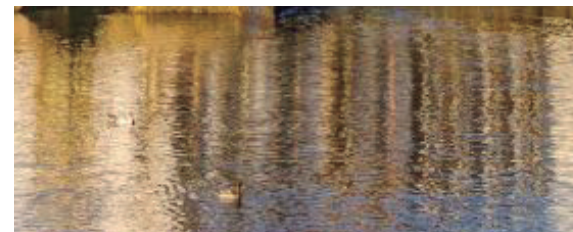
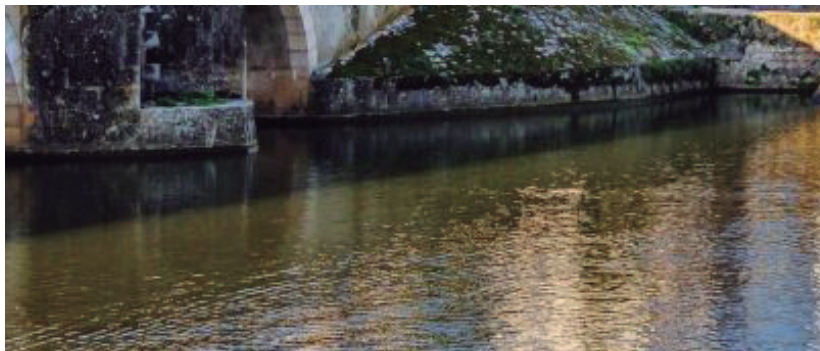


# TOMAR MUNICIPALITY

## CASE STUDY



## Pioneering Street Lighting project managed on an IoT platform and Artificial Intelligence

### GOALS

Tomar municipality launched a challenge of a Smart City integrated project to cover the entire county. The project included the modernization of the street lighting infrastructure, from traditional lighting to LED lighting, in all parishes in the municipality, including the historic city center, making a total of approximately 14 thousand luminaires.

Within the scope of energy efficiency management, four pilot projects were also contemplated for monitoring air quality, water quality of the Nabão River and its flood levels, as well as the use and loss of water in the fire hydrants.

The implementation of this project, in addition to promoting territorial cohesion, as it covers the entire municipality, it is a clear commitment of the municipality of Tomar to the technological component, moving towards a Smart Human City at the level of scientific, technological, intelligent and human territory.

### TESTIMONY

“This project will work as a highway, on which we can then place other [vehicles] to provide new services to the city. After the luminaire, and the air quality and flood sensors in the Nabão river, we will move on to smart irrigation systems, bicycle sharing, a specific app for urban transportation, and the collection of solid urban waste... even because it makes no sense to keep collecting garbage containers that are not full.

It is an infrastructure that will allow us to act in anticipation of occurrences. Our final goal is to create a control center that allows us to operate with all the features provided for these new services”.

The focus on IoT and monitoring data in real time, the one that deserves the most attention is street lighting: “It is always a pressure factor for inhabitants: everyone wants to have light at it door, but the costs of the luminaires are very high”.

Anabela Freitas  
Mayor of Tomar Municipality

# INSTALLED SOLUTION

## THE FIRST PORTUGUESE STREET LIGHTING PROJECT IN LoRaWAN®

The project of Tomar County is absolutely a pioneer in in Portugal regarding smart street lighting, as it presents centralized management on an Internet of Things (IoT) and Artificial Intelligence platform, of approximately 14.000 luminaires.

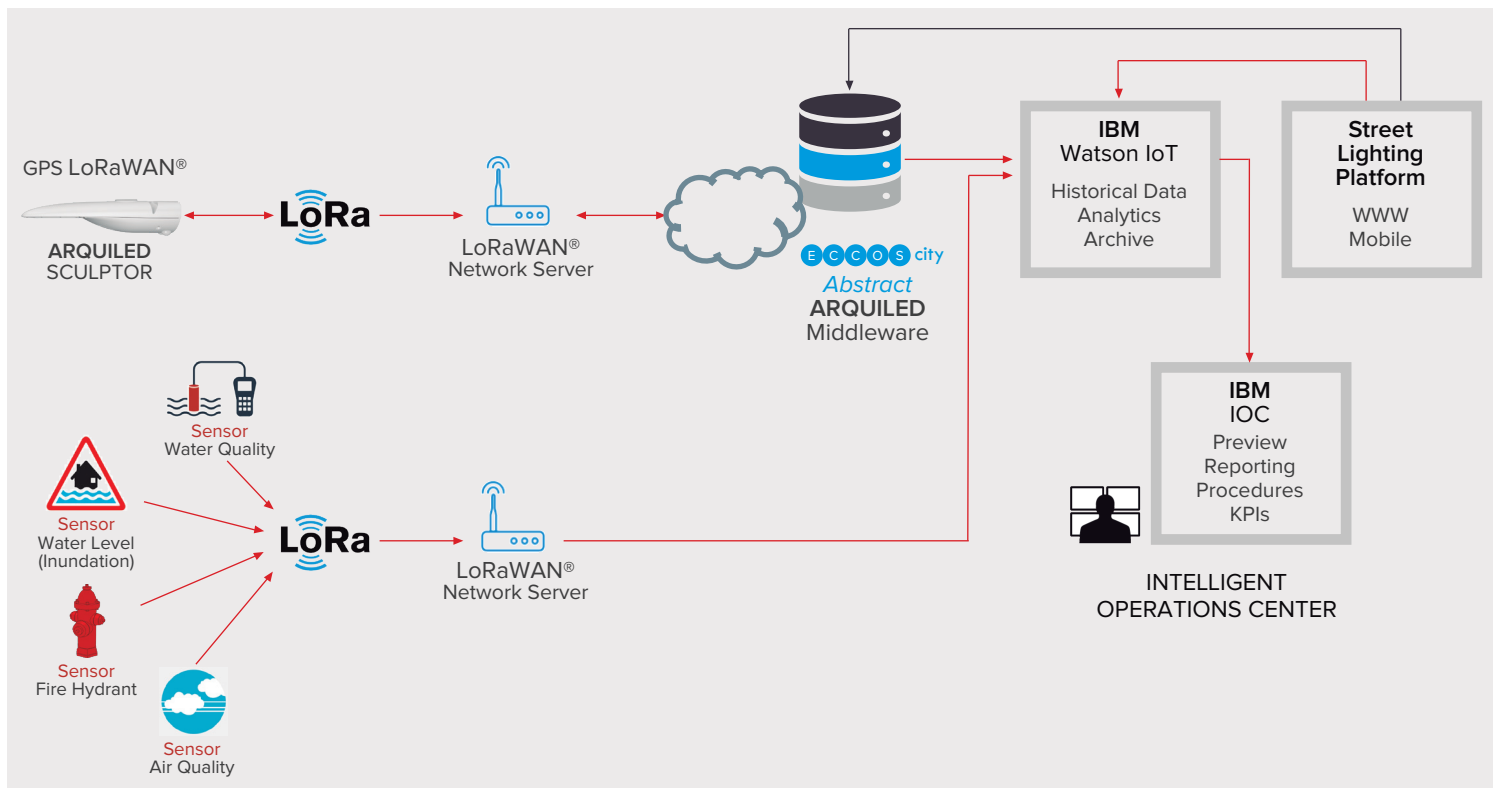
The creation of the new street lighting model in Tomar County is part of an energy efficiency management contract with a 16 years duration, with an ESCo<sup>1</sup> company. The total estimated investment is of 8.9 million euros, of which almost 3 million euros are allocated to the component to be implemented by Arquiled. The savings generated during the project period are estimated at around 11.5 million euros<sup>2</sup>, a sum that will be used to invest in the municipality's infrastructure.

The contract signed between the municipality and Ferrovia Serviços (as ESCo), uses the savings generated by the reduction of energy consumption in street lighting to invest in the municipality's infrastructure, without additional charges or investments for the municipality. As a management entity, and aiming at the operationalization of the project, Ferrovia Serviços joined Arquiled, as a specialist in the area of street lighting solutions, and Softinsa, an IBM group company specialized in management and application development services and infrastructures, to assist in the operationalization of the project.

### OBJECTIVES | DEVELOPMENT GUIDE

- ▶ Integration of all operating systems in a **single intuitive GUI**<sup>3</sup>.
- ▶ All data generated and events available **instantly** | **warning system**.
- ▶ All data and events **georeferenced**.
- ▶ **Analytics** system.
- ▶ The solution architecture respects the **European Union's Open Data Directive**<sup>4</sup>.
- ▶ **100% area coverage**.
- ▶ Data integration through different mechanisms, the **OASIS**<sup>5</sup> **MQTT**<sup>6</sup> **standard**.
- ▶ Ability to import and create **OpenAPI**<sup>7</sup> models.

## TOMAR SMART HUMAN CITY PHYSICAL MODEL



<sup>1</sup> Energy Services Company.

<sup>2</sup> Estimated savings in municipal expenses, over the 16 years of the contract. Data provided by Ferrovia Serviços, SA. - ESCo allocated to this project.

<sup>3</sup> Graphic User Interface.

<sup>4</sup> <https://eur-lex.europa.eu/legal-content/PT/TXT/PDF/?uri=CELEX:32019L1024&from=EN>

<sup>5</sup> Organization for the Advancement of Structured Information Standards.

<sup>6</sup> Message Queuing Telemetry Transport.

<sup>7</sup> Application Programming Interface.

# SMART STREET LIGHTING

## THE WAY TO A SMART HUMAN CITY

The upgrade of 13.522 traditional light fixtures to Arquiled LED luminaires covers the entire eleven parishes in the municipality, where road, urban and historical luminaires were installed, ensuring the characteristics of the different areas of the region.

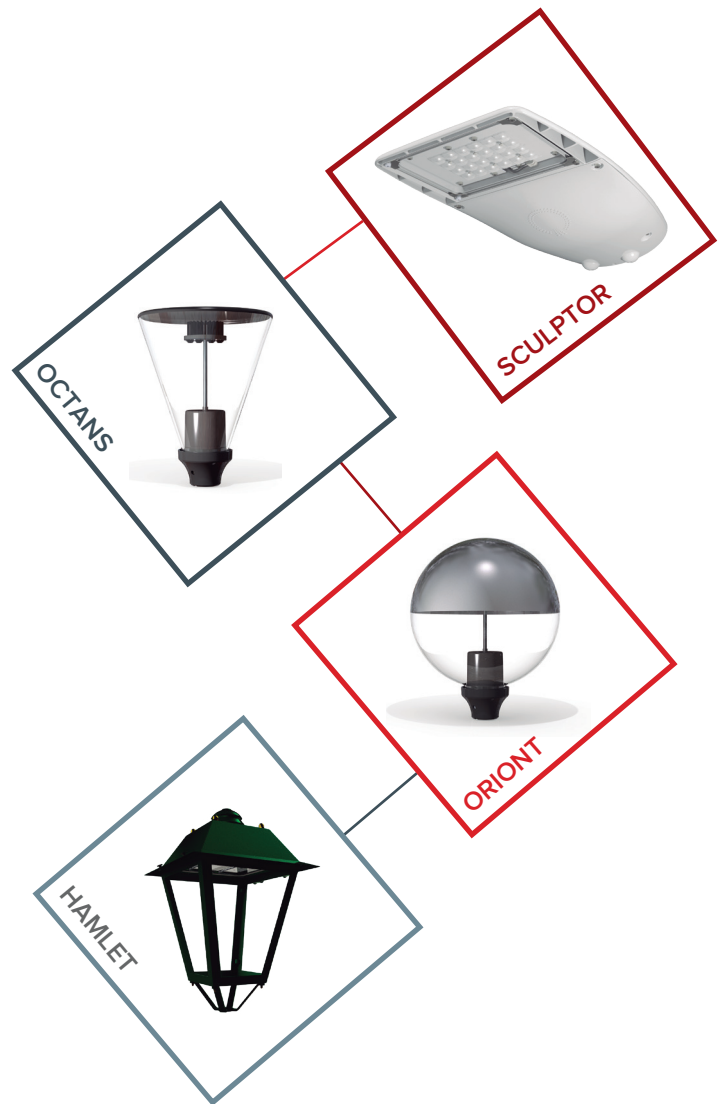
Total built-up park - **13.522 luminaires**:

- ▶ 12.526 **SCULPTOR** (road luminaire);
- ▶ 599 **ORIONT** (urban luminaire);
- ▶ 106 **OCTANS** (urban luminaire);
- ▶ 271 **HAMLET** (classic luminaire);
- ▶ 20 **Retrofit** (historic luminaires recovered and converted to LED technology).

In the most emblematic sites in the city center of Tomar, the historic lanterns have been preserved.

Thus, the project also includes a technological upgrade component, maintaining and preserving the existing equipment through the **retrofit** - restoring the body of the lanterns and introducing an LED module.

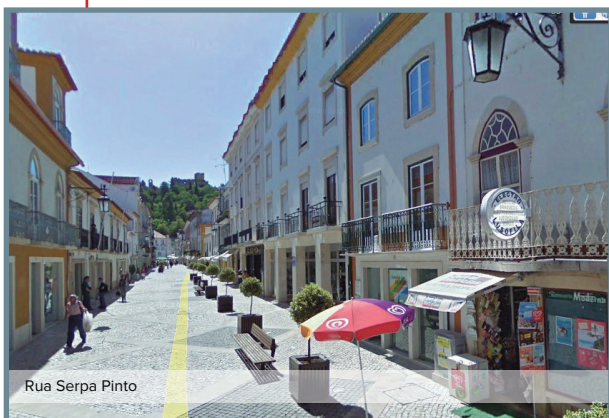
By doing the retrofitting the atmosphere and architectural landscape was preserved in the historic city center in places like *Praceta Infante D. Henrique*, *Praça da República* and *Rua Serpa Pinto*.



Praceta Infante Dom Henrique



Praça da República



Rua Serpa Pinto



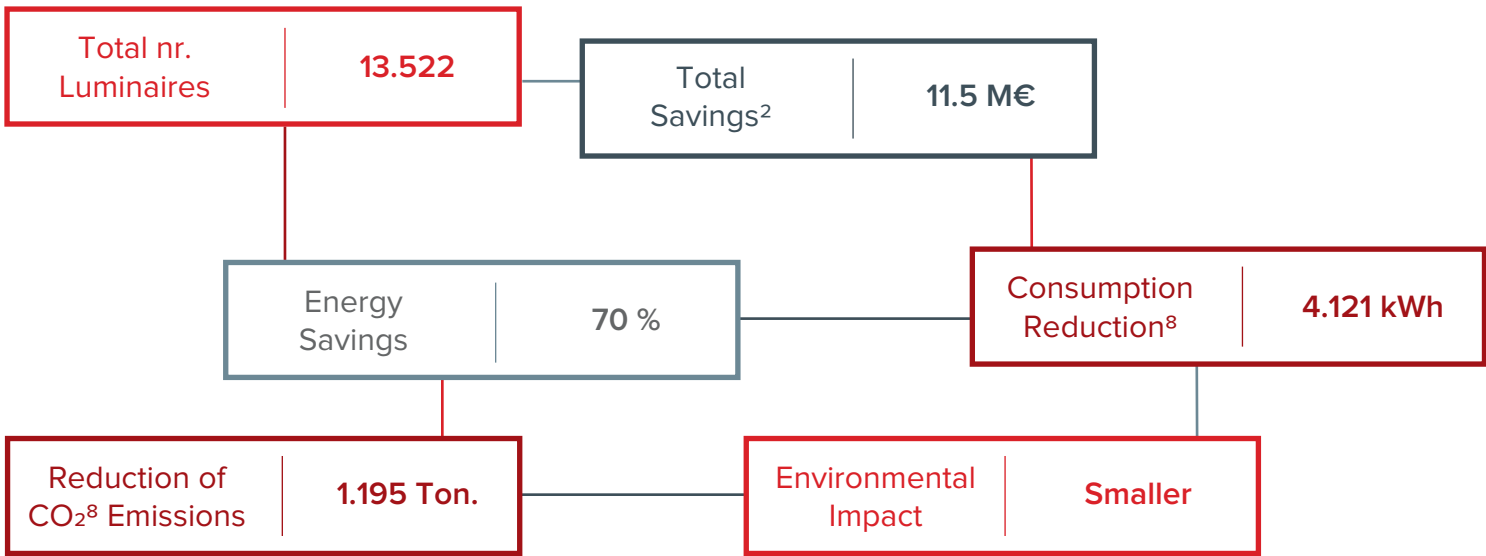
# LUMINAIRES WITH LoRaWAN® IN THE HISTORICAL CENTER OF TOMAR

All lighting fixtures are equipped with a remote management system developed by Arquiled (**ECCOS CITY**), in which each luminaire has its own Low-Power WAN (LPWAN) communications module in LoRaWAN®, managing point-to-point, all the lighting network through Arquiled's API.

Using the IBM Watson IoT integrated management platform, which aggregates several systems in the municipality, it is possible to give visibility to various events instantly, as well as to monitor the other services in the municipality through alerts, allowing the municipality to act immediately.

The information provided can be used to make changes or adjustments or to act preventively based on the analytics of the system.

Within the scope of energy efficiency management, four pilot projects were also contemplated to monitor the water quality of the Nabão River and its flood levels, as well as the water quality, the air quality, and the use and loss of water in the hydrants.



## ARQUILED SMART MANAGEMENT SYSTEM

All the fixtures in the municipality of Tomar are equipped with the **ECCOS CITY** remote management system based on LoRaWAN® communications.

This integrated management solution for street lighting grids, provides detailed information on the activity of the lighting system, enabling and maximizing its monitoring and management.

The modular system can be progressively increased, according to the needs of expanding the street lighting grid.

### SIGNIFICANTLY CONTRIBUTES TO:

- ▶ Reduced energy consumption.
- ▶ Reduction of CO<sub>2</sub> emissions.
- ▶ Reduced maintenance costs.
- ▶ Reliability of lighting installations.

<sup>8</sup> Estimated values at the end of 16 years' contract.



## BENEFITS

### OF PROJECT IMPLEMENTATION

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#### LoRaWAN® TECHNOLOGY

- ▶ **WIDE RANGE:** in urban areas or in rural areas.
- ▶ **LOW CONSUMPTION:** extended service life of more than 20 years.
- ▶ **LOW COST:** reduces initial investments in infrastructure, as well as operating costs.
- ▶ **HIGH CAPACITY:** allows you to connect thousands of devices.
- ▶ **HIGH STANDARDIZATION:** the LoRaWAN® specification guarantees interoperability between applications, IoT solution providers and telecommunications operators.
- ▶ **SECURE:** advanced AES-128 data encryption.

#### ESCo MODEL

The investment is entirely supported by ESCo, it means 'zero' investment by the municipality. This allows the municipality of Tomar to pay the investment of 8.9 million euros with their own savings over the 16 years of the contract, without increasing public expenditure.

The implementation of this project allows the municipality to:

- ▶ benefit from a **significant reduction in the energy bill;**
- ▶ modernize and improve the **quality of street lighting;**
- ▶ guarantee the **quality of the service** in the entire contract, with **maintenance included;**
- ▶ contribute to decarbonisation by **minimizing the environmental impact of CO<sub>2</sub> emissions.**



## ARQUILED

### BRIGHT NEW FUTURE

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Arquiled is a general LED lighting manufacturer, specialized in professional luminaires for street lighting, systems and services.

Headquartered in Mora-Alentejo, is a Portuguese industrial company, pioneering the market since 2005, that designs and develops its own products and solutions.

ARQUILED is committed to develop smart management solutions focused on reducing energy consumption and decarbonization, contributing to sustainable urban clusters.

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