieve sustainable goals minimising ecological footprint.

Reality illustrates the need to modernise the habitat's built environment by the functional, social and economic obsolescence presented by apartments, buildings and neighbourhoods. Dwelling environment as a real estate asset definitely requires its management. Otherwise, dwelling environment will be the investment / property of the poor, once everyone wants/ expects to become an owner but do not have the financial resources and competencies to manage it, depreciating its value continuously.

### **4 Conclusions**

An attentive survey of the dwelling environment shows that it is a piece of built environment that presents significant levels of functional, economic and social obsolescence. Dwelling built environment, like industrial and tertiary built environment needs to be managed to dignify and enhance its life cycle without undermining the users' needs and expectancies. Dwelling built environment is an asset (the biggest investment and expenditure of its owner) that requires its evaluation.

Considering traditional functions at the home environment, comfort emerges as the main issue regularly neglected by conceptual models and constructive processes; beyond the traditional activities performed, attached to individual and familiar requirements, home environment gained, along the recent decades, new functions comprehending professional and leisure performances, which by their nature depend significantly from technologic developments. Facing this reality, technology is an answer to promote comfort, throughout appliances that help to perform household tasks;

systems to guarantee the desired level of temperature and humidity; devices to promote security and equipment to develop work and leisure activities. The addition of technology, spatial environment implies significant costs on its acquisition, implementation and operation. The present-day status regarding different levels of obsolescence is due to the fact that dwelling environment do not benefit from maintenance and update policies, once there is no administrative motivation and obligation. Most apartments are occupied by their owners, who can't afford refurbishing to adapt them to contemporaneous life styles.

The sustainable awareness developed to minimize ecologic footprint motivates a rationalized use of energy resources along with the optimization of dwelling functional and comfortable performance. To achieve such goal the user needs to act as a facility manager to avoid and/or minimize any kind of home environment obsolescence and optimize the costs of its performance. Building automation appears as a trend to answer to users' needs and mostly to users' expectations. However, the solutions available are very expensive to individual investment; the inexistence of municipal, fiscal or administrative advantages implies that the time to reimburse such systems is not compatible with their life cycle.

From the reality experienced and its technical optimization, some actions can be implemented. From maintenance policies based on planning actions and not just reactive attitudes; communitarian solutions that can be applied in all the storey's of the building; individual behaviours more attached to sustainable principles; energy suppliers policies to motivate different uses and schedules rates; technical systems, equipment and devices suppliers to a rationalization of energy resources and inherent costs, can be the first step to achieve a more sustainable dwelling environment and a better human quality of life.

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