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D5.3 Energy audit report

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1.0	Fergal Purcel	20/05/2014	Irish energy audits (annex 1-2)
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1. Abstract

Deliverable 5.3 focuses on the prepared energy audits reports for the pilot buildings in Bulgaria, Ireland and Spain. Each energy audit report is carried out in each pilot building during the project execution and description of a common audit methodology preparation.

In the presented deliverable are included detailed and professional analyses of different type of buildings such as administrative building, medical centre, leisure centre,

The Deliverable contained results in office pilot buildings after measuring energy use according to D2.3 and D2.4 and highlighting the energy efficiency improvements.

The energy audit reports give detailed information as follows:

- Description of audited pilot building;
- Detailed information of each facility and used energy carriers;
- Energy consumption information for each pilot building;
- Data analysis and building's base line;
- Energy Management Action Plan and Energy Management Matrix included.

Detailed energy audit report information for pilot buildings is given Annex A.

2. Finglas Leisure Center

Finglas Leisure Centre was built in 2003 as a state of the art leisure centre with a total floor area of 2,600 m². It incorporates many energy efficient features including a CHP plant, heat recovery ventilation a BMS and insulated building fabric. Notwithstanding these features, the centre was built over 10 years ago and there is considerable scope for energy efficiency improvement. The energy uses at the leisure centre are natural gas and electricity with monthly bills based on the billing gas and electricity meters on site.

Over 80% of the electricity us used by plant (pumps and fans) with the majority of the remaining 20% used for lighting. The air handling units are the largest single use at 21% for AHU-1 and AHU-2 and an estimated 10% for AHU-3. The pool circulating pumps account for almost 20% of use and miscellaneous pumps and fans for 30%. The main energy saving opportunities centre around improved efficiency and control of this plant with significant savings also attainable through a lighting retrofit. Projects with total savings of 290 MWh or € 43,000 per annum. This represents readily attainable and easily implemented saving of 40% in use with a payback of under 2 years.

There is no gas or heat submetering and therefore no breakdown in thermal energy demands. There are three distinct demands – pool and pool area heating via AHU-1 (supplied by CHP and HE boilers), changing village heating via AHU-2 (supplied by CHP and HE boilers and radiator and underfloor heating circuits supplied by condensing boiler plant. With a gas use of 2.5 GWh per annum and thermal demands of 1.7 GWh per annum there are significant opportunities for improved efficiency.

The analysis of the energy carrier’s consumption and costs is carried out on the basis of the data, received by the Account Department and verified by continuous on-site measurements and data-logging. The natural gas, electricity and delivered heat energy consumption and cost by teh Finglas Leisure Center for the 2012 and 2013 years are shown in table 1.

	2012 kWh/yr	2012 €/yr	2013 kWh/yr	2013 €/yr
Gas	2,322,464	€101,066	2,546,472	€116,355
Electricity Imported	318,053	€64,200	297,175	€62,985
Delivered Heat	1,604,108		1,705,572	
Total Electricity	675,899		726,953	

Table 1: Energy carriers consumption and cost at the Finglas Leisure Center

The BMS controls the 4 boilers on site according to opening hours with temperature control and load management based on return temperatures. There is little control based on climatic conditions (temperature and humidity) within the building. An upgrade of the BMS to include enhanced environmental controls should yield savings in excess of 10%.

A significant proportion (over 70%) of the energy delivered to the swimming pool leaves in the wet exhaust air. Some of this is recovered by the heat exchanger in the pool area ventilation system (AHU-1). However the majority of heat leaves as the latent heat of vapourisation of the moisture in the exhaust air. A heat pump on the ventilation system would recover this energy efficiently and cost effectively yielding and indicative 800 MWh in total final energy use and savings of € 15,000 per annum.

A heat pump (ground source or air source) would be ideally suited for replacing the condensing boiler plant and could save in the region of 350 MWh in final energy.

These are other measures to improve efficiency of the heat supply require more detailed design and consideration and ideally data on the profile and breakdown of gas use. The implementation of these measures may be intrusive requiring significant works in the plantroom and possibly closure of the facility for short periods.

Finglas Leisure Centre is an exemplar site in the National Energy Services Framework and energy savings are planned to be delivered through an EPC. This report will assist in informing the EPC procurement and negotiation process.

Easily attainable electricity savings of 40% (290 MWh/€34,000 per annum) are identified in this audit report. The report indicates potential thermal demand savings of up to 1.2 GWh subject to a detailed energy efficient design process.

NOTE: More detailed information in Annex 1 of the deliverable

3. Tallaght Library

The County Library, Tallaght, which reopened in April 2008 following a major refurbishment program, is in the heart of the cultural quarter of the Tallaght Town Centre, which includes the Civic Theatre, the Big Picture and Rua Red Art Centre. The library extends to over 2,500 m² over three floors with public areas on the ground and upper floors and an open plan office area for staff in the basement.

As electric energy and heat is delivered, unmetered, to the library via the services for the entire South Dublin County Council (SDCC) campus, historic data on thermal and electrical energy use is not available at the moment.

The electricity metering from February to May 2014 indicates a consistent use of 4,400 kWh per week or 230,000 kWh per annum. Lighting is the largest use accounting for 48% with general services accounting for 42% as shown in the usage breakdown below. General services mainly consist of fan coil units and air handling units associated with HVAC for the building (Figure 1).

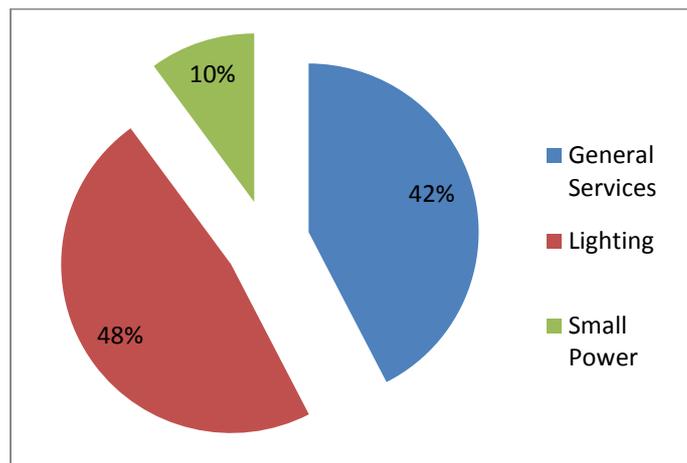


Figure 1: Percentage Allocation of Energy Use at Tallaght Library

The main energy saving opportunities are centred around the general services and lighting loads. There are zero investment cost opportunities to reduce the out of hour's base load for

both lighting and general services, particularly over weekends when the out of hours load is higher.

The usage trend for both lighting and general services is very constant, rising from about four hours before opening time to a constant load and falling again after closing time to the base load. Improved control of both loads could reduce the usage in the four hours leading up to opening time and could also modulate the daytime demand depending on occupancy and conditions.

The lighting fixtures are reasonably new and efficient and predominantly comprise linear T8 fluorescent fittings with electronic ballasts. However, savings of over 40,000 kWh per annum could be made through replacing with more efficient T5 or LED fittings.

NOTE: More detailed information in annex 2 of the deliverable

4. Administrative Building Septemvri

The administrative building of Septemvri Municipality was constructed in 1978 and there was a full reconstruction in 2001. The total built area is 3,687 m². The building is a reinforced construction with brick walls, flat roof, and reinforced concrete floors. The windows are double glazed, with PVC frames and have low infiltration of cold outer air. There are 105 employees working in it, engaged primarily in servicing the local citizens.

The building consumes only electric energy for its necessity. The electricity is supplied by the local electricity supplier EVN-Bulgaria. The analysis of the energy carrier's consumption and costs is carried out on the basis of the data, received by the Account Department and verified by continuous on-site measurements and data-logging. The electric energy consumption and costs by the administrative building for the 2012 and 2013 Years are shown in Figure 2.

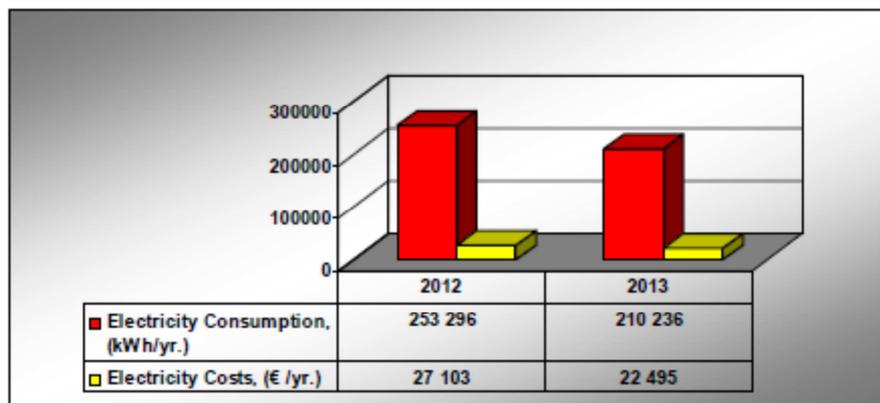


Figure 2: Electricity Consumption and Cost at the Administrative Building

The allocation of the electricity consumption shows mostly considerable part for heating (61%), the office equipment (20%), indoor lighting (13%) and other (6%).

The estimated energy saving measures can include: heat insulation of outer surrounding elements of the building; installation of central heating system; replacement of conventional bulbs by modern energy efficient ones; installation of BMS, which must control the feeding of heat energy depending on outer temperature. The central heating system will consist of internal heating installation, powered by a highly efficient hot water pellet boiler. The implementation of these energy conservation opportunities will lead to energy costs reduction by 40% at least, while the payback period will be below of 4 years.

The potential thermal energy saving opportunities in the administrative building are:

- Heat insulation of outer surrounding elements.
- Heat insulation of building's roof.
- Substitution of existing outer windows and doors by energy efficient ones.
- Installation of hot water pellet boiler for production of hot water with nominal capacity of 75 kW and temperature of outlet hot water of 70 oC.
- BMS implementation which will have an option to control the feeding of wood pellets to the boiler burner depending on outside temperature.

The expected annual electricity savings having implemented the above mentioned measures might reach 155,471 kWh and that is equal in the amount of € 15,547. The payback period is estimated to 2.5 years.

NOTE: More detailed information in annex 3 of the deliverable

5. Medical Center septemvri

The Medical centre building in Municipality of Septemvri was built in 1958, and there was a full renovation in 1992. It is a two-floor building with unheated ground floor. There are 114 employees working in it, primarily medics, who provide only diagnostic medical services to local citizens of the municipality. The Medical centre is visited by about 72,757 citizens per year.

The only energy source used in the Medical centre is electricity supplied by the local electricity supplier EVN-Bulgaria. There is no central heating/cooling system as well as a building management system (BMS). The heating is ensured by electric heating appliances.

The analysis of the energy carrier's consumption and costs is carried out on the basis of the data, received by the Account Department of the Medical centre and verified by continuous on-site measurements and data-logging. The electricity consumption and costs by the Medical centre for the 2012 and 2013 Years are shown in Figure 3.

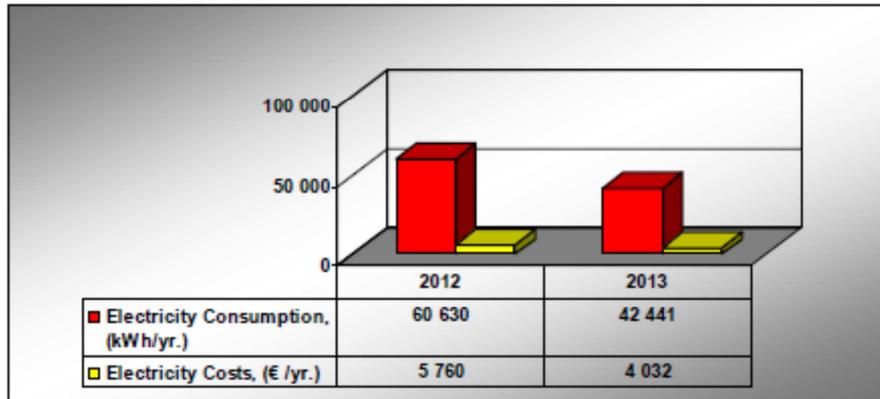


Figure 3: Electricity Consumption and Cost at the Medical Centre

A considerable part of the electricity consumption belongs to heating (46%), but there is a significant consumption by a X-ray device, which is of an older generation. The estimated energy saving measures can include: heat insulation of outer surrounding elements of the building; installation of central heating system in the building; replacement of conventional bulbs by modern energy efficient ones; installation of BMS, which must control the feeding of heat energy depending on outer temperature. The implementation of these energy conservation options will lead to energy costs reduction by 40% at least, while the payback period will be below 4 years.

The potential thermal energy saving opportunities in Medical centre are as follows:

- Heat insulation of outer surrounding elements.
- Heat insulation of building's roof.
- Substitution of existing outer windows and doors by energy efficient ones.
- Installation of hot water pellet boiler for production of hot water with nominal capacity of 50 kW and temperature of outlet hot water of 70 oC.
- BMS which will have an option to control the feeding of wood pellets to the hot water boiler burner depending on outside temperature.

The expected annual electric energy savings having implemented the above mentioned measures might reach 27,617 kWh and that is equal in the amount of € 2,762. The payback period is estimated to 9.3 years.

NOTE: More detailed information in annex 4 of the deliverable

6. City council of Cartaya

The City Council of Cartaya was built in the sixteenth century although carried out a comprehensive reform in 2000, leaving the interior with modern architecture and exterior with the facade without changing. It is located in the center of Cartaya, in Plaza de la Redondela 1. The gross floor area is 1606,3 m² and the occupancy is about 22 days per month and 264 days per year.

The analysis of the energy carrier's consumption and costs is carried out on the basis of the data, received by the Account Department and verified by continuous on-site measurements and data-logging. The imported electricity and delivered electric consumption and costs by the Cultural center of Cartaya for the 2012 and 2013 Years are shown in the next table.

	2012 kWh/yr	2012 €/yr	2013 kWh/yr	2013 €/yr
Electricity Imported	79.373	9.525,48	67.467	8096,04
Delivered HVAC (Electric consumption)	44.096	5.291,52	37.481	4.497,72
Total Electricity	123.469	14.816,28	104.948	12.893,76

Table 2: Energy Carriers Consumption and cost at the city council of Cartaya

The following figure is used to show different electricity use. 28% of the power delivered corresponds to the attic. The SAI and the Police Department are the 19%, and the other significant electricity use are the mayor offices. The main consumption is the light and electrical appliances.

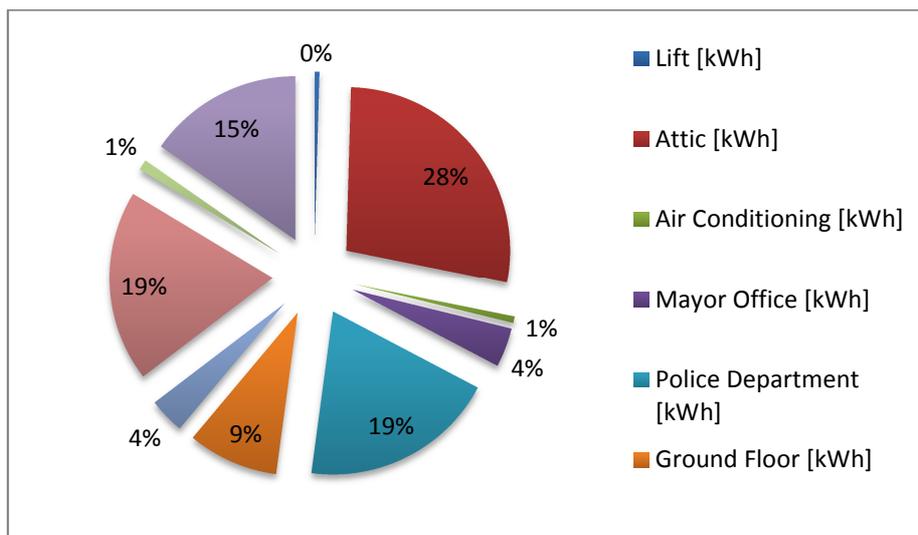


Figure 4: percentage allocation of electricity use at city council of Cartaya

The municipality of Cartaya no gas installation or boiler to heat water. For this reason potential savings opportunities are not covered in this sector.

In the City Council of Cartaya already are implementing austerity energy savings measures to reduce economic costs. Work on the project aims eplace further optimize saving measures that have not been raised yet.

Furthermore, and associated to the city council installation, there is a monitoring equipment installed for teh street lighting consumption in a near street. This is a very good opportunity because the City will look at increases in the energy savings in one of their streets and they have the opportunity to change the consumption.

The consumption obtained is shown in the following table.

	2014 kWh/yr	2014 €/yr
Total Electricity	39.600	4.752

Table 3: Electricity and heat use.

NOTE: More detailed information in annex 5 and 8 of the deliverable

7. Cultural center Cartaya

One of the most important building in Cartaya is the Cultural Center. Is the place where people can be to study, watch a theatre performance, look for some books, learn music, etc.

The Cultural Center of Cartaya was built in 2000 year. The gross floor area is 5103 m2 and the occupancy is about 26 days per month and 12 months

The analysis of the energy carrier's consumption and costs is carried out on the basis of the data, received by the Account Department and verified by continuous on-site measurements and data-logging. The electricity imported and delivered electricity consumption for heating and costs by the Cultural center of Cartaya for the 2012 and 2013 Years are shown in the next table.

	2012 kWh/yr	2012 €/yr	2013 kWh/yr	2013 €/yr
Electricity Imported	88.499	10.619,88	86729,02	10407,482
Delivered HVAC (Electric consumption)	58.998	7.079,76	53098,2	6371,784
Total Electricity	147.497	17.699,64	139827,22	16779,266

Table 4: Electricity consumption and cost at the cultural center of Cartaya

Figure 6 shows different electricity use in the building. 44% of the power delivered corresponds to the Attic. The basement is the 23%, and the other significant electricity use are shared between the others zones. It can understand that the main focus of the consumption goes to conditioning the temperature of the areas.

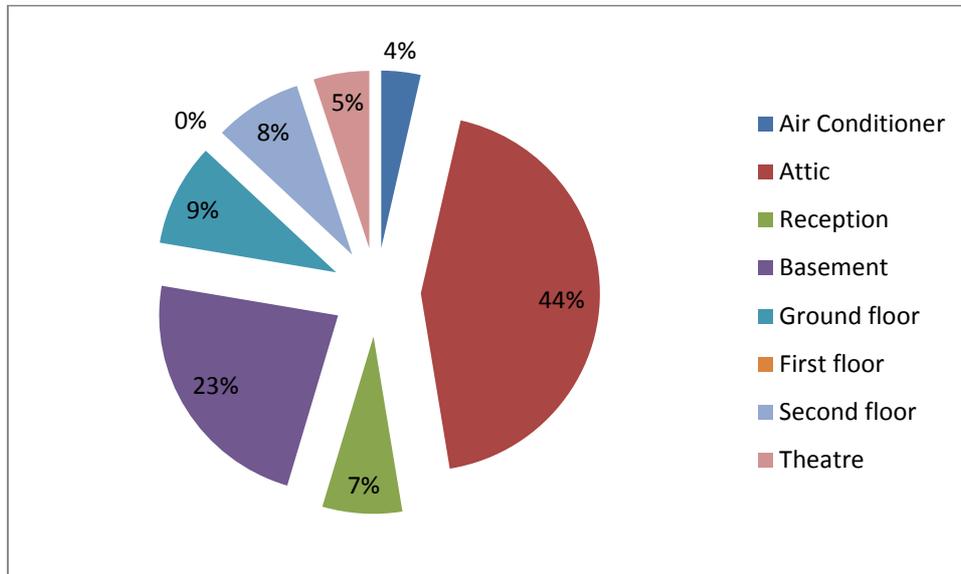


Figure 6: Percentage allocation of electricity use at Cultural Center of Cartaya

The Cultural Center of Cartaya not have gas installation or boiler to heat water. For this reason potential savings opportunities are not covered in this sector.

In a leisure/cultural center you can do many things, and every day has a different visitor, for this reason it is a complicated project to educate people to do certain actions to save energy. It is much easier to make people aware that you always work on the same site that visitors

NOTE: More detailed information in annex 6 of the deliverable

8. Guadalinfo room Cartaya

To understand the usefulness of Guadalinfo Cartaya center must know that this is a promote by Community of Andalusia and is used to disseminate new information, workshops, computer resource center, disseminating content etc. It is really a room that there are many networked computers with printers and some devices. It is over a market building. It is over a market building and was built in 2012. The gross floor area is 25-30 m² and the occupancy is about 26 days per month and 12 months.

The analysis of the energy carrier's consumption and costs is carried out on the basis of the data, received by the Account Department and verified by continuous on-site measurements

and data-logging. The electricity imported and delivered electricity consumption for heating and costs by the Guadalinfo center of Cartaya for the 2012 and 2013 Years are shown in the table 5.

	2012 kWh/yr (estimated)	2012 €/yr	2013 kWh/yr	2013 €/yr
Electricity Imported	5 616	673,92	3508	420,96
Delivered HVAC (Electric consumption)	0	0	0	0
Total Electricity	5 616	673,92	3508	420,96

Table 5: Electricity consumption and cost at the Guadalinfo Center

The following Figure 7 is used to show different electricity use. 84% + 9% of the power delivered corresponds to the ofimatic. The lighting is the 7%, and it is necessary know that there not exist any HVAC system.

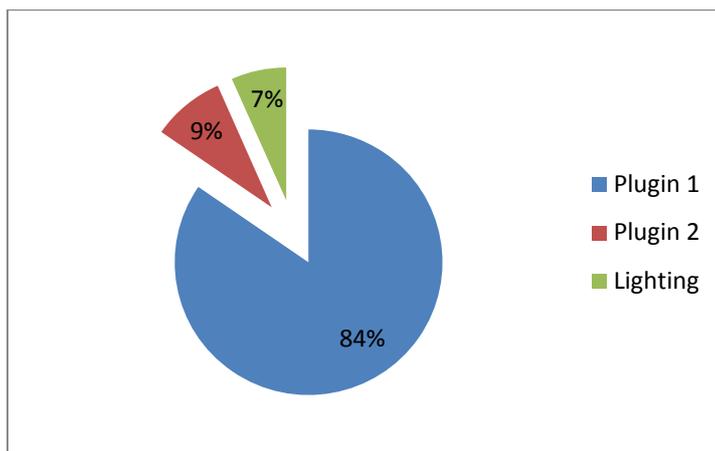


Figure7: Percentage allocation of electricity use at Guadalinfo center

The Guadalinfo Centre not have gas installation or boiler to heat water. For this reason potential savings opportunities are not covered in this sector.

Guadalinfo Center every day has a different visitors, for this reason it is a complicated project to educate people to do certain actions to save energy. However because Guadalinfo is a small place, is very easy aware people by the Guadalinfo Manager, only need to give and show information for each person that enter in the room.

NOTE: More detailed information in annex 7 of the deliverable