Lighting refurbishment in commercial parking area using advanced lighting control system

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***Abstract* – Paper describes the lighting refurbishment of the The Mall Athens underground parking areas and the installation of a lighting management system based on DALI (Digital Addressable Lighting Interface) communication protocol. In order to achieve the maximum energy savings and minimize the maintenance costs, the installation of a lighting management system was crucial. The choice of luminaires with adequate photometrical characteristics, lighting control and the resulting energy savings are presented in this paper.**

***Keywords* - energy savings, energy management system, DALI, parking illumination, lighting control.**

I. Introduction

ILLUMINATION of a parking area is undoubtedly a project of great importance. What makes this project special though, is not the lighting installation but the implementation of a sophisticated lighting management system.

The 2500 old fashioned 2x36W damp-proof luminaires have been replaced by new DALI dimmable fixtures equipped with 2x25W & 2x50W TL5 lamps. Additionally 12 controllers and 25 motion sensors were installed, all managed by a dedicated server equipped with the software Polaris 3D of the company Encelium-Osram.

The implemented customized commercial parking lighting solution:

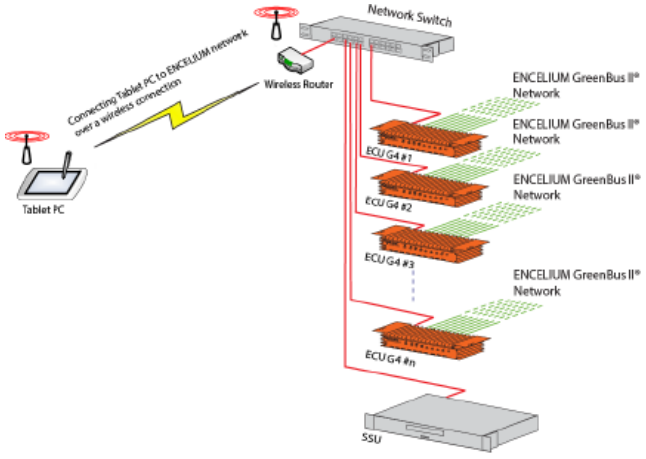
- provided important energy savings, approximately 65%
- reduced maintenance costs
- increased safety and personal security in the area
- provided flexibility
- improved overall illumination levels and quality

II. Main Text

A. Installation

In this project the following equipment has been installed:

- 2500 damp-proof DALI fluorescent luminaires
- 12 ECU controllers (4 ECU per level)
- 25 Motion sensors
- 1 Server equipped with the Encelium Polaris 3D interface



Picture 1 System structure

B. After installation planning

After the installation, all units have been uniquely addressed on site.

Once the luminaires were installed, the measured illuminance was beyond standard illumination levels needed for the parking area so every fixture was dimmed down to 90%.

According to the client's needs, the parking area was separated in two main sectors: the constantly operating area which visitors constantly use and the area which is open to public only on rush hours.

The lighting of the constantly operating area is fully automated, being controlled by a time schedule, while the other areas are switched on and off manually and controlled by motion sensors.

The time schedule is able to switch on, switch off, and recall scenes with predetermined dim levels, for example: switch on 09:00-00:00 to 90% intensity, after 00:00 dim to 50%, and switch off all the lights at 04:00, leaving switched on only the necessary lights for safety precautions.

Luminaires controlled by motion sensors are operated in the following way:

- 50% standby mode
- If a sensor is triggered dims up to 90%
- Returns back to 50% after sensor deactivation (10min)

Picture 1 depicts a parking level where both above mentioned sectors are used. Bottom-half sector in yellow color operates on a time schedule, while the upper-half level is controlled by sensors. Yellow color represents 90% intensity, green 50% and blue represents switched off luminaires (0%).

Picture 2 Example of a floor operating on both scenarios

Picture 3 Yellow area switched on from a motion sensor

C. *Other System advantages*

Polaris 3D software is able to provide feedback from every addressable unit of the system.

For example:

- ballast failure
- lamp failure
- communication errors and ECU errors

With the 3D visualization of the site there is real time information about the exact location of the failed unit.

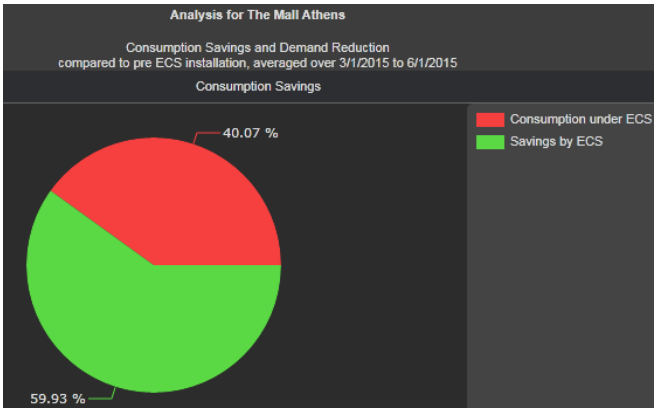
That makes maintenance much more efficient, reducing labor costs, increasing safety.

D. *Energy Consumption under lighting management system*

At the same time Polaris 3D is able to live record and save every information for all the components on the site.

This information can be for example the operational status analysis or the occupancy analysis of the whole site, of each floor, each area or each individual unit.

This way the user can retrieve information based on energy consumption for any period of time, and additionally compare it with the consumption of the prior installation. As seen in Picture 3, consumption over a trial period of 3 months was 60% less.



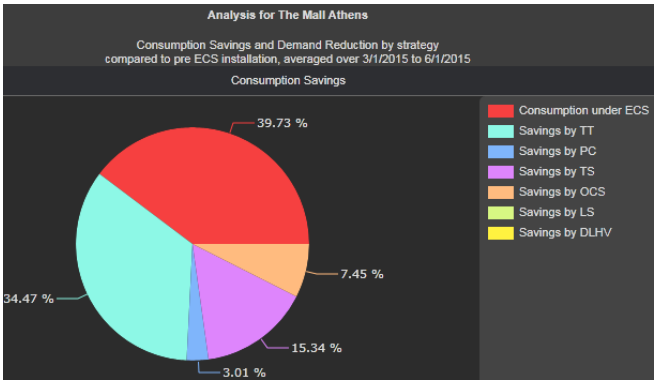
Picture 4 Consumption analysis over a 3 month trial period

Encelium offers six strategies for saving energy, which are coordinated and optimized using sophisticated software algorithms. As a result lightings energy consumptions can be reduced up to 75% without compromising light quality.

For example, Pic. 4 shows energy savings of:

- Task Tuning (TT) eliminates "over lighting" by setting a maximum luminous flux intensity below 100%
- Time Schedule (TS)
- Personal Control (PC)
- Occupancy Control System (OCS).

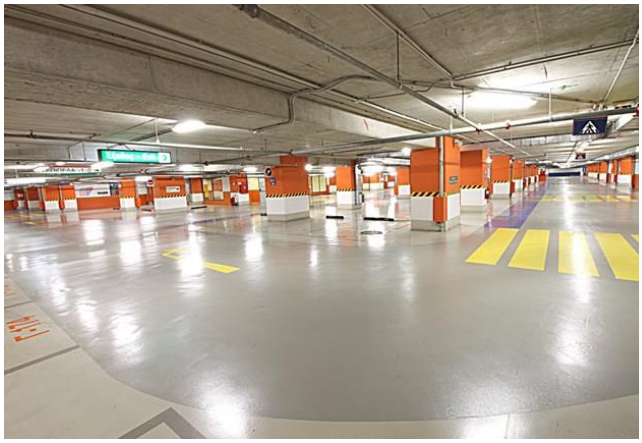
Additional strategies such as Load Shedding (LS) and Daylight Harvesting (DLHV) where not implemented on this project.



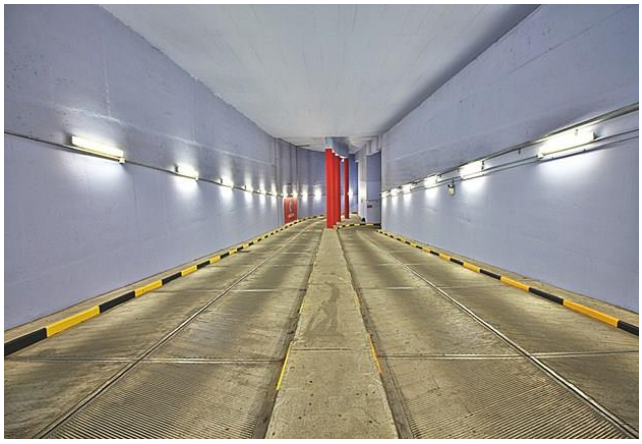
Picture 5 Consumption analysis by strategy

E. *Project Photos*

Picture 6 Corridor 1



Picture 7 Corridor 2



Picture 8 Exit

Picture 9 Entrance

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