



Cost Efficient Options and Financing Mechanisms
for nearly Zero Energy Renovation
of existing Buildings Stock

DELIVERABLE 2.3

RELATÓRIO SUMARIO DOS OBSTÁCULOS, RISCOS E DIFICULDADES PARA OS ESQUEMAS DE RENOVAÇÃO

Município de Coimbra, Portugal

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Apresentação dos obstáculos, riscos e dificuldades que foram encontrados durante a elaboração dos 12 planos de renovação do WP2.

Palavras-chave: obstáculos, riscos, dificuldades, esquemas de renovação

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Esta *deliverable* contém obra inédita original, exceto onde claramente indicado de outra forma. A referência a material já publicado ou resultante do trabalho dos outros foi feita por meio de citações adequadas.

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ABREVIATURAS E ACRÓNIMOS

Acrónimo	Definição
COP	Coefficient of performance
EPBD	European Performance Buildings Directive
HVAC	Heating Ventilation Air Conditioning
ICT	Information and Communication Technology
nZEB	Nearly Zero Energy Building
PUR	Polyurethane
PV	Photovoltaic
RES	Renewable Energy Sources

O PROJETO CERTUS EM SÍNTESE

Os países do sul da Europa passam por uma grave crise económica. Tal dificulta o cumprimento da última Diretiva de Eficiência Energética, que exige medidas rigorosas de eficiência energética para o setor público. Os investimentos necessários para renovar os edifícios públicos de forma a alcançar um consumo de energia quase nulo têm tempos de recuperação longos e o interesse de entidades de financiamento é geralmente baixo. Muitos edifícios públicos no sul da Europa necessitam de renovações profundas para se tornarem edifícios com necessidades quase nulas de energia (nZEB), mas tal não deve ser considerado como uma ameaça, mas sim como uma oportunidade para o sector financeiro e de serviços de energia.

O objetivo do projeto CERTuS é ajudar as partes interessadas a ganhar confiança em tais investimentos e fomentar o crescimento do setor dos serviços de energia, através do desenvolvimento de projetos representativos de renovações profundas para serem usados como modelos para replicação. Municípios, empresas de serviços de energia e entidades de financiamento de Espanha, Grécia, Itália e Portugal estão envolvidos neste projeto. Foram selecionados doze edifícios em quatro municípios de cada país. Os parceiros irão adaptar os modelos e procedimentos de serviços de energia existentes e desenvolver esquemas de financiamento adequados para os 12 projetos. Consequentemente, os parceiros vão criar materiais, tais como guias e folhetos, adequados para apoiar um plano de comunicação intensiva.

O projeto irá realizar quatro workshops com sessões direcionadas para municípios, empresas de serviços energéticos e entidades financiadoras. Estas ações serão complementadas por quatro atividades de formação dirigidas a funcionários municipais e pela participação em eventos internacionais. Esperamos que esta ação tenha um impacto significativo por desencadear investimentos em renovações para atingir níveis nZEB e para o desenvolvimento do mercado de ESCOs nos Estados-Membros do Sul da Europa.

SUMÁRIO EXECUTIVO

Esta *deliverable* é parte do trabalho desenvolvido no Package 2 “Validação Técnica e Económica dos Esquemas de Renovação nZEB” e sumariza os obstáculos, riscos e dificuldades para os esquemas de renovação de cada edifício dos quatro Municípios.

Este documento apresenta os obstáculos, riscos e dificuldades para os esquemas de renovação do Município de Coimbra. Os três edifícios são apresentados de acordo com a seguinte estrutura:

- Breve introdução ao edifício: principais características, localização, uso e perfil energético, etc.;
- Breve apresentação do esquema de renovação selecionado, incluindo a apresentação das medidas adotadas;
- Dificuldades técnicas previstas para a implementação das soluções propostas;
- Riscos económicos e/ou financeiro a considerar;
- Obstáculos legislativos considerados na seleção dos esquemas de renovação.

No final, é apresentado um resumo das ações, bem como as principais conclusões para o Município de Coimbra.

As principais barreiras técnicas são o uso de eletricidade em outros edifícios geridos por outras entidades, sem qualquer medição para garantir a desagregação do consumo entre os edifícios, tal como acontece na Escola e na Biblioteca. Outro entrave técnico importante é a incompatibilidade entre o uso e as obras de renovação na Biblioteca e nos Paços do Concelho. Há também o risco técnico na qualidade dos produtos, devido à necessidade de processos de contratação pública.

A principal barreira económica é o alto investimento global, que é agravado pela falta de orçamento público e pela baixa disponibilidade de esquemas financeiros. O principal obstáculo legislativo é o nível de proteção dos Paços do Concelho, uma vez que é parte da propriedade "Universidade de Coimbra - Alta e Sofia" inscrita na Lista do Património Mundial da UNESCO.

1. OBSTÁCULOS, RISCOS E DIFICULDADES PARA OS ESQUEMAS DE RENOVAÇÃO EM COIMBRA

1.1. ESCOLA BÁSICA DO 1º CICLO DA SOLUM

1.1.1. INTRODUÇÃO

The Elementary School of Solum (Escola Básica do 1º Ciclo da Solum) was built in the 1950s. Until the 1970s this was an annex school to the teacher training colleges dedicated to pedagogical training. In the 1990s it was converted into an Elementary School. The construction of refectory and a partial renovation of the building was done 10 years ago. Figure 1 presents the front façade of the building. The building is located in the East side of the city, near to the Stadium and a commercial area.



FIGURE 1: ESCOLA BÁSICA DO 1º CICLO DA SOLUM

The building is divided in 3 main areas: 2 blocks of classrooms and the refectory. It has total area of about 1655 m² (756 m² in each block and 142 m² in the refectory) and a volume of 6269,21 m³ (2828,19 m³ in each block and 612,84 m³ in the refectory). The roof is of ceramic tile and has a surface of 898 m². Figure 2 presents the plan view of the building.



FIGURE 2: PROJEÇÃO HORIZONTAL DA ESCOLA BÁSICA DO 1º CICLO DA SOLUM

The building is used as an elementary school (with about 300 students) and has the following schedule of diary activities (Monday to Friday):

- Classes – 9h00 to 12h30 and 14h00 to 16h00
- Lunch – 12h30 to 14h00
- Extra-curricular activities – 16h30 to 17h30
- Family support – 7h30 to 9h00 and 17h30 to 19h00

The periods of classes during 2013/2014 were:

- 1st period – September, 16th to December, 17th
- 2nd period – January, 6th to April, 4th
- 3rd period – April, 22nd to June, 13th

Outside these periods the use of the building is very low.

In 2013 the building had an electricity consumption of about 30 MWh and an associated cost of about 6,7 k€. Figure 3 presents the disaggregation of electricity consumption between uses.

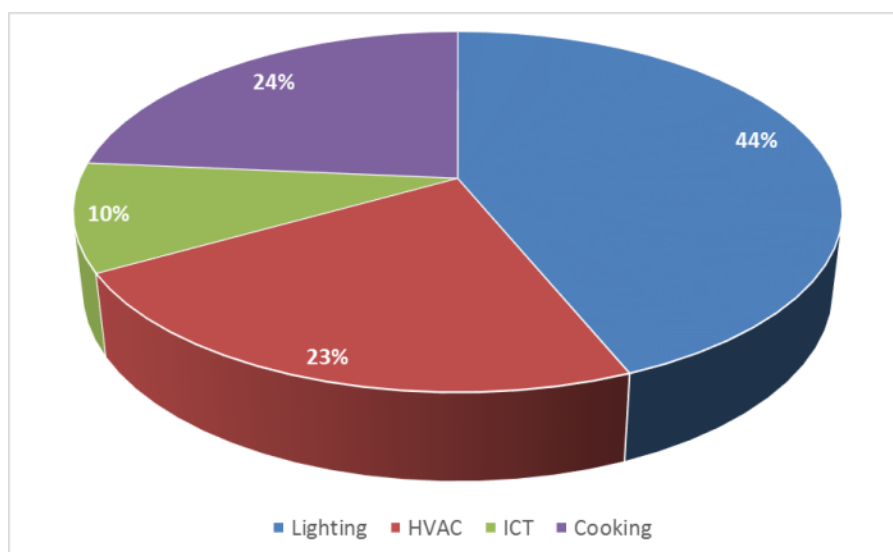


FIGURE 3: DESAGREGAÇÃO DO CONSUMO DE ELETRICIDADE ENTRE USOS, EXCLUINDO O EDIFÍCIO PRE-FABRICADO

The building also has consumption of natural gas during the winter (used in the heating of the refectory building). The consumption in 2013 was 16775 kWh (1548 m³) with an associated cost of 1778 €.

The building has a PV system of 4230 W with all the generated energy being sold to the grid, which ensures an average yearly generation of 6100 kWh (20% of the electricity consumption in 2013).

1.1.2. PLANO DE RENOVAÇÃO

In the renovation plan the following main options were considered:

- Increase of the PV generation system;
 - Scenario 1: duplicate the row of 18 panels and use the same structure in area 7 (total of 72 panels);
 - Scenario 2: increase the row for 27 panels, duplicate the row and repeat the structure in the area 7 (total of 108 panels);
- Retrofit of the lighting system;
 - Scenario 1 - Replacement of all T8 lamps with electromagnetic ballast by T5 lamps with electronic ballast;
 - Scenario 2 - Replacement of all lamps by LEDs;
- Retrofit of the HVAC system;

- Replacement of the gas boiler used in the central heating of the refectory by a heat pump;
- Replacement of ICT and cooking appliances.

The selected scenario is constituted by:

- Increase the PV system to 72 PV panels;
- Replacement of all T8 lamps with electromagnetic ballast by T5 lamps with electronic ballast;
- Replacement of the gas boiler by a heat pump.

1.1.3. DIFICULDADES TÉCNICAS

General

There are 7 prefabricated buildings in the exterior area of the school (Figure 4). Such buildings are not a permanent construction and do not belong to the Municipality, being managed by the Family Support project. However, they receive electricity from the school (Figure 5) without any individual metering. Therefore, its consumption is included in the total consumption of the building, but such energy consumption cannot be considered as a consumption of the studied building. The consumption of the prefabricated buildings was assessed (considered to be 27% of the total energy consumption) and subtracted from the total considered for the building. This situation can also be a barrier in the future, creating difficulties to a properly monitoring of savings.

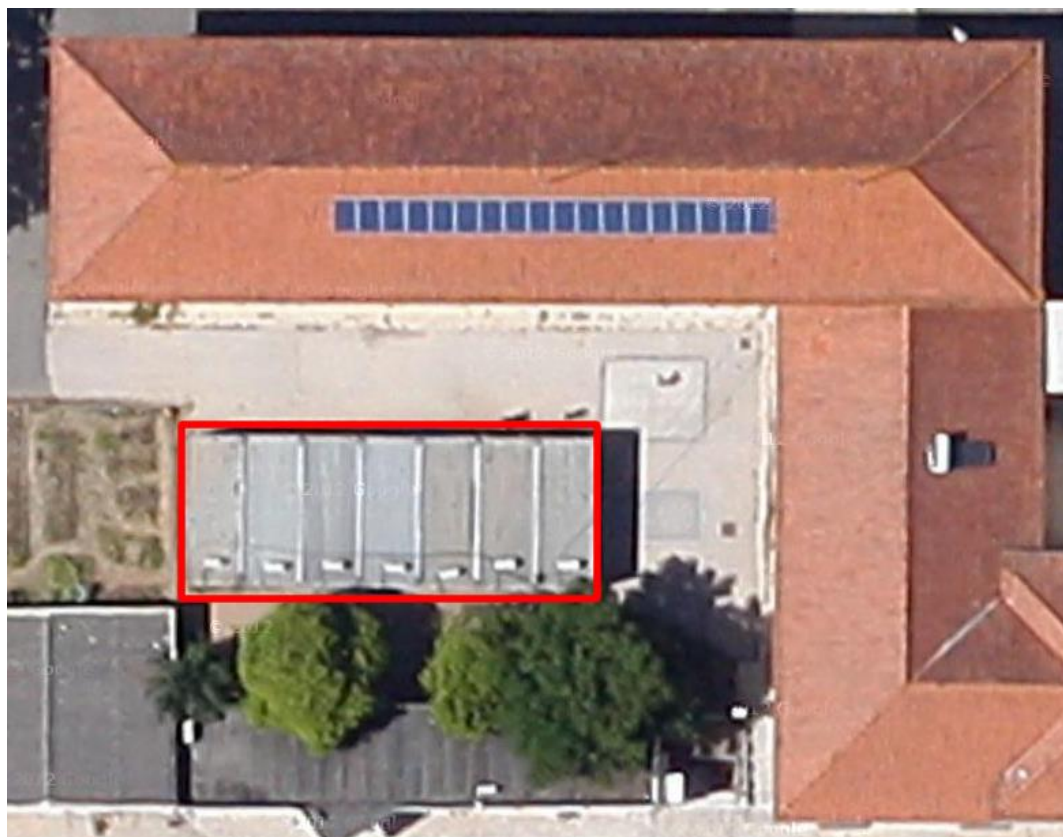


FIGURE 4: PREFABRICATED BUILDING FROM THE FAMILY SUPPORT PROJECT



FIGURE 5: PREFABRICATED BUILDING FROM THE FAMILY SUPPORT PROJECT (CABLE FROM THE MAIN BUILDING)

One general technical risk is the quality of the products. In a public procurement process the brand and model of the technology cannot be previously chosen and therefore there are always uncertainty regarding the quality of some products proposed by the installers (lifetime, quality of light in the lighting products, etc.).

PV

There are no major technical limitations to the installation of PV systems, since the roof presents a good orientation and tilt and there is enough available area. However, since the building already has a PV system, the best solution is to keep such system and to increase the number of PV panels using the available area. Therefore, it was considered the use of the same type of PV panels and inverters. The installed PV system was also considered as a limitation to define the number of PV panels in each scenario, since it was decided to just increase and/or replicate the actual structure to minimize the visual impact (avoiding an irregular distribution of PV panels in the roof).

Envelope

Since most of the buildings do not have any regular source of heating or cooling, the improvement of the envelope would not bring relevant energy savings.

Lighting

There are no major technical limitations to the retrofit of the lighting system.

HVAC

The building only has central heating in the refectory. The other areas of the building do not have central heating, being the heating in the classrooms ensured by one oil-filled radiator during the coldest days. However, the option to replace such oil-filled radiators by heat pumps is not effective due to the following reasons:

- The oil-filled radiators have a small power and do not ensure all the needed power for the heating requirements of each room. Then, the replacement would increase the available

thermal power. Due to the higher control capabilities of a heat pump the use would also increase.

- The heat pump can also be used for cooling and since actually the building does not have any cooling source (since it is not needed), it would create new energy consumption.

This renovation is an option to increase the comfort in the building. However, it cannot be considered as an option to increase the energy efficiency since the total energy consumption would increase and therefore it is not included in the renovation plan.

Appliances

ICT and other appliances (mainly PCs, monitors and printers) do not represent individually a large share of energy consumption and therefore the achieved savings with such appliances would not have a major impact on the total energy consumption. The replacement of such appliances by new devices is not cost-effective just from the energy savings point of view and therefore this is not considered in the renovation plan. However, in the regular replacement of ICT appliances it is recommended to install just ICT appliances with lower energy consumption.

From the energy savings point of view, the most cost-effective solution is the installation of devices to reduce the standby consumption of ICT appliances, the so called standby killers. However, the potential savings achieved with such devices do not depend on the technology, but on the users' behaviour and therefore a reliable assessment of savings is not possible. Therefore, such measure is not included in the renovation plan, due to the difficulty of assessment, but its implementation is recommended.

The cooking appliances also do not have a major impact on the total energy consumption and the quantity of equipment is low. Therefore, its renovation was not included in the plan. However, in the regular replacement of such appliances it is recommended to install just appliances with lower energy consumption (with label A+ or better).

1.1.4. RISCOS ECONÓMICOS / FINANCEIROS

The main economic barrier to the implementation of the renovation plan is the high overall investment, which is aggravated by the lack of public budget and the low availability of financial schemes (mainly due to the economic crises and the transition period between the Community Support Frameworks).

The main economic risk is the reliability of the value considered to the total investment needed to the implementation, due to the following reasons:

- The prices of the technologies present variations over time, and in some technologies such as photovoltaic the oscillations of prices can be high.
- The percentage of price reduction obtained in the public procurement process is uncertain.

1.1.5. OBSTÁCULOS LEGISLATIVOS

There are no major legislative obstacles to the renovation of this building.

1.2. CASA MUNICIPAL DA CULTURA

1.2.1. INTRODUÇÃO

The Municipal House of Culture was built in 1991-1993 and opened on October, 26th 1993. Figure 6 presents the front façade of the building. The building is located near to the city centre and near to the University.



FIGURE 6: MUNICIPAL HOUSE OF CULTURE

Figure 7 presents the plan view of the building.

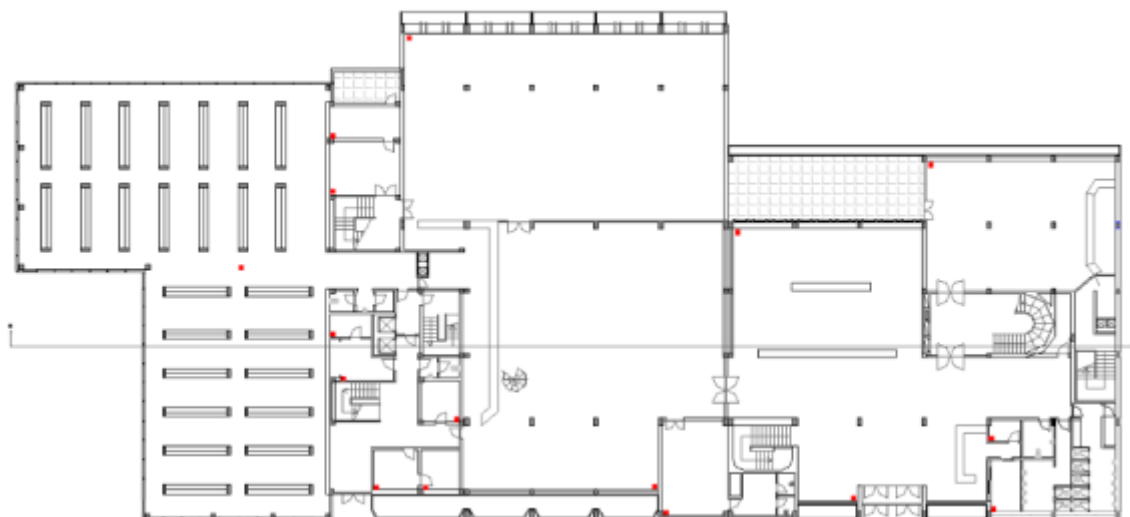


FIGURE 7: PLAN VIEW OF THE MUNICIPAL HOUSE OF CULTURE

The building has 8 floors with a total area of about 13225 m² with a total used surface of about 9862 m² and a volume of 39944 m³. The roof is flat without tiles and has a surface of 2565 m².

The building is used as Municipal House of Culture and has several cultural equipment, such as library, auditorium and art gallery, as well as several offices. The building has 80 employees and is visited by 17 500 users/year and works with the following schedule.

- July 15th to September 15th:

- Monday to Friday: 9h00 – 18h30
- September 16th to July 14th:
 - Monday to Friday: 9h00 – 19h30
 - Saturday: 11h00 – 13h00 and 14h00 and 19h00

The users have access to the rooms of public use only after 10h00.

In 2013 the building had an electricity consumption of about 521 MWh and an associated cost of about 84 k€. Figure 8 presents the disaggregation of electricity consumption between uses.

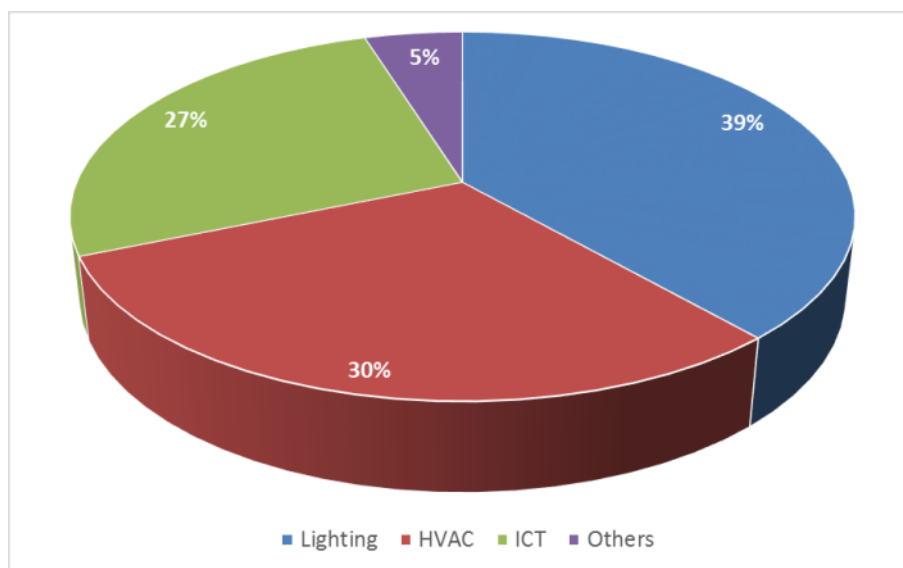


FIGURE 8: DISAGGREGATION OF ELECTRICITY CONSUMPTION BETWEEN USES, EXCLUDING THE REFECTORY

1.2.2. PLANO DE RENOVAÇÃO

In the renovation plan the following main options were considered:

- Installation of the PV generation;
- Retrofit of the lighting system;
- Retrofit of the HVAC system;
 - Scenario 1 - Replacement of all T8 lamps with electromagnetic ballast by T5 lamps with electronic ballast and replacement of the incandescent lamps by CFLs;
 - Scenario 2 - Replacement of all lamps by LEDs;
- Replacement of ICT and other appliances.

The selected scenario is constituted by:

- Installation of 770 PV panels;
- Replacement of all lamps by LEDs;
- Replacement of the THC and mono-split systems by systems with higher COP/EER.

1.2.3. DIFICULDADES TÉCNICAS

General

Part of floor -2 is a refectory from the University of Coimbra. However, this refectory receives electricity from the Municipal House of Culture without any individual metering. Therefore, its consumption is included in the total consumption of the building, but such energy consumption cannot be considered as a consumption of the studied building. The consumption of the refectory was assessed (considered to be 17% of the total energy consumption) and subtracted from the total considered for the building. This situation can also be a barrier in the future, creating difficulties to a properly monitoring of savings.

Additionally, it was detected that 4 of the 9 systems of temperature and humidity control (THC) are not working and since this is not the normal mode of operation the electricity consumption for the baseline was corrected to take into account the consumption of the 9 systems.

The building have an intensive utilization, receiving a large number of visitors, and is the working place for a large number of Municipal employees and such activities cannot be interrupted since it is not easy to temporarily move the services to another building. Therefore, renovation options requiring major construction works, incompatible with the normal activities of the building, should be avoided.

One general technical risk is the quality of the products. In a public procurement process the brand and model of the technology cannot be previously chosen and therefore there are always uncertainty regarding the quality of some products proposed by the installers (lifetime, quality of light in the lighting products, etc.).

PV

Some areas of the roof have shading due to a small extra floor (floor 4) and in other area the installation of PV panels would cause shading on the skylights.

The building is not perfectly oriented to south, presenting an azimuth of 20°. Despite the reduction of the production, the PV panels should be installed keeping the orientation of the building (azimuth of 20°) in order to minimize the visual impact.

Envelope

As previously explained, renovation options requiring major construction works, incompatible with the normal activities of the building, should be avoided.

Lighting

Some rooms have a false roof in wood with small square holes, being the luminaries installed above the false roof. The installation of the lamps above the false roof causes a high loss of luminosity, which is aggravated by the difficulty of maintenance of such luminaries. These situations lead to a low visibility in some areas. Therefore, other renovation option would be to move the luminaires to below the false roof.

This retrofit option would increase the comfort level, ensuring a better distribution of light and would facilitate the maintenance. However, such option would not bring a major reduction of energy consumption since the power of lamps cannot be substantially decreased just due to this change. It would be possible to decrease the total power of the lighting system by decreasing the number of lamps. However, such option would require larger changes on the lighting circuits, impossible to achieve without major construction works which would have a large impact on the activities. This would also have much higher costs, reducing the cost-effectiveness of the renovation.

HVAC

The replacement of the several mono-split systems by multi-split systems was not considered, since despite the potential lower purchase cost of multi-split systems the costs of installation would be higher and mainly the impact of the installation process on the building operation would be much higher.

Appliances

ICT appliances (mainly PCs, monitors and printers) represent an important share of the consumption. The replacement of such appliances by new devices is not cost-effective just from the energy savings point of view and therefore this is not considered in the renovation plan. However, in the regular replacement of ICT appliances it is recommended to install just ICT appliances with lower energy consumption.

From the energy savings point of view, the most cost-effective solution is the installation of devices to reduce the standby consumption of ICT appliances, the so called standby killers. However, the potential savings achieved with such devices do not depend on the technology, but on the users' behaviour and therefore a reliable assessment of savings is not possible. Therefore, such measure is not included in the renovation plan, due to the difficulty of assessment, its implementation is recommended.

The building also has 2 lifts 2 small goods lifts. However, the use of such lifts is low since they serve areas without public and therefore the replacement of such lifts by systems with higher efficiency is not cost-effective.

1.2.4. RISCOS ECONÓMICOS / FINANCEIROS

The main economic barrier to the implementation of the renovation plan is the high overall investment, which is aggravated by the lack of public budget and the low availability of financial schemes (mainly due to the economic crises and the transition period between the Community Support Frameworks).

The main economic risk is the reliability of the value considered to the total investment needed to the implementation, due to the following reasons:

- The prices of the technologies present variations over time, and in some technologies such as photovoltaic the oscillations of prices can be high.
- The percentage of price reduction obtained in the public procurement process is uncertain.

1.2.5. OBSTÁCULOS LEGISLATIVOS

There are no major legislative obstacles for the renovation of this building.

1.3. PAÇOS DO CONCELHO

1.3.1. INTRODUÇÃO

The Coimbra Town Hall was built after the demolition of part of the old Monastery of Santa Cruz. The demolitions works and construction was carried out mainly between 1876 and 1879, but some construction works were developed gradually until the beginning of century XX. Figure 9 presents the front façade of the building. The building is located in the downtown.



FIGURE 9: COIMBRA TOWN HALL

The building has 3 floors and 2 intermediate floors with a total area of about 5880m² with a total used surface of about 3711m² and a volume of 40575m³. The roof is made of ceramic tile and has a surface of 1974m². Figure 10 presents the plan view of the building.

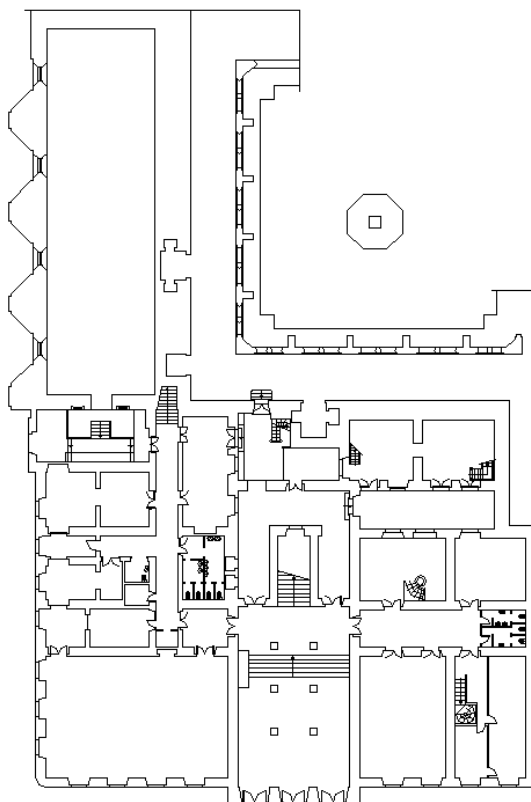


FIGURE 10: PLAN VIEW OF THE TOWN HALL

The building is used as the town hall of the Municipality of Coimbra. Therefore, the building is mainly constituted by offices and storage areas. The building usually has occupation between 7h30 and 19h30 (Monday to Friday). However, the public only have access between 9h00 and 17h00. The building has 220 employees and is visited by a large number of public.

In 2013 the building had an electricity consumption of about 305 MWh and an associated cost of about 60 k€. Figure 11 presents the disaggregation of electricity consumption between uses.

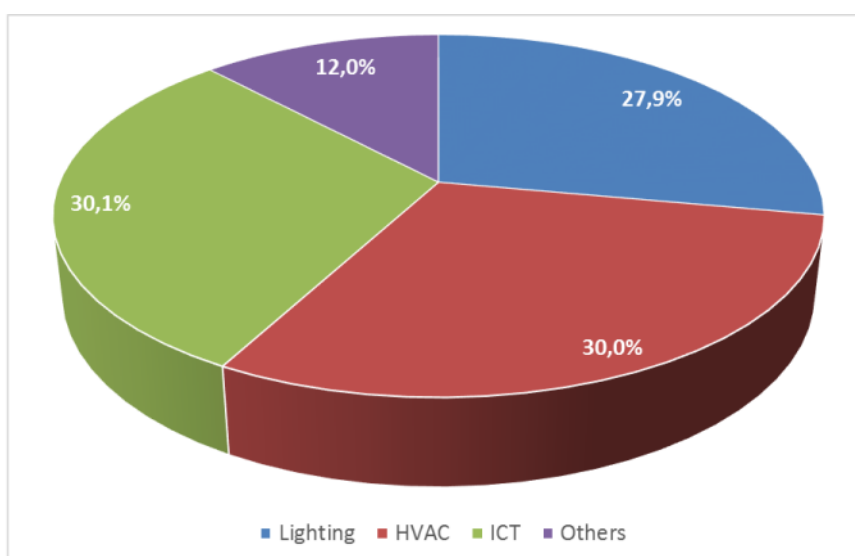


FIGURE 11: DISAGGREGATION OF ELECTRICITY CONSUMPTION BETWEEN USES

1.3.2. PLANO DE RENOVAÇÃO

In the renovation plan the following main options were considered:

- Installation of the PV generation;
- Retrofit of the lighting system;
 - Scenario 1 - Replacement of all T8 lamps with electromagnetic ballast by T5 lamps with electronic; and replacement of the incandescent lamps by CFLs
 - Scenario 2 - Replacement of all lamps by LEDs.
- Retrofit of the HVAC system;
- Replacement of ICT and other appliances.

The selected scenario is constituted by:

- Installation of 126.1kWp of PV tiles;
- Replacement of all lamps by LEDs;
- Replacement of the THC and mono-split systems by systems with higher COP/EER.

1.3.3. DIFICULDADES TÉCNICAS

General

The general technical difficulties are imposed by the protection rules. Since the building is part of the property “University of Coimbra — Alta and Sofia” inscribed on the World Heritage List of UNESCO several strong restrictions are applied in the renovation of such building due to the protection rules. Therefore, it is not possible to implement any change in the building envelope able to cause any visual impact.

The building have an intensive utilization, receiving a large number of visitors and is the working place for a large number of Municipal employees and such activities cannot be interrupted since it is not easy to temporarily move the services to another building. Therefore, renovation options requiring major construction works, incompatible with the normal activities of the building, should be avoided.

One general technical risk is the quality of the products. In a public procurement process the brand and model of the technology cannot be previously chosen and therefore there are always uncertainty regarding the quality of some products proposed by the installers (lifetime, quality of light in the lighting products, etc.).

PV

The orientation of the building is not the optimum, since it presents an azimuth of -10°, and mainly due to the orientation to west of the larger faced. However, this do not represent a major constrain, since the impact on the possible generation level is not too large.

The main restrictions are due to the protection rules. Since it is not possible to implement any change in the building envelope able to cause any visual impact, the use of traditional PV panels was not considered due to its high visual impact. Therefore, it was considered the use of solar tiles to replace the actual roof. This is aligned with the actual regulation that allows the use of PV panels if integrated

into the roof. However, the actual regulation also limits it to a maximum area of 3 m² by building and by keeping this restriction it is not possible to achieve a nZEB level.

Envelope

Due to the protection rules it is not possible to replace the windows by double glazed windows using standard solutions; because the original frame must be kept (the usual solution is to implement other window in the interior). Since this cannot be ensured with standard solutions available in the market, this solution is not cost-effective just from the energy efficiency perspective.

Lighting

The building uses a large number of different formats of lamps and luminaires and for some formats (e.g. 2G11 or F30) the availability in the market and quality of solutions is lower.

HVAC

The replacement of the several mono-split systems by multi-split systems was not considered, since despite the potential lower purchase cost of multi-split systems the costs of installation would be higher and mainly the impact of the installation process on the building operation would be much higher.

Appliances

ICT appliances (mainly PCs, monitors and printers) represent an important share of the consumption. Replacing the PC and monitors by laptops would save, in average, 60% of the energy (a laptop has an average power of 50 W whereas a PC with CRT monitor has an average power of 150W and a PC with TFT monitor has an average power of 100W).

However, the replacement of such appliances by new devices is not cost-effective just from the energy savings point of view due to the high cost of the equipment and therefore this is not considered in the renovation plan. However, in the regular replacement of ICT appliances it is recommended to install just ICT appliances with lower energy consumption.

From the energy savings point of view, the most cost-effective solution is the installation of devices to reduce the standby consumption of ICT appliances, the so called standby killers. However, the potential savings achieved with such devices do not depend on the technology, but on the users' behaviour and therefore a reliable assessment of savings is not possible. Therefore, such measure is not included in the renovation plan, due to the difficulty of assessment, its implementation is recommended.

The main ICT systems receive power from 3 groups of UPS with a total power of 39kVA. Such UPS have a weighted efficiency of 92% and nowadays there are available in the market products with higher efficiency (weighted efficiency of 95% or higher). The replacement of a UPS before the end of its lifetime is not cost-effective. However, in the processes of renovation due to the end of lifetime or due to needed upgrades on the ICT system, such UPS should be replaced by high efficient UPS systems.

1.3.4. RISCOS ECONÓMICOS / FINANCEIROS

The main economic barrier to the implementation of the renovation plan is the high overall investment, which is aggravated by the lack of public budget and the low availability of financial schemes (mainly due to the economic crises and the transition period between the Community Support Frameworks). Other economic barrier is the large payback period of the solar tiles.

The main economic risk is the reliability of the value considered to the total investment needed to the implementation, due to the following reasons:

- The prices of the technologies present variations over time, and in some technologies such as photovoltaic the oscillations of prices can be high.
- The percentage of price reduction obtained in the public procurement process is uncertain.

This risk is higher in the installation of solar tiles, since the availability of such solutions in the national market is low and therefore the reliability of the investment estimation is lower.

1.3.5. OBSTÁCULOS LEGISLATIVOS

Coimbra - part of the historic city center, older University buildings and other urban structures - is since June 22th 2013 inscribed on the World Heritage List of UNESCO. The Property inscribed is called University of Coimbra — Alta and Sofia (<http://worldheritage.uc.pt/>). It is composed of a set of buildings whose history has been associated to the academic institution, either through participation in the process of knowledge production and dissemination, or through contribution to the creation of unique cultural and identitarian traditions. The Coimbra Town Hall is included in this area and therefore strong restrictions are applied in the renovation of such building due to the protection rules. Therefore, it is not possible to implement any change in the building envelope able to cause any visual impact.

1.4. SUMÁRIO

Two buildings present global main technical difficulties due to the use of electricity in other buildings managed by other entities without any metering to ensure the disaggregation of consumption between the buildings. Such situation created difficulties in the design of the renovation plans and can be an important barrier to a properly monitoring of the achieved savings.

The Library and the Town Hall also present other major technical barrier, the incompatibility between use and renovation works, since these buildings have an intensive utilization. Therefore, renovation options requiring major construction works, incompatible with the normal activities of the building, had to be avoided.

The most important general technical risk is the quality of the products. In a public procurement process the brand and model of the technology cannot be previously chosen and therefore there are always uncertainty regarding the quality of some products proposed by the installers (lifetime, quality of light in the lighting products, etc.).

Regarding the economic barriers, the main barrier is the high overall investment, which is aggravated by the lack of public budget and the low availability of financial schemes. In some situations (e.g. the PV installation in the Town Hall) the large payback period is also a strong economic barrier.

The main economic risk is uncertainty on the assessment of the total investment needed to the implementation due the regular variations of costs and uncertainty about the percentage of price reduction achieved in the public procurement process. In the case of the installation of solar tiles in the Town Hall the risk is higher due to the low availability of solutions in the national market.

The main legislative obstacle is the protection level of the Town Hall, since it is part of the property “University of Coimbra — Alta and Sofia” inscribed on the World Heritage List of UNESCO. Therefore, several strong restrictions are applied in the renovation of such building with high impact on the options of renovation in the envelope and on installation of renewable generation. The other two buildings do not have major legislative obstacles.



ENEA – Italian National Agency for New Technologies, Energy and Sustainable Economic Development (IT)



Municipality of Messina (IT)



Municipality of Erreterria (ES)



Municipality of Coimbra (PT)



Municipality of Alimos (EL)



ISR – University of Coimbra (PT)



SINLOC - Sistema Iniziative Locali Spa (IT)



ETVA VI.PE. S.A. (EL)



TECNALIA Research & Innovation Foundation (ES)



EUDITI Energy and Environmental Design LTD (EL)



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