MAtchUP

D2.6: Public Lighting in Valencia – First version

WP 2, T 2.4

September, 2019 (M24)

Authors: Eva Muñoz (ETRA)
MAtchUP - SCC-1-2016-2017
Innovation Action – GRANT AGREEMENT No. 774477

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### Technical References

<table>
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<th>Project Acronym</th>
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<td>Project Title</td>
<td>MAximizing the UPscaling and replication potential of high-level urban transformation strategies - MAtechUP</td>
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| Project Coordinator | Ernesto Faubel  
Ayuntamiento de Valencia  
efaubel@valencia.es |
| Project Duration | 1 October 2017 – 30 September 2022 (60 Months) |

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<td>Task</td>
<td>T 2.4 – Smart Energy Infrastructures</td>
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<td>Contributing beneficiary(ies)</td>
<td>1 (VLC)</td>
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Abstract

The design and development of an innovative concept of smart lighting, integrating recharging points into the luminaires of Valencia and integrating smart lighting control systems is the focus of the MAtechUP intervention “Public Lighting”. In this context, new tele-management devices have to allow smart control of the street lighting and innovative tools must be used by the public administrations for a smart management of the system.

MAtechUP project is implementing two actions with a focus on the public lighting infrastructure in the city of Valencia, with the involvement of several partners in the Valencia demo site in charge of designing, developing and deploying the technical solution:

A.26 – 10 humble lamp-posts
A.27 – Smart lighting – 4000 street lamps

According to the project work plan, this intervention has been designed in Task 2.1 and documented in D2.1 (M12) and D2.14 (M24), “Valencia Lighthouse interventions detailed definition” reports. The implementation of public lighting services is effectively taking place in Task T2.4, Smart Energy Infrastructures, Subtask 2.4.2 Public Lighting.
1 Introduction

1.1 Objective

This report is aimed at delivering the main outcomes of Subtask ST2.4.2 – Public lighting in a first version which covers the implementation until September 2019 (project month M24). The final version of this report (i.e. D2.18) will be delivered in September 2020 (project month M36).

The main objective of the document is to provide a description of the two actions that are part of this task, including a technical definition and the implementation plan of each action. Actions are also related with the successful deployment of smart lighting infrastructure in Subtask 2.4.2, therefore it becomes very relevant to show the detailed progress of this implementations as well as to identify possible blocking issues or barriers to overcome in this stage. The above-mentioned actions are the following:

A.26 – 10 humble lamp-posts
A.27 – Smart lighting – 4000 street lamps

1.2 Table of acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>CCTV</td>
<td>Closed Circuit Television</td>
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<tr>
<td>DSO</td>
<td>Distribution System Operator (electrical production)</td>
</tr>
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<td>EIP-SCC</td>
<td>European Innovation Partnership on Smart Cities and Communities</td>
</tr>
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<td>ERDF</td>
<td>European Fund of Regional Development</td>
</tr>
<tr>
<td>EV</td>
<td>Electric Vehicle</td>
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<tr>
<td>IDAE</td>
<td>Instituto para la Diversificación y Ahorro de la Energía</td>
</tr>
<tr>
<td>LED</td>
<td>Light-Emitting Diode</td>
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<td>M2M</td>
<td>Machine to Machine</td>
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1.3 Contribution from partners

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<td>ETRA</td>
<td>T2.4.2</td>
<td>Deliverable and Leader of action A27. ToC. Chapter 1 (Introduction), 3 (Technical definition of the interventions), and 6 (Conclusions).</td>
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<td>LNV</td>
<td>T2.4.2</td>
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Table 1 – Contribution from partners to D2.6
1.4 Relation to other project activities

The tables below depict the main relationship of this deliverable to other activities (or deliverables) developed within MAthUP. These dependences should be considered along with this document for further understanding of its content.

<table>
<thead>
<tr>
<th>Action</th>
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<tr>
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**Table 2 - Relation to other actions in the project**

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Relation to D2.6</th>
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<tr>
<td>D2.8</td>
<td>D2.8 reports the new services on sustainable mobility in Valencia which are developed on top on the infrastructures defined in D2.7 and also as a result of A26.</td>
</tr>
<tr>
<td>D2.14</td>
<td>The contents in this deliverable are directly linked to Valencia lighthouse interventions definitions which are reported in D2.14</td>
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<tr>
<td>D6.x</td>
<td>This document includes preliminary information about financial plans and the accompanying business model structure of interventions. It is thus directly linked to WP6 (Exploitation and Market Deployment).</td>
</tr>
<tr>
<td>D2.18</td>
<td>D2.6 is the basis for Deliverable D2.18 that will be the final version.</td>
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**Table 3 - Relation to other activities in the project**
2 General overview

According to the EIP-SCC\(^1\), there are 60-90 million lampposts across Europe; 75% of which are more than 25 years old. They consume between 20 and 50% of a city’s energy budget. A single digit percentage of them use high efficiently (LED) lamps. An upgrade to LED can save 50-70% of energy costs – that’s ~€2 billion at an EU-wide level; as well as 50% of the maintenance costs.

The status in city of Valencia by 2017 was as follows: the public lighting system in Valencia had a total of 744 control centers, which managed a total of 101,328 lampposts. Only 71 of them had remote control equipment installed, which allows acting on the switching on and off manoeuvres and on flow reducers, collecting the states of those actions to verify that the orders have been executed correctly, and collecting the electrical parameters of the installation.

These remote control devices, in charge of managing and acting on the street lighting autonomously, communicated with a specific public lighting web platform, which managed more than 450 control centers throughout the Spanish geography. This has allowed to optimize the on and off schedules over the years, and therefore, to reduce consumption.

The remote control devices allowed MODBUS communication with network analyzers, that read electrical parameters. They have digital inputs and outputs, for the management of manoeuvres, control of their status and alarm generation, and depending on the model, they have analogue inputs for monitoring complex sensors and temperature probes for recording operating ranges. Furthermore, these devices had GPRS communication with the platform server, which guarantees bidirectional communications, so that the devices launched a communication to inform in real time when they have an alarm instead of waiting to be asked by the server (as in GSM or polling communications).

This public lighting platform had a large number of functionalities and capabilities, which have been acquired over the years of experience, while adapting to the different circumstances and needs of the evolution of public lighting in Spain.

The current lighting management platform is a modular solution, in which maintenance personnel, municipal technicians and personnel attending breakdown calls have all the necessary tools for their daily work: inventory management, on and off operations both scheduled or by means of manual orders in exceptional situations (parties, events, ...), work orders, energy management, invoice checking, saving indicators according to the IPMVP protocol, geographical viewer, etc. All of this, just by accessing the platform via web with username and password.

The total number of control centers, lines, supports, luminaires and lamps in the city of Valencia are inventoried on this platform, regardless of whether or not they have telecontrol equipment installed. Those control centers that do not have telecontrol equipment cannot currently be managed remotely.

\(^1\) [https://eu-smartcities.eu/](https://eu-smartcities.eu/)
Valencia Smart City Office\(^2\) is an entity created to make Valencia smart by helping all the stakeholders of Valencia’s socio-economic environment to use technology to solve public problems and achieve a better quality of life for citizens.

In 2017, the municipal lighting services were integrated as part of this Smart City Office. In the context of the Valencia Urban Agenda 2030, several projects are taking place and some of them are dealing with public (smart) lighting. Besides MAtchUP, which is implementing specific actions as those reported in this deliverable, also the project “Impulso VLCi” is promoting some activities in this context.

The ‘IMPULSO VLCi’ project, presented by the Valencia City Council, was awarded in 2018 as beneficiary of the ‘II Call for Smart Cities’ of the Spanish Ministry of Energy, Tourism and Digital Agenda. It had a budget of 5,998,733.46 euros, which will be contributed 70% by the Ministry, through Red.es, and 30% by the City of Valencia, with the co-financing of the European Fund of Regional Development (ERDF).

As part of IMPULSO VLCi, the Smart Lighting initiative will provide of intelligence by means of control units to 65 control centers and 2,000 luminaries in the Northern and Southern districts of the city. Thanks to these devices, information on the status of the different lighting sections that exist in these areas can be made available in real time, and environmental sustainability can be improved by drastically reducing consumption. In turn, valuable indicators (KPIs) related to consumption, luminaire availability, indexes, etc. can be calculated, substantially improving the service offered to citizens.

![Figure 1 Projects in the Smart City Office Roadmap](image-url)

The humble lamppost initiative of the EIP-SCC\(^3\) is an ambitious and innovative action within the targets of the European Commission towards the identification of new business models that will improve quality of life, competitiveness and sustainability of our cities in a smart way.

\(^2\) [http://smartcity.valencia.es/es/](http://smartcity.valencia.es/es/)

\(^3\) [https://eu-smartcities.eu/initiatives/78/description](https://eu-smartcities.eu/initiatives/78/description)
The initiative intends to exploit the city-wide lighting infrastructure to deliver new value-added services: i.e. multi-purpose the asset to increase savings; deliver better services; and offer additional revenue potential for cities. This provides a compelling financial case to act and opens the opportunity to multi-purpose the lamppost to provide smart services. Smart street lighting provides more than just light. In the future, city lampposts could monitor a broad range of environmental issues such as noise and air quality, increase connectivity at a hyper-local area, provide CCTV to improve public safety or allow the integration of charging points for electric vehicles. This last technology is the object of MAtchUP, and it is currently one of the less matures in the humble lamppost ecosystem. While some other initiatives can assume the use of lamppost to supply the power for low-power consumption devices (cameras, wi-fi access points, environmental sensors), a EV charging point requires higher power supply, which means additional electrical connections and a change in the configuration of the public lighting system. This makes the system to become more complex and hinder the deployment by cities.

Figure 2 – Humbles lamppost possibilities (source: https://eu-smartcities.eu/)
3 Technical definition of the intervention

Public lighting actions, including repurposing actions in line with the humble lamppost initiative of the EIP on SCC, are part of the interventions at city level aimed at improving several infrastructures closely linked with a specific district: With regards to the Valencia demo site in MAtchUP, the intervention of Public Lighting in Valencia encompasses two actions focusing the Poblats Maritims district:

A.26 – 10 humble lamp-posts (ETRA)

This action will integrate 10 recharging points into the luminaries of the city and smart lighting control system. Then, the activity will design and deploy the recharging light points, as well as integration of the new data into the VLCi urban platform. Plans will also be elaborated on how to locate and deploy strategically the recharging points based on the different demands and needs of Valencia city, and how these interact with other systems. In addition, a High Efficiency Lighting Intelligent and Optimized control system will be integrated with the overall energy management system and with the newly designed recharging light points. The control will be deployed as a modular Street lighting Management system, as service of the VLCi platform, that involves all the necessary aspects to make a comprehensive and efficient control of lighting installations, aiming the achievement of up to 34% of savings.

A.27 – Smart lighting – 4000 street lamps (VAL)

This action will replace 4000 street lamps in the Nazaret area of the Poblats Maritims district. This substitution will consist of new and more efficient light bulbs, which integrate M2M innovative tele-management devices. These new luminaires will be monitored and managed through the VLCi platform, which will allow the reduction of the energy consumption, as well as the maintenance costs thanks to the surveillance service that is provided.
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under Grant Agreement N°774477
4 Executive project of the actions

4.1 A.26 – 10 humble lampposts

4.1.1 Management structure

The team in charge of the implementation is composed of ETRA and VAL as main agents, furthermore LNV will assist VAL when it is required.

ETRA will lead the action, designing and implementing the technical solution.

VAL will purchase the equipment related to the lampposts and charging stations. ETRA will purchase the control units for the smart control of the lamps.

There will be some third parties involved, as managers of the public infrastructures in which the deployment is foreseen: La Marina and Polideportivo Municipal Samaranch.

4.1.2 Technical specifications of the city infrastructure

Overall, the humble lamppost infrastructure must focus on the improvement of energy efficiency in lighting installations and to offer added value services. The main characteristics of the system to be deployed within MAtchUP have been identified as follows:

- It will include smart lighting and control system
- It will add presence detection and control (vehicles and pedestrians)
- It will integrate a smart charging point

Furthermore, the new lampposts will be integrated with the rest of the lighting infrastructure of the city council.

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Figure 4 – Dashboard for lighting system management
The following objectives have been identified:

- Reduction in energy consumption
- Reduction of CO₂ emissions
- M2M tele management and a smart management system for the street lamps
- New open data
- Possibility of adjusting the light basing on conditions
- Reduction of maintenance cost per lamp before & after
- Reduction in energy bill
- Increase security at the streets
- Increase the comfort

An analysis had to be performed regarding the conditions of use and identification of lampposts participating in the action:

- Number of Street lights.
- Availability of LED luminaries
- Location.
- Electrical connections.
- Existing Monitoring and Control Equipment (if any). This can be covered by the action, if that is the case.
- Ex-ante analysis (for baseline identification)
  - Current Consumption (bills)
  - Technical specification of lamps (power) and use (schedule)

### 4.1.3 Planning of the tasks

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(1) Design and specifications
(2) Selection of equipment and installers
(3) Acquisition and Installation of hardware
(4) Deployment of software
(5) Start of operation
(6) Monitoring

**Milestones:**

M1: Purchase of equipment (lamppost, control units, charging station)
M2: Equipment installed
M3: EV charger integrated in platform for public charging system (A20)
M4: Lamppost integrated in platform for smart lighting (A27)
4.1.4 Health, safety and waste management requirements

Health issues as the promotion of EV will reduce GHE, so CO2 and NOx reduction. Safety and waste issues are to be considered since this action has civil works associated, therefore all procedures as defined by current regulations need to be fulfilled.

4.1.5 Risks and proposed risk-mitigation measures

Main risks are related to the availability of places for the deployment of the humble lamppost and the restrictions imposed by the municipality related to the public lighting system. In case of barriers coming from the Street lighting Department of the city, additional locations need to be identified which do not depend on the city.

4.2 A.27 – Smart lighting – 4000 street lamps

4.2.1 Management structure

This action is led by VLC, with the support of LNV. ETRA is service provider for the lighting system in the city of Valencia, therefore they also support this action regarding technical details.

4.2.2 Technical specifications of the city infrastructure

The Light Efficiency Plan of Valencia City Council began in 2015 with a shutdown plan as the first saving measure in public lighting, a selective shutdown of 4,125 lights in several over-lit areas.

Afterwards, Valencia has focused on the implementation of efficient public lighting measures, with an investment of more than 15M€ including own funds, through participation projects, through financially sustainable investments or through IDAE credits. More than 50% of the installations of public lighting in the city have been changed, and important economic savings have been achieved.

Procurement process, September 2017: Improvement of the energy efficiency of the public lighting installation in the northern area of Valencia city. The objective was the replacement of more than 3,000 streetlamps that resulted obsolete and not efficient, also including the equipment for the remote control (control units).

IDAE 2017 call (Procurement in May 2018): Replacement of more than 5,700 streetlamps by efficient LED-based lamps including a control unit for integration in the smart lighting system.

4 IDAE is the Spanish Government’s Institute for the Diversification and Saving of Energy, see https://www.idae.es/en
Therefore, the city infrastructure before launching this intervention of Valencia included about 10,000 streetlamps intended to be part of the smart lighting system.

Valencia City Council is managing the smart lighting system through the use of several tools, that depend on the area covered by each of the subcontractors providing the solution. ETRA is one of these technology providers and therefore has developed and implemented a platform for the smart management of this system and to respond to all of the issues related to the Management of the street lighting of a city: Remote Management, Energy Management and Maintenance.

HELIOS is the tool that allows the integration of monitoring equipment lights and lighting fixtures from different manufacturers and technologies, all managed from a common system, without the need of depending on a particular supplier. It contributes in this way to the reduction of energy consumption and energy efficiency for these types of facilities.

![Figure 5 - Platform for smart lighting](image)

### 4.2.3 Planning of the tasks

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(1) Design and specifications  
(2) Tendering process  
(3) Installation of hardware (control units)  
(4) Start of operation  
(5) Monitoring

**Milestones:**  
M1: Selection of contractor  
M2: Equipment installed  
M3: Integration in Smart Lighting platform
4.2.4 Health, safety and waste management requirements

Health issues applies in terms of the user comfort as a consequence of the action. Safety issues need to be considered since intervention in the public lighting network are expected. Therefore, all procedures as defined by current regulations need to be fulfilled.

Regarding Waste issues, replaced equipment will be brought to a selective garbage center.

4.2.5 Risks and proposed risk-mitigation measures

The installation of about 3,000 additional smart lighting street lamps left to complete the action need to be allocated to a contractor still to be defined by a tendering process. In case this process is delayed, VLC has to articulate an alternative procedure to ensure the new street lamps are modified as expected.
5 Implementation plan

5.1 Status of the intervention

5.1.1 A.26 – 10 humble lampposts (ETRA)

The first stage in the implementation of this action was the requirements definition, with the analysis of potential lamppost locations according to their availability and characteristics for the project purposes.

After different meetings with the Street lighting Department from Valencia City Council, several barriers were detected related to the deployment of a humble lamppost for EV charging points within the network managed by the city. Basically, power supply for the street lighting system is managed by the municipality (Valencia), not by the DSO, therefore the possible need for a new wiring installation to support the higher energy supply required by EV chargers cannot be assumed.

Therefore, new locations were analysed which are not part of the public lighting system, but managed from some other entities:

- La Marina\(^5\), a public space in the area of Valencia Port (9 lampposts) managed by Consorci Valencia 2007.
- Municipal Sports Center Samaranch (1 lamppost), managed by Municipal Sports Foundation.

Following, technical specifications have been defined:
- Existing lighting specifications: lamps (power) and use (schedule).
- Electrical connection specifications in place.
- Charging points specifications: Intensity (A), Tension (V), Rated power (kW), etc.

\(^5\) [http://www.lamarinadevalencia.com/](http://www.lamarinadevalencia.com/)
• EV Charging Point characteristics:
  o Manufacturer and technical specs.
  o Monitoring and Control (basic charging manager).
  o Monitoring and Control (remote management, if any).
  o Use of Charging Point:
    ▪ Public vs. private.
    ▪ Access rights and payment.
    ▪ Integrated with the rest of charging points of the city (A20).

![Image of a humble lamppost for light EV charging – Idea of installation]

Figure 6 – Humble lamppost for light EV charging – Idea of installation

• Design. Main functionalities in lighting:
  o Smart Lighting and control system.
  o Presence detection and control (vehicles and pedestrians).
  o Smart Charging Point (as example of added value service).

Finally, also the platform integration was designed, with the definition of the data models for integration with VLCi

5.1.2 A.27 – Smart lighting – 4000 street lamps (VAL)

We focus mainly in the Poblats Marítims District, which is the target of MAtchUP. There are currently about 1000 streetlamp which have already been deployed. Plans for the deployment of additional 3000 streetlamps are part of a public procurement to be launched.

The Street lighting management system has the following features:

• Measurement of energy consumption and electrical parameters
• Monitoring of the panel through the available digital inputs (open door, contactor status, protection trips, etc.)
- Reception and execution of Lighting Plans defined in the system. Execution of the Plan even if communications with the Control System are lost.
- Internal storage of the monitored data in case of loss of communications.
- Integration with municipal GIS
- Data in real time provided to VLCi

![Diagram of VLCi platform with GIS integration](image)

**Figure 7 – Smart lighting management system link to VLCi**

![Screenshot of Smart Lighting Management system tool](image)

**Figure 8 – Screenshot of Smart Lighting Management system tool**

### 5.2 Risks found and corrective actions performed

There is a risk of the public procurement being delayed. VAL is monitoring the process.
5.3 Business model and financial scheme applied

Via MAAtchUP the following funds are available to finance the humble lampposts deployment (A26):

- 40.425 € for ETRA
- 2.150 € for Las Naves
- 11.000 € for Valencia City Council
- Equipment funding by EC is: 22.725 €

Via MAAtchUP the following funds are available for the smart lighting deployment (A27):

- 8.600 € for LNV (funded by 100%).
- 8.800 € for VAL (funded by 100%).
- 320.000€ in VAL budget for equipment (256.000€ funded)
- 40.000€ in VAL budget for subcontracting (not funded)

VAL will co finance this action.

In order to analyze a potential business case for the smart lighting deployment, several potential benefits have already been defined in the context of T6.1: the reduction of public lighting cost since real time data from smart public lighting enable a more efficient management of on/off switches of the lighting network; the reduction of public lighting maintenance cost because the deployment of smart lighting allows to identify more quickly technical problems or issues to be solved; and the integration and enablement of new services: in case that smart public lighting builds upon a platform that can enable and deliver new services such as noise detection, movement detection, air pollution detection, CCTV cameras, traffic sensors, etc. On the other hand, the humble lampposts deployment can deliver energy and operational budget savings; more control over, and better, lighting. The business model for the humble lamppost will depend on the selected areas for the installation of the charging points as well as on the strategy selected by the manager/owner of the premises in which the installation will take place. It can ensure new value-added services such as the light EV charging, thus ensuring revenue potential for cities. It also opens the opportunity for the lamppost to provide additional smart services.

5.4 Citizen engagement strategy implemented

The humble lampposts together with the public charging system management will allow to optimize the activities related with smart charging of the EVs and reduce energy billing contributing therefore to the optimum household energy management. Moreover, by means of this platform EVs fleet managers and city managers will be able to plan and control the charging schedule of all EVs of the fleet.

On the other hand, the smart lighting is intended to cover all the Poblats Marítims district, which is the target of the Valencia demo site. The action has a demonstration function, therefore information and training activities will be realized. The participatory environment will ease these activities, which will be addressed to the district inhabitants and the public.
5.5 Next steps

The roll-out of this intervention continues until M36 (September 2020), in which the final systems have to be completely deployed in the city of Valencia. This includes the final refinements, since in M30 (April 2020) the technical, social and economic evaluation will take place and this will contribute to get some valuable data related to the actions implemented. Therefore, there is still some room for improvement and refinement until the final version of this report, D2.18, is delivered.
6 Conclusions

Valencia’s public lighting platform has a large number of functionalities and capabilities, which have been acquired over the years of experience, while adapting to the different circumstances and needs of the evolution of public lighting.

The current lighting management platform is a modular solution, in which maintenance personnel, municipal technicians and personnel attending breakdown calls have all the necessary tools for their daily work.

Valencia Smart Lighting initiatives will provide of intelligence to the lighting system by means of control units and about 4000 luminaries will be part of this system in the context of MAtechUP. Thanks to these devices, information on the status of the different lighting sections that exist in these areas can be made available in real time, and environmental sustainability can be improved by drastically reducing consumption. In turn, valuable indicators (KPIs) related to consumption, luminaire availability, indexes, etc. can be calculated, substantially improving the service offered to citizens.