Project no. 691735

REPLICATE PROJECT

Renaissance of Places with Innovative Citizenship And Technology

This Project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N° 691735

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REnaissance of PLaces with Innovative Citizenship And Technology

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H2020-SCC-2015 Smart Cities and Communities

Innovation Action (IA)

D3.11 Report on Public Lighting System

Due date of deliverable: 31/01/2018

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Organisation name of lead contractor for this deliverable: Leycolan

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PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. REPLICATE

The REPLICATE project will generate smart city business models, and tailor-made solutions in the areas of energy, transport and ICT starting from the districts: Urumea Riverside (San Sebastián), Novoli (Florence) and Ashley, Easton and Lawrence Hill Neighbourhood (Bristol). In summary there will be pilot actions in energy efficiency, efficient and sustainable transport and integrated infrastructures, being the latter the key elements for the integration and development of cross-sectorial solutions. Three follower cities participate in the project: Essen (Germany), Nilufer (Tutkey) and Lausanne (Switzerland).

Being a demonstration project, the main concept that is on the top of the project is REPLICABILITY: it will be necessary that the project results could be applicable throughout the lighthouse cities and in other cities which want to evolve towards the 'smart city' concept, and could grow of scale too. To assure the large scale deployment of innovative technologies successfully demonstrated in the lighthouse districts specific studies will be necessary for each of the demonstrated solutions to ensure that they are scalable and can be replicated.

Prior to REPLICATE project San Sebastian, Florence and Bristol have already collaborated in a STEEP project (Systems Thinking for Comprehensive City Efficient Energy Planning) which have allowed to the cities generate Smart City Plans. STEEP project has defined a collaborative and participatory methodology to reach the objective of defining an Action Plan for particular districts of each city.

The main objective of REPLICATE project is the development and validation in three lighthouse cities (San Sebastián – Spain, Florence – Italy and Bristol – UK) of a sustainable City Business Model to enhance the transition process to a smart city in the areas of the energy efficiency, sustainable mobility and ICT/Infrastructure, in order to accelerate the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas.

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2. INTRODUCTION

2.1. Relation to Other Project Documents

The actions carried in the WP3.3.4, are related to energy efficiency, and therefore are important from the point of view of the possibilities of reducing the energy consumption on street lighting, service provided by the Municipality.

The more specific documents related to this deliverable are the following:

D6.8- Standardisation between Intelligent Lighting systems

D7.4 – Report on Management Models.

D9.3 – Business model Analysis.

D10.4- Monitoring programme San Sebastian

Finally WP6- Integrated Infrasteructures- ICT Platform

It would be interesting to compare the documents to the Intelligent Lighting projects in Bristol and Florence.

2.2. Reference documents

This document is based in the following projects level documents:

Ref.	Title	Description
REPLICATE Grant Agreement signed 240713.pdf	Grant Agreement	Grant Agreement no. 691735
DoA REPLICATE (691735)	REPLICATE Annex 1 – DoA to the GA	Description of the Action
REPLICATE Consortium agreement signed December 2015 (7th December version)	Consortium Agreement	REPLICATE project – Consortium Agreement
REPLICATE Intelligent lighting Systems	D6.8 Standardisation between Intelligent lighting systems	REPLICATE standardisation
REPLICATE Management Models	D7.4 – Report on Management Models	REPLICATE Management Models

REPLICATE Business model Analysis	D7.4 – Report on Business Models	REPLICATE Business Models Analysis
REPLICATE Monitoring Programme	D7.4 – Monitoring Programme	REPLICATE Participation and reporting to the Monitoring Programme
REPLICATE Integrated Infrastructures ICT Platform	D7.4 –ICT platform	REPLICATE Integration of Lighting data to the ICT platform

These will also be stored on the shared online platform.

Where there are contradictions, the documents listed above supersede this plan. The Grant Agreement is the contract with the European Commission so takes precedence over all other documents.

2.3. Abbrevations list

GA	Grant Agreement
CA	Consortium Agreement
DoA	Annex I–Description of the Action
EC	European Commission
H2020	Horizon 2020
PC	Project Coordinator
PL	Pilot Leader
PMP	Project Management Plan
TC	Technical Coordinator
WP	Work Package

WPL	Work Package Leader

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3. DELIVERABLE DESCRIPTION

In this deliverable, D3.11 – deliverable on Public lighting system, will be described the concept and systems behind the implementation proposed for the innovation on the public lighting system in San Sebastian.

The Innovation related to the public lighting system described in this document covers the following aspects:

4. ANALYSIS OF THE EXISTING PUBLIC LIGHTING SYSTEM IN SAN SEBASTIAN
5. ELABORATED PROPOSAL FOR INNOVATING THE PUBLIC LIGHT SYSTEM
6. THE TRANSFORMATION OF THE EXISTING LIGHTING
7. COMPARISON OF THE TARGETS AND THE ACHIEVEMENTS.
8. FIRST RESULTS & IMPACTS
9. LESSONS LEARNED
10. REMAINING QUESTIONS/TASKS FOR THE PERIOD: MONTHS 24 TO 36-60
11. FINAL CONCLUSION TO THE ACTUAL PROJECT STATUS

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4. ANALYSIS OF THE EXISTING PUBLIC LIGHTING SYSTEM IN SAN SEBASTIAN

In San Sebastian as in most cities, it was, and partially is using conventional old (conventional) technology for the street light infrastructure. And in some cases, is just changing the old technology to newer technologies.

The meaning for Old Technology is the technology of HPSV light generation (High Pressure Sodium Vapour). Until now the renewals have been made with more efficient but always conventional technologies, evolving from Mercure vapour, to HPSV (High Pressure Sodium Vapour), and in some cases to MH (Metal Hydride) lamps.

These conventional technologies, despite their evolution on efficiency, have not reached the newer LED (Light Emitting Diode) technology efficiency, and in addition are not able to be managed as far as a LED technology can be managed.

In the latest years, the city of San Sebastian has also started the substitution of those conventional lamps with LED lamps, but has not taken the challenge of starting to move towards intelligent lighting. Therefore, it makes a lot of sense to take advantage of the REPLICATE project to start introducing a system of Smart lighting.

The City of San Sebastian counts with over 30.000 Street light points, and the costs of its annual energy consumption is over the 3,5 million €, and of over 1,774 million € the annual maintenance costs. (BASELINE unit cost €/kWh 15,9 €c/kWh and 59€/year maintenance cost per lamppost…).

Therefore, it makes sense to try the introduction of intelligent lighting systems to be much more efficient, save energy & reduce maintenance costs, and be much more environmentally conscious, reducing considerably CO_2 emissions with the above-mentioned energy consumption reduction.

Some images of the old technology in the area of the project:

Figure 1 – Newer, but still conventional lighting

Figure 2 – HPSV Conventional lighting

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5. ELABORATED PROPOSAL FOR INNOVATING THE PUBLIC LIGHT SYSTEM

(IN THE DEFINED AREA OF SAN SEBASTIAN.)

The implementation consisted on changes and improvements on:

a) The Lighting system

b) Innovative services possible to implement using the existing infrastructure of the public lighting after a deep analysis on the power grid infrastructure, the status of the electrical circuits, the lighting needs, and the intention of the municipality of improving the services provided in this area, the final proposal will be explained below.

For the analysis of the situation and area of work, the following study was done for the replacement of existing sodium-vapour luminaries with new LED technology:

Study of the project:

The scope of the project was changed, reducing the quantity of points from 142 to 90 points, which were due to:

- 19 points were reduced due that they belong to a circuit depending to another administrative body (Diputación de Guipuzcoa)
- 5 points were reduced due that they belong to a circuit depending on the neighbour village called Astigarraga.
- 29 points were reduced due that this area is planned to be re-developed in a period of 3-4 years.

Due to this change in the scope of the project, the final decision was to reduce the number of points, maintaining the core of the project, were it was planned to install the development of the system intelligence part and the deployment of the IP services, together with the remote-control system that was planned to be installed in the total area.

This change in the scope generated the following tasks and activities to be done:

- Realisation of a new light study, adapting the lights to the correct scope of project, and in addition adapting to new and more efficient lights (As due that light technology has evolved significantly during this period since the first study was made,) giving better efficiency results than the originally planned.
- Validation with the Municipality and the city responsible of Light infrastructure. Several meetings were held together with the Street light department of Ayuntamiento de SS, to finally agree the correct scope of the project, and the final functionality of the system.

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After a deep analysis on the power grid infrastructure, the status of the electrical circuits, the lighting needs, and the intention of the municipality of improving the services provided in this area, the proposal consisted on,

a. LIGHTING AND LIGHTING SYSTEM:

The project proposal consisted, finally, on substituting the whole 90 lampposts of the area covered by 2 cabinets. (Initially the project contemplated 142 lampposts, but after a deeper analysis, it was considered much better to implement the project over 90 lampposts and only 2 cabinets).

These lampposts consisting in HPSV lamps of 250W and 150 W, where proposed to be substituted by LED lamps, in 2 different models or LED technologies:

i) 52 conventional lamps of 250W to be substituted by 52 LED lamps from Philips brand (SMD Led Modules) of 120 W and 100 W.

ii) 38 conventional lamps of 150W to be substituted by 38 LED lamps SULKA Model with LED COB Technology (1 LED – Citizen Brand) of 100 W.

Figure 2 – Area of action and electrical circuits.

In addition, the proposal includes the installation of an intelligent and remote-control system of the street lights, controlling point to point, with the target of having the capability of controlling every single light point, monitor the energy consumption, manage calendars, regulation (DIM) of the lights according to the real needs of the environment, and the presence of cars and persons.

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b. Innovative services possible to implement using the existing infrastructure of the public lighting (Existing power/energy wires).

While it is stablished a system for the street light management, and due to the system characteristics, it is possible to implement new services for the citizenships using the already built infrastructure.

The proposal consists on implementing just one "control Node" in every lamppost or point/service to be controlled, and just 1 head end or concentrator at every control cabinet of each circuit. The communication for these services is carried through the existing Power line for the supply of energy to the lampposts. Therefore, it is not needed to incur in additional and expensive road works, or deployment of new wiring for implementing these services of light management and/or new services.

With this thinking the proposal consists on implementing a remote-control system for the 90 Lampposts, having 2 central cabinets: 1 providing the power and control to 52 lamps, and the second one providing the power and control to 38 lampposts.

To have the control of every lampposts, in every lamp will be installed 1 control Node for the intelligent lighting system (It is incorporated into the pole) and to make it more intelligent, it is proposed to implement specific detection systems, in some of the posts, making a maximum coverage of the detection areas in order to provide maximum security and effectivity when providing light in all cases that there is presence in the area. The proposal includes the installation of 4 detection Radars. (Wide angle detection radars that will manage the light regulation according to the presence of persons or vehicles), and 12 vision detection cameras. The aim of these presence detectors is to provide the adequate lighting to the passing by people or cars. Every street is classified according the Spanish street light regulation RD 1890/2008, and could be adapted also to EN13201.

In addition to the intelligent lighting control system, it is proposed to implement different IP services, taking advantage that with the installation of the head ends and the control nodes; it is created a LAN over the power grid covering the street light installation grid. The proposal includes: 6x2 IP audio services, 4 IP vision cameras (2 for the Municipality police, and 2 for Streaming viewing cameras), 2 rain sensors, 1 vehicle counter, and 2 energy meters.

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The next figure shows the drawing of the area of implementation and all the services to be implemented.

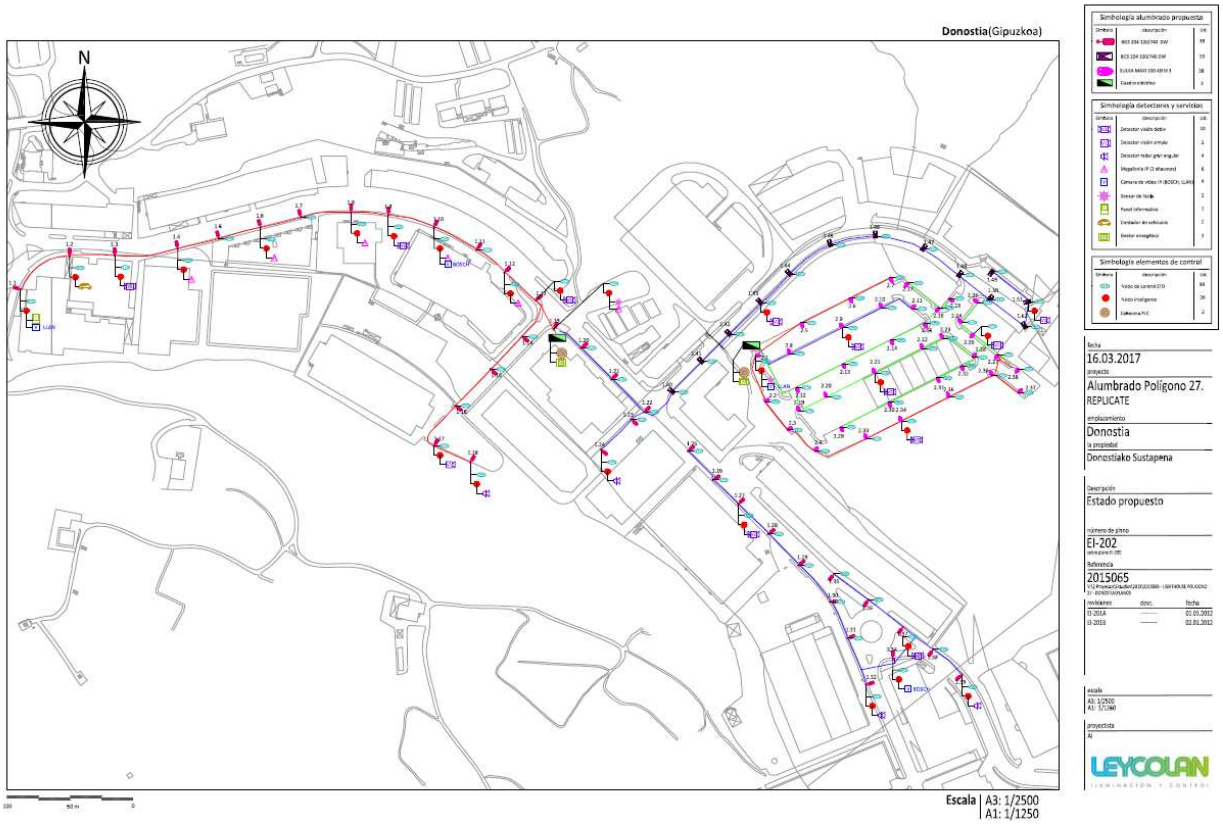

Figure 3- Final drawing of the proposal

The implementation of these services over the existing power line requires protecting and preventing that those services should not interfere or damage the equipments and service of the street light, as this service must be considered as a total priority over the other proposed services. In this sense, a totally new technical project is needed to elaborate, and an audit is carried to ensure the feasibility and the compliance of the electrical regulations in mid and low voltage grids.

To cover this part, an additional electrical protection device will be implemented in every point where an IP service will be connected.

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6. THE TRANSFORMATION OF THE EXISTING LIGHTING

(INFRASTRUCTURE INTO AN INTELLIGENT STREET LIGHT SYSTEM.)

With the implementation of the new technology LED lights and all these new generation devices for the remote-control management and additional IP services, the street light system has been converted into a LAN, where every single lamppost is and intelligent point and where it is possible to connect an IP device that can work over internet and promote the IoT activities in the area.

Additionally, the control system will contribute to reduce the street light maintenance costs, as the system can have the knowledge and information of every lamppost, the working regime that has implemented, and so on, and can report alerts to the maintenance department, reducing considerably the maintenance costs compared to older conventional systems, where the maintenance was carried out only through the need of physical visit to every lamppost, except for scheduled, mandatory mechanical inspections

Images of the new lighting Luminaries (LED)

SMD- Led modules from Philips

SULKA LED COB lights

SMD- Led modules from Philips

SULKA LED COB lights

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IP SERVICES IMPLEMENTED:

In addition to the replacement of the Conventional Lights with LED Technology there have been implemented the following IP services:

6.1. Presence detection:

6.1.1. with Radar Technology (4 Units)

6.1.2. an with vision Technology (2 Single and 12 double vision -detection cameras)

6.2. Rain sensors: 2 units

6.3. Audio over IP (Sound system): 6 units of 2 loudspeakers.

6.4. Video Surveillance for Municipality Police use: 2 devices (Domo type).

6.5. Video surveillance, for municipality use: 2 devices

6.6. Vehicle counting device: 1 unit.

With all these devices, it is possible to control, or get knowledge and information about the street lighting service status, about its performance, on real time, at every moment. It is possible to regulate the lights, or modify the regulations. It is possible to act on the sound system and give notices/advertisings, or evacuation notices, for example.

Data can be stores, from the vehicle count that are coming into this area or leaving the area of the project.

The modified infrastructure with this technology, can perform these services, but additionally as it has been created a LAN network over the Power line, is also possible to incorporate other IP services that could come later, just with the connection of any device to the created LAN network.

Therefore, it is possible to say, that it has been created an smart street lighting system.

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7. COMPARISON OF THE TARGETS AND THE ACHIEVEMENTS.

ANALYSIS OF THE COSTS: BUDGET AGAINST REAL EXPENSES OF THE PROJECT IN THE PERIOD

As It was mentioned before, the scope of the project was changed from the original idea, and the main facts of the change were:

The scope of the project was changed, reducing the quantity of points from 142 to 90 points, which were due to:

- 19 points were reduced due that they belong to a circuit depending to another administrative body (Diputación de Guipuzcoa)
- 5 points were reduced due that they belong to a circuit depending on the neighbour village called Astigarraga.
- 29 points were reduced due that this area is planned to be re-developed in a period of 3-4 years.

With these facts as main issues, the comparison of all the parts on the project are shown here blow:

CONCEPT	TARGET	ACHIEVEMENT	DEVIATION / Comments
Deployment of LED Lights	142 light spots	90 Light spots	-52 Light spots. Philips Brand. SMD Leds -38 Light Spots. SULKA Brand. COB Led It was needed a review of the project scope to adequate it to the best options for the area of work.
Intelligent system	3 Head end controllers	2 Head end controllers	Due to Project area adecuation (Best implementation possible), the number of cabinets was reduced to 2 units.
Intelligent system	140 Intelligent Nodes	105 Intelligent Nodes	Due to Project area adecuation (Best implementation possible), the number of Nodes was reduced to 90 units, and due to the Legal Mid and Low-Tension grid regulations, It was needed to increase them in 15 devices, (Making a new total of 105 units), to ensure installation electrical control and safetiness.
Intelligent system	4 Radar Detectors	4 Radar Detectors	Main control and detection areas remained quite similar

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Intelligent system	2 Single Vision Detection devices	2 Single Vision Detectors	Main control and detection areas remained quite similar
CONCEPT	**TARGET**	**ACHIEVEMENT**	**DEVIATION / Comments**
Intelligent system	13 Double Vision detectors	10 Double Vision detectors	Due to Project area adecuation (Best implementation possible), the number of Double Vision Detectors was reduced to 10 units
Intelligent system	4 Wifi Spots – running over the BPLC Lan network	0	Due to Project area adecuation (Best implementation possible), the number of wifi spots were eliminated, also considering that a WIMAX wireless communication was going to be implemented within the REPLICATE project, and our WIFI spots became redundant.
Intelligent system	Audio IP – 1 SET (with 8 x2 units)	6x2 – 6 units of sound extreamers and 2 loud speakers per unit.	Due to Project area adecuation (Best implementation possible), the number of Audio IP was reduced to 6 units (6x2)
Intelligent system	8 units of VIDEO IP – including 2 Bosch Video DOMO units for the Municipality Police and 6 Video IP for general use.	2 Video IP + 2 Bosch Video Domo units	Due to Project area adecuation (Best implementation possible), the number of Video IP was reduced. It has been maintained the Video Domo, but reduced the Video IP to only 2 units, for general use and demonstration of the use of Standar market devices running over BPLC Communication. The infrastructure created is ready for the connection of other IP devices when needed (under actual technological conditions..)
Intelligent system	Routers for security data transmission. (Not in original budget) (0 units budgeted)	2 Routers for security data transmission	Due to the implementation of Wimax wireless communication, and to include the Video IP data and image transmission, in these communication system, It is needed these 2 routers to guaranty data transmission safetiness.
Intelligent system	2 units of Informative digital panel	0 units	An internal deep analysis of the real need and use of this service, ended up with the final decision of cancelling this part/Component of the project.
Intelligent system	3 Rain optic Sensors	2 Rain optic sensors	Due to Project area adecuation (Best implementation possible), the number of cabinets was reduced to 2 units, and therefore the rain sensors devices

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			needed are only 2.
CONCEPT	**TARGET**	**ACHIEVEMENT**	**DEVIATION / Comments**
Intelligent system	3 Energy meter devices	2 Energy meter Devices	Due to Project area adecuation (Best implementation possible), the number of cabinets was reduced to 2 units, and therefore the Energy meter devices needed are 2.
Intelligent system	1 Vehicle counter	1 Vehicle Counter	No change in this part
Subcontracting	Not in original budget	22.358,44 + VAT The cost of installation of all the devices had to be subcontracted	Installation of the devices and deployment had to be made through the existing street light maintenance company that had gained the maintenance contract in the Municipality tender for this service/cost.
TOTAL FINANCIAL BUDGET OF Direct Costs	158.082,10 € (VAT Included)	112.550,72€ (VAT Included)	Du to the previous modifications in quantities and area of the project.

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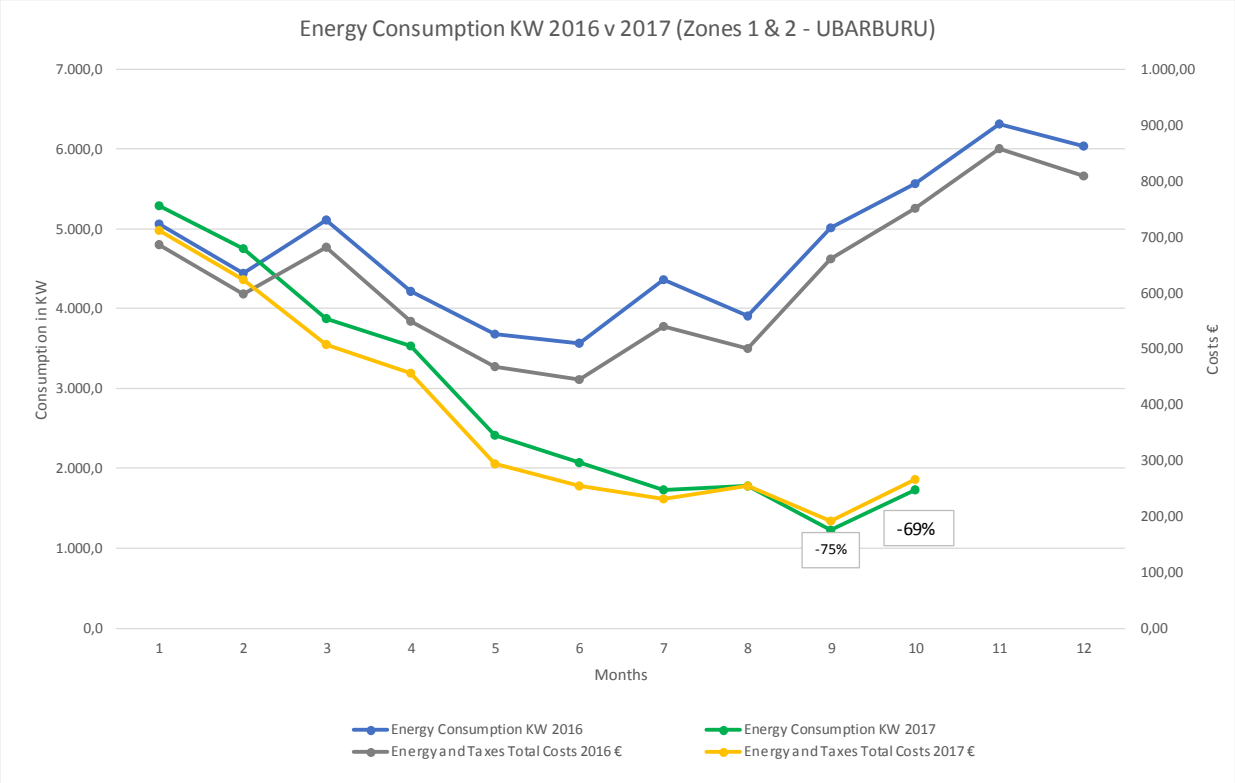
8. FIRST RESULTS & IMPACTS

8.1. First results obtained.

As first results Obtained the Graphs below show the cost reduction in energy (€ and W), compared to the same month in the previous year:

8.1.1. Area 1 & 2: Cabinet called UBARBURU:



The reduction in KWh consumption comparing same months of the previous and actual year has been of 69% at the end of October 2017 compared to same month in 2016. Finally, it is foreseeable the project should reach a total average saving in energy consumption of a 75%.

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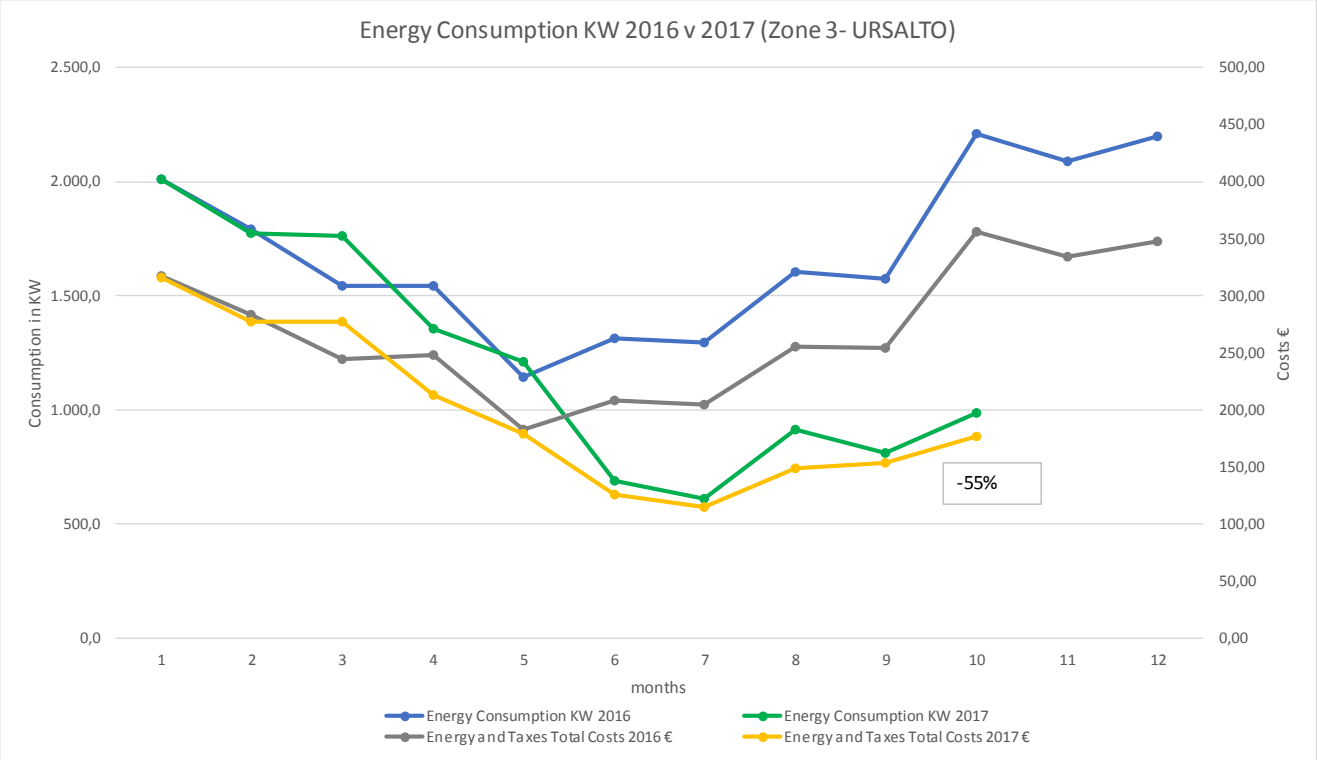
8.1.2. Area 3: Cabinet called URSALTO:



In this cabinet, the status of the installation was newer, more efficient, and the nominal reduction of the lights power was only a reduction from 150W in HPSV technology (Conventional), to 100 W in led, plus detection system. Here the saving obtained in total of 55% comparing month to month. Due that in this area the traffic and affluence of people is lower, it will be possible to make different tests of re-scheduling and re-programming the settings stablished for the lights behaviour, and it will be possible to reach an average savings in this are of at least 65% on energy consumption.

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Service implementation and use: Presentation on the base of some pictures:

1- Columns of street lights and the implemented IP services and/or Detection devices.

2- Pictures of the detection devices as to show that the system is running.

3- Pictures of the energy consumption monitorization (on the basis of 24h period, showing the variation in the consumption depending on the set calendar plus the detection system.)

Lampposts Without IP Services. (System – Control node is installed inside the pole.)

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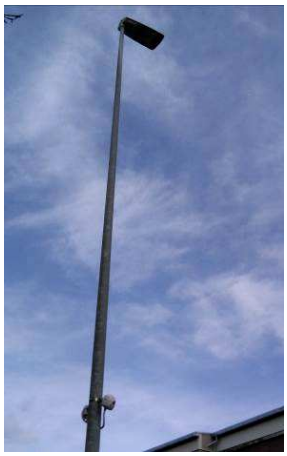
Lampposts with Audio IP, and Domo video IP



Lampposts with Vision Detection devices

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COB Led Light, Vision detection

Led COB, System inside Pole, + Vision IP device, Vision detection

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2) Pictures of the detection devices function:

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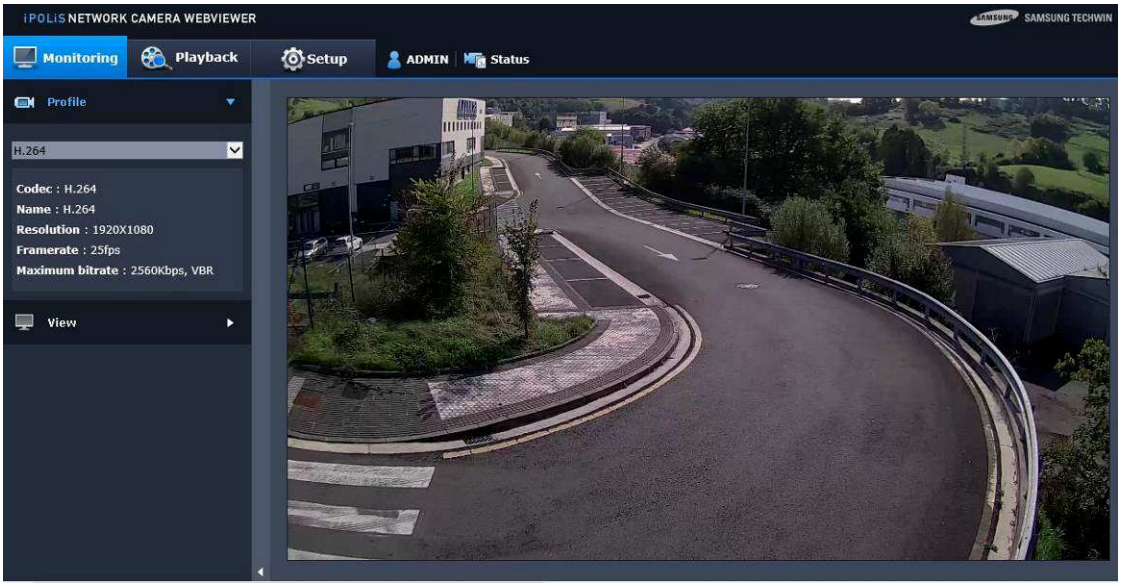
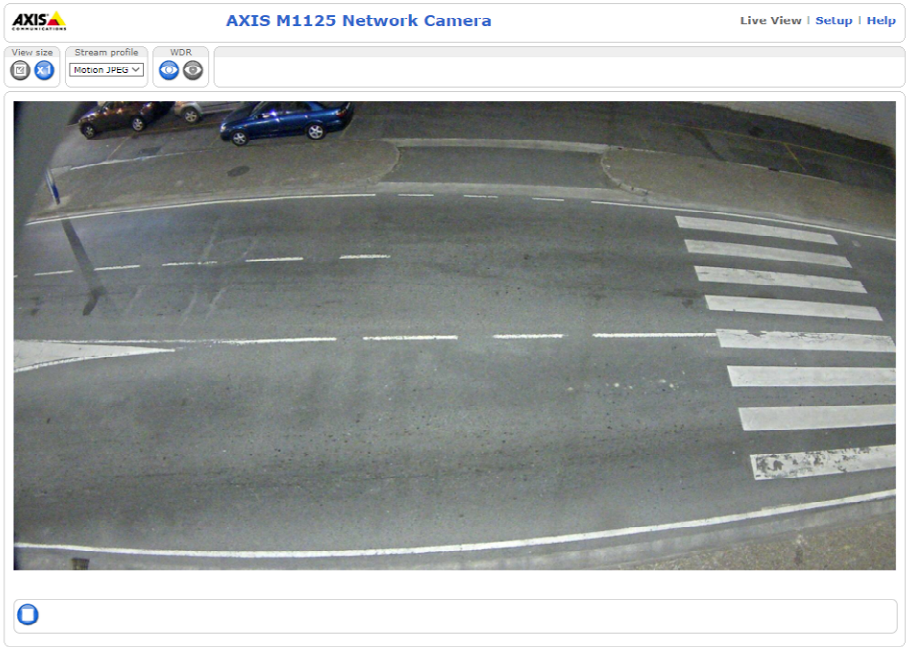
Vision IP: Samsung Cameras:



Vehicle Counter:



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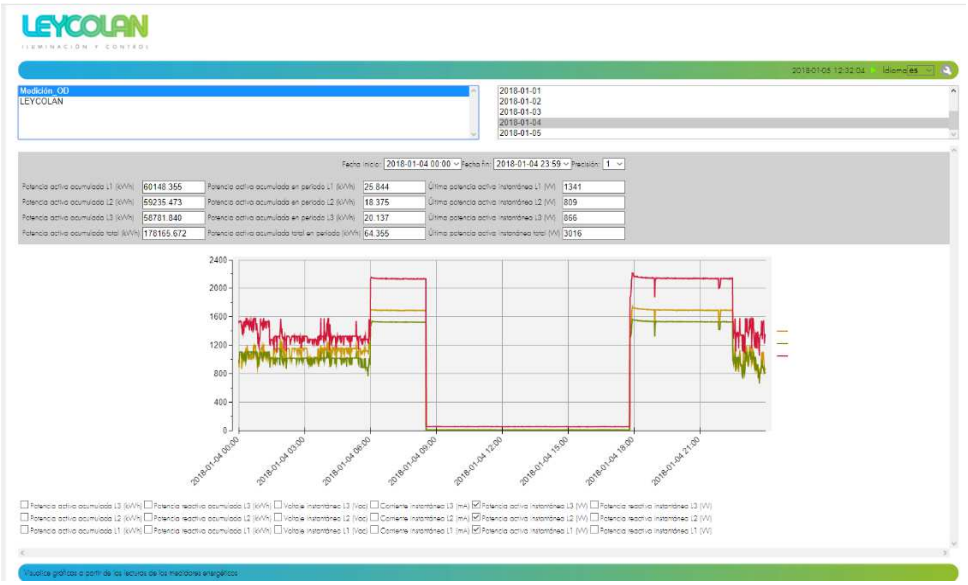
3) Pictures of energy consumption data:24 h period: (example of 1 day) (Cabinet of 52 Lampsposts – UBARBURU)

Example: the system is programmed with 3 steps during the night, and in one of the steps, is activated the presence detection (from 22.30 to 06:00 is working under a step configuration plus under presence detection configuration). When there is no presence the lights are dimmed to 25%, and when there is presence the lights dim to 60%. In all cases additionally they work under the Rain sensor detection: therefore if it is a rainy night the lights will be dim to 90%, in order to guaranty the vehicles and people safetyness).



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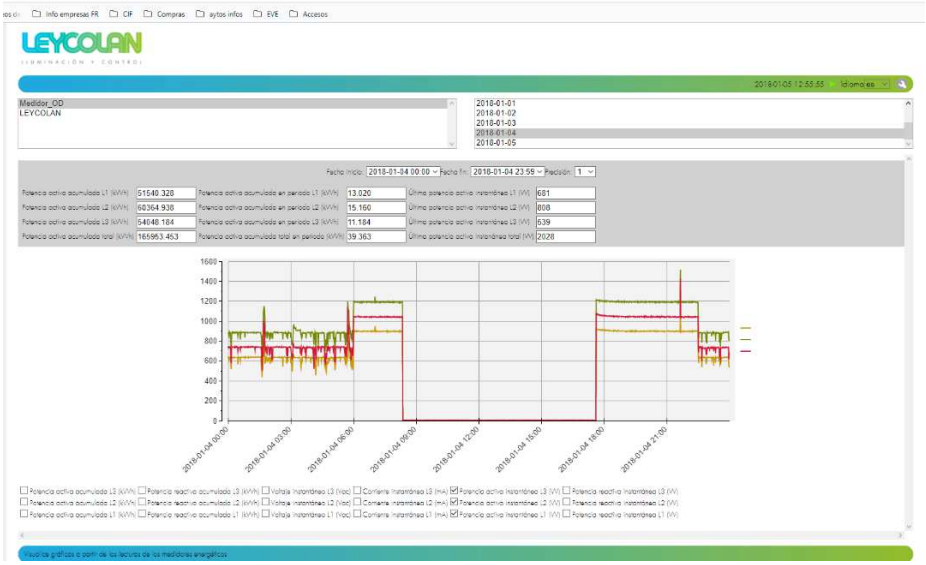
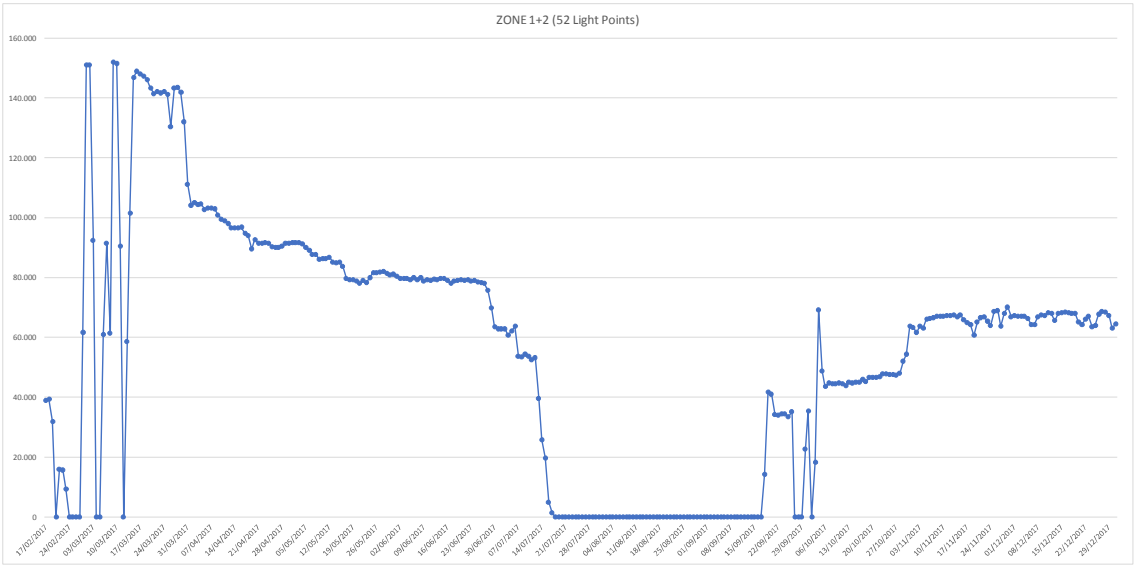
Example of Another day:

Example of the 2nd Cabinet: 38 lampposts. (Cabinet URSALTO)

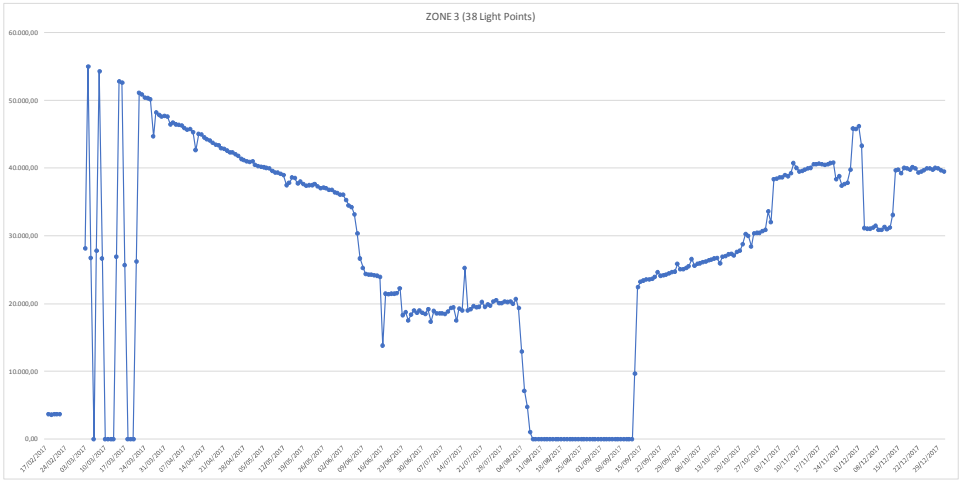


Example of consumption monitorization. (Cabinet UBARBURU):



The 0 values during August /September where due to a misfunction of the metering devices in both cabinets. Once corrected, it shows different consumptions depending on aggressive regulation curves for the lights. (Up till mid of March-2017 it was just adjusting the metering devices and system)

Example of consumption monitorization. (Cabinet URSALTO):



The 0 values during August /September where due to a misfunction of the metering devices in both cabinets. Once corrected, It shows different consumptions depending on aggressive regulation curves for the lights. (Up till mid of March-2017 It was just adjusting the metering devices and system)

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Therefore, It is possible to say that within the regulations and the prudence, It is possible to manage the energy consumption of the street lights.

8.2. Impacts:

8.2.1. On existing infrastructure and in the future costs/energy consumption.

The first impact on the existing infrastructure is that the existing wiring is now sufficient to hold other power supplies, as the reduction of the installed power has been reduced by 50% in zones 1 & 2, and by 33% in zone3. This means that the infrastructure will be much safer and less wearable (if it is possible to us this expression). Additionally, the bill paid to the power supplier could be also reduced in the part of the fix costs due to the contracted power fee.

In addition the maintenance cost will be reduced in the coming years, due to:

- The products lifetime,

- plus the maintenance works as a result of the system alerting on the installation issues or problems by remote control, previous to needing a physical visit to the site.

8.2.2. On the area:

The quality and quantity of light has been improved considerably, and also the environmental impact due to the reduction of amount of light emitted during the night, as a consequence of the intelligent system that reduces the light consumption and emission when there is no presence.

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9. LESSONS LEARNED

9.1. From the existing infrastructure.

It is very important to analyse in quite deep detail, and as more accurately as possible, the situation of the existing infrastructures, in order to plan and calculate as precisely as possible all the actuations and modifications needed for the intervention.

9.2. From the deployment practice.

Actions to be implemented and time for resolving or conducting the administrative procedures must be considered in all cases, as they may interfere deeply on the time planning of the projects.

The collaterals, and other key or less key but still affected holders or entities (people) must be taken in consideration beforehand, in order to avoid time losses and/or cost deviations.

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10.REMAINING QUESTIONS/TASKS FOR THE PERIOD: MONTHS 24 TO 36-60

10.1. Monitoring of the installation:

During the following 36 months, the works will be of monitoring the system, its performance, and making different tests of the potential additional savings according to different behaviour of the system in function of the parametrization of the presence detection.

And of course, a study to see which factors can influentiate in this system for the variation of energy consumption like rain, weekends, holiday days, an so on.

10.2. Integration in the ICT Platform

During the following 36 months it will be also made the needed works for integrating the data generate by the LEYCOLAN system into the ICT platform of the project, and cooperate with the other participants in order to debate which additional services and information can be managed, and offered to the citizens with the data collection managed by LEYCOLAN system.

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11. FINAL CONCLUSION TO THE ACTUAL PROJECT STATUS

11.1. From the deployment

The deployment of the project has been implemented and the system is running successfully. In San Sebastian there is replication potential for Smart Lighting and the project results will be taken into account when renovation is needed in public lighting to install this innovative Smart Lighting.

11.2. From the services provided:

Main advantages of the new installation:

The main advantages generated with this new intelligent lighting deployment that could be mentioned are:

- Very relevant reduction on energy consumption. (Thus reduction of € expenditure for the municipality, and the reduction of CO_2 generated – environmental improvement.)
- An important reduction on maintenance costs.
- A management system of the lighting service offered to the citizens that are able to be adapted to the real needs. Therefore, it is not a system that just exists and consumes energy, it can be managed.
- The creation of a LAN network that can be used for creating services for the citizens in the area, based on the existing infrastructure.
- The possibility of using different data collected through the management system and shared in the ICT platform for further analysis and improvement of implementation of other services.

11.3. From the cost Side of the project:

The total cost of the project is lower compared to expected, in terms of direct costs implemented.

11.4. Further results expected:

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The installation while in the monitoring period is expected that should improve in the reduction of energy consumption, and if possible, it should allow to implement additional IP services.

And additionally the experience should be valuable for improving the replicability of the technology used on it, and the collaboration and integrations generated.

END OR REPORT – FIRST 24 MONTH DELIVERABLE D3.11