

# SUMMARY OF ENERGY-EFFICIENCY MEASURES AT SPEA-PROJECT LIBRARIES

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## 1. AIM

The aim of this document is to describe the energy-efficiency measures defined in the basic projects for the ten libraries that have been studied.

## 2. AREA OF ACTION

The ten libraries that have been studied and where the basic project has been carried out, are the following:

District	Library	Surface area (m <sup>2</sup> )
Ciutat Vella	Barceloneta – La Fraternitat Library	687
Eixample	Sant Antoni – Joan Oliver Library	1,884
Sants – Montjuïc	Poble Sec – Francesc Boix Library	683
Les Corts	Les Corts – Miquel Llongueras Library	1,445
Sarrià – Sant Gervasi	Clarà Library	1,323
Gràcia	Penitents – M <sup>a</sup> Antonieta Cot Library	1,383
Horta – Guinardó	Juan Marsé – El Carmel Library	2,800
Nou Barris	Vilapiscina – Torre Llobeta Library	1,358
Sant Andreu	Trinitat Vella – J.Barberó Library	1,547
Sant Martí	Xavier Benguerel Library	1,996

The areas of action for energy-efficiency measures are:

- Monitoring
- Regulation and control
- **Lighting**
- Climate control
- **Lighting**
- Insulation
- Office automation
- User awareness
- Water consumption
- Others

The actions to be carried out in each library will be selected in order to affect the existing facilities as little as possible, while maximizing energy savings.

### 3. ACTIONS

The energy-efficiency actions defined in the basic projects are grouped into the 8 actions listed in the following table.

ACTIONS		Definition
A1	Action 1	Protection from Sunlight
A2	Action 2	Lighting Replacement
A3	Action 3	Installation of presence detectors
A4	Action 4	Installation of natural-light detectors
A5	Action 5	Installation of presence + natural-light detectors
A6	Action 6	Lighting systems
A7	Action 7	Exterior lighting
A8	Action 8	Plumbing features

#### 3.1 CRITERIA FOR SELECTING ACTIONS

The criteria used to define which actions should be implemented in each of the 10 libraries that have been studied are shown in the following table.

	Definition	Indicative elements / Examples (non-limiting)	Criteria
A1	Protection from Sunlight	Solar filters, interior curtains, awnings	-Windows without protection, allowing direct sunlight to enter  -Windows facing south-east and south-west, without exterior protection  -Exception for windows subject to complaints by users due to solar radiation
A2	Lighting Replacement	LED  Electrical ballast	- Incandescent lamps  - 50 W dichroic lamps  - Electrical ballast is only replaced when another action is carried out on the lighting system
A3	Installation of presence detectors	Presence detectors  Electrical ballast	- Public toilets  - Staff toilets where detection is not planned  - Public work rooms  - Staff work rooms with switches - No action  - Electrical ballast is only replaced when another action is carried out on

			the lighting system -ON-OFF with presence detectors
A4	Installation of natural-light detectors	Twilight detector Electrical ballast	<ul style="list-style-type: none"> <li>- First line of lighting next to windows where natural light enters and according to visit</li> <li>- 1 detector is considered as maximum 10 lights</li> <li>- Electrical ballast is only replaced when another action is carried out on the lighting system</li> <li>- Dimmable 1-10V with twilight detectors</li> </ul>
A5	Installation of presence + natural-light detectors	Presence detectors, twilight detectors, electrical ballast	<ul style="list-style-type: none"> <li>- Study rooms with inconstant user-access, and with windows allowing natural light to enter</li> <li>- Electrical ballast is only replaced when another action is carried out on the lighting system</li> <li>-ON-OFF with presence detectors</li> <li>- Dimmable 1-10V with twilight detectors</li> </ul>
A6	Lighting systems	Handsets	<ul style="list-style-type: none"> <li>-Light control from an electric panel, handset installation at the staff desk on each floor</li> <li>- Light switches not used, handsets at the entrance for switching lights on and off on each floor</li> </ul>
A7	Exterior lighting	Programmable astronomi	- Exterior lighting without control system
A8	Plumbing features	Double flush Time-regulated taps	<ul style="list-style-type: none"> <li>- Toilets with single-flush cisterns</li> <li>- Washrooms for library users with conventional taps</li> <li>- Staff office and washrooms - no action</li> </ul>

### 3.2 DESCRIPTION OF ACTIONS

A general description of the 8 actions to be undertaken follows below.

#### 3.2.1 Action 1: Protection from sunlight

The installation of solar filters, interior curtains and awnings on the window panes of the various facades and floors, according to the criteria defined in the previous section.

### 3.2.2 Action 2: Lighting Replacement

The replacement of existing lighting, according to the criteria defined in the previous section, with LED lighting in the same positions, using the same holes.

The electrical connections that are to be installed consist of connecting the wiring of the current lighting connectors with those of the new lighting.

### 3.2.3 Action 3: Installation of presence detectors

The installation of a movement detector for switching on lighting for every area, according to the criteria defined in the previous section. Each detector will act directly on each lighting group's power lines, switching on the lighting for each area when it detects movement and switching it off after a programmed period of time following the last detected movement.

### 3.2.4 Action 4: Installation of natural-light detectors

The installation of a lighting-regulation system, by means of a twilight detector, according to the criteria defined in the previous section. This new system will make the best use of the natural light that enters through the windows.

The system consists of a photocell that measures ambient light intensity. This is incorporated into the lighting for the direct control of 1-10V (HF+R) dimmable electrical ballast, gradually reducing lighting intensity when the ambient light intensity on the floor area under the photocell is above a previously selected value.

In order to allow for lighting adjustment it is necessary to replace the existing electrical ballasts with dimmable 1-10V input electrical ballasts.

The photocell is coupled to a light and wired to the 1-10V dimmable electrical ballast of that light and the other electrical ballasts: this is done in accordance with the maximum limits permitted by the manufacturer.

The regulation of these photocells is carried out at times when there is not much light, in order for it to be effective. It is programmed so that it switches on the lights when the level of natural light is below the intensity that artificial lighting can provide.

This system is independent from the on/off lighting systems and the electric power supply for each light. The system directly regulates the light intensity of each group of lights as long as they have electric current.

### 3.2.5 Action 5: Installation of presence and natural-light detectors

The installation of a lighting-regulation system, by means of a twilight detector, according to the criteria defined in the previous section.

This new system aims to make the best use of natural light entering through the windows and to ensure that the lights are automatically switched off when there is no one in the room.

The system consists of three PIR sensors connected in parallel which register people's presence and a photocell that measures ambient light intensity. The photocell is incorporated into the lighting for the direct control of the 1-10V (HF+R) dimmable electrical ballasts, gradually reducing lighting intensity when the ambient light intensity on the floor area under the photocell is above a previously selected value.

In order to regulate downlights, it is necessary to replace the current electrical ballasts with 1-10V input dimmable electrical ballasts.

The photocell will be coupled to the light, wired to the 1-10V dimmable electrical ballast of that light and connected to the other electrical ballasts: this is done in accordance with the maximum limits permitted by the manufacturer.

The regulation of these photocells is carried out at times when there is not much light, in order for it to be effective. It is programmed so that it switches on the lights when the level of natural light is below the intensity that artificial lighting can provide.

This system is independent from the on/off lighting systems and the electric power supply feeding each screen. The system directly regulates the light intensity of each group of lights as long as they have electric current.

### 3.2.6 Action 6: On/off lighting systems.

The installation of a handset for switching the lights on each floor on or off, located at the staff desk of each floor and/or area, according to the criteria defined in the previous section.

The handset will have as many switches as the electric control panel has wiring for.

Therefore, there will be electric wiring from the safety switch for each line to the corresponding switch, with the addition of a power contactor located on the electric control panel, for carrying out the corresponding actions.

### 3.2.7 Action 7: Exterior lighting

The replacement of analogue clocks by IC Astro 1 C programmable astronomical twilight switches. This means that time changes will be carried out automatically

. Time-adjustment functions can be added for control according to the hours of sunlight.

### 3.2.8 Action 8: Plumbing features

Replacement of single-flush toilet cisterns by double-flush cisterns in order to allow 3 or 6-litre flushes.

In addition, the replacement of conventional taps on wash basins by push-button time-regulated taps.