



**Deliverable 5.1:**  
**TECHNICAL DOCUMENTATION**  
**OF THE INVOICING MODULE FOR R2**  
**WP 5**

Lead WP: SOFTline

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## Executive report

This deliverable presents the technical documentation of the Invoicing Module for R2 and contains the technical explanation of new invoicing software that integrates PAYT (Pay As You Throw) schemes.

- In *Section 1* we present an overview of the document and its connection with other WPs of the DoA.
- In *Section 2* we present the Sections of D5.1.
- In *Section 3* there is an overview of PAYT schemes in Waste4Think but we have leaved details in D1.3.
- *Section 4* explains content and methodology used in this deliverable.
- In *Section 5* we present the security assessment of the components used in Seveso and Zamudio pilots.
- In *Section 6* we present the Architecture of the Software, giving an overview of the three software - WINTARIF, Mawis U2 and the W4T-backend (D2.3. Implementation of the Back-End for R1, R2 and R3) - by introducing the relationship between the environment and the development principles used in component design and by describing i. how the software is divided; ii. the functionality of every component; iii. the main interaction between each component, which fulfils the functional requirements.
- In *Section 7* we present the Data Interface describing how the invoice module is related to the external environment and the interfaces for Wintarif software, while for Zamudio Invoicing Module, we describe the extension to the data model presented in Section 7 of Deliverable D2.1 used to store the information needed to issue the PAYT in Zamudio.
- In *Section 8* we describe how the tariff is algebraically defined and examples notice of payment structure for the Seveso pilot.
- In *Section 9* we describe how the safety, reliability, transparency and data security are guaranteed in Wintarif Software.
- In *Section 10* we have reported the reviewers comments.

# Glossary

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## *E*

### **Enterprise Resource Planning (ERP)**

is the integrated management of core business processes, often in real-time and mediated by software and technology.

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## *F*

### **File Transfer Protocol Security (FTPS)**

Is an extension to the commonly used [File Transfer Protocol \(FTP\)](#) that adds support for the [Transport Layer Security \(TLS\)](#) and, formerly, the [Secure Sockets Layer \(SSL\)](#), which is now prohibited by [RFC7568](#) cryptographic protocols.

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## *G*

### **Graphical User Interface (GUI)**

is a type of user interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation, instead of text-based user interfaces, typed command labels or text navigation. GUIs were introduced in reaction to the perceived steep learning curve of command-line interfaces (CLIs), which require commands to be typed on a computer keyboard.

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## *I*

### **Identifier (ID)**

is a name that identifies (that is, labels the identity of) either a unique object or a unique class of objects, where the "object" or class may be an idea, physical [countable] object (or class thereof), or physical [no countable] substance (or class thereof).

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## *P*

### **Pay as you throw (PAYT)**

(also called trash metering, unit pricing, variable rate pricing, or user-pay) is a usage-pricing model for disposing of municipal solid waste. Users are charged a rate based on how much waste they present for collection to the municipality or local authority.

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## *R*

### **Radio-frequency identification (RFID)**

uses electromagnetic fields to automatically identify and track tags attached to objects.

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# 1. Introduction

## 1.1. Purpose

The Work Package 5 specifically addresses the 4 pilots in order to encourage them to implement appropriate and innovative economic instruments to enhance high recycling and waste prevention. The Objectives (O) of this WP are:

O5.1- To raise the recycling rate of municipal waste in the 4 pilots by means of introducing PAYT and incentives;

O5.2- To develop an invoice system: able to calculate bills from different PAYT schemes and ready to be easily integrable in different ERP systems (Result R2).

In order to achieve these objectives and in accordance with the definitions and regulations in the Annex I of the Grant Agreement and the Consortium Agreement, SOFTLINE (Partner 14), MOBA (Partner 15) and FDEUSTO (Lead Partner) are developing invoicing modules for domestic and commercial users for the pilots in Cascais and Zamudio. The billing system is based on different parameters to calculate a fix part of a fee plus a variable part calculation based on the waste generation according to the Bin Identification and the Chamber Systems. The module will be fully configurable in a way that can be adapted to the different rules of Municipalities without the need of additional programming or maintenance

This document “**Technical Documentation of the Invoicing Module for R2**” is the Deliverable 5.1 (D5.1) and contains the technical explanation of new invoicing software that integrates PAYT (Pay As You Throw) schemes.

The Deliverable 5.1 has a close relationship with many other tasks and deliverables foreseen by other WPs, with:

- 1) all task of WP1 “PILOTS PLANNING AND EXECUTION”
  - a) Task 1.1 “Pilots preparation” in which a set of Key Performance Indicators (KPIs) established in order to assess the efficiency of the systems as well as the monitoring of the strategic and operational objectives in each pilot from an economic, environmental and social perspective.
  - b) Task 1.2 “Pilots planning” in which functional requirements for all the proposed eco-innovative solutions and the analysis of the use cases, in particular for R2 “invoice module” and for R16 “PAYT system”, are identified.
  - c) Task 1.3 “Sustainability Modelling” in which the Sustainability Assessment Models are developed in order to calculate the set of economic, social and environmental KPIs defined in Task 1.1 and the baseline of the pilots are analysed.
  - d) Task 1.4 “Pilot deployment” because it covers the deployment and execution of the 4 pilot sites and, therefore, the action of the pilot related to the invoice module.
  - e) Task 1.5 “Pilot Monitoring” in which periodical review of social, economic and environmental KPIs will be issued to evaluate progress and achievement of

Milestones (MS) 6 - Average reduction of urban waste generation; MS7 – Increase of the average of urban waste sorted; MS8 – Decrease of the average of waste diverted to landfill; MS9 – Decrease of the average of the urbane waste management costs.

- f) Task 1.6 “Pilots results consolidation and lessons learnt” which aims to analyse the results and explore the possibility to exchange the tested solutions among the 4 pilots.
- 2) Two tasks of the WP2 “DEVELOPMENT OF COMPUTER ASSISTED INTEGRAL WASTE MANAGEMENT SYSTEMS”:
    - a) Task 2.1 “Sensor Platform” in which the different devices defined in Task T1.2 for each pilot will be deployed and integrated together with the existing ones in the Waste4Think platform.
    - b) Task 2.2 “Software Platform”. Here, FDEUSTO, MOBA and SOFTLINE are supported by the municipalities together with ARS and BCN for the design and development of the user interfaces of the components of the system that managers and planners will use. These interfaces will be based on the user’s histories described in Deliverable 1.2.
  - 3) One task of the WP4 “CREATION OF INNOVATIVE SOCIAL ACTIONS”:
    - a) Task 4.5 “Apps for citizen empowerment and engagement”, point (3) Citizen App to foster transparency and citizen participation (R7). This task will be to design and develop a multi-platform app that, in particular
      - Allows consulting the invoices and retrieving information about citizen behaviour as well as the overall state of the waste collection system in the municipality, like the economic, environmental and social impacts.
      - Allows citizens to get access to the bill information or submit issues about the collection system.
  - 4) Finally, this Deliverable relates to all tasks of the WP 5 itself:
    - a) Task 5.1 “New PAYT schemes” has the goal to define the models to calculate the parameters of the PAYT schemes and to identify a set of innovative parameters aimed at certifying the effectiveness of the measurements of PAYT schemes. Each indicator will be identified to be potentially applied at the EU level.
    - b) Task 5.2 “Definition of specific PAYT systems on pilots” to introduce a new regulation for waste management, including PAYT specific criteria.

On the other hand, this D5.1 has a close relationship with the following Deliverables related to the mentioned tasks:



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- a) D1.1 “Pilot planning documentation” is the result of the tasks 1.1 and 1.2 and is connected to this D5.1 because it defines the KPIs, the Use Cases and the Functional and non-Functional requirements.
- b) D1.3 “Sustainability Assessment Models” is the result of task 1.3 and it is connected to D5.1 because it:
  - Fixes the sustainability model and the KPIs to be used in the evaluation of the project objectives;
  - Sets the baseline of the pilot sites;
  - Defines the models to calculate the parameters of the PAYT schemes including a set of innovative parameters aimed at certifying the effectiveness of the measurements of PAYT (Task 5.2).
- c) D2.7 “Technical Documentation of R3: Planning Module” is in relation with all the tasks of WP1, task 2.4 which consists of a set of tools to optimize different aspects of the waste management system.
- d) D4.11 “Technical Documentation of the Apps of R5, R6 and R7” where the Citizen App is technically described to foster transparency and citizen participation.

The objectives of this deliverable are the following:

1. Ensure that the measurement methodology for waste will comply with criteria of reliability, safety, fairness and transparency.
2. Identify indicators for the chosen measurement model and provide the Local Authority with IT instruments to facilitate the monitoring and control phases, in order to easily identify anomalies and take corrective actions.

## 2. Overview of PAYT schemes in Waste4Think

### 2.1 Key features of PAYT schemes to be implemented

Waste4Think foresees the implementation of a Pay As You Throw scheme in the three pilots of Seveso, Zamudio, Cascais, while in Halandri it will not be implemented as described in D1.3, Section 4.

A summary of each scheme is provided in the following table. Further details can be found in D1.3.

Table 1 Key features of the three PAYT schemes implemented in W4T pilots

	Seveso	Zamudio	Cascais
<b>Implementation area</b>	All of the city (23.000 inhabitants)	All of the city (3.270 inhabitants)	Limited area (2.500 citizens out of 200.000)
<b>Regulatory issues</b>	PAYT is specifically foreseen by national waste tax law, allowing and pushing municipalities to implement it	PAYT not foreseen by national waste tax law, municipalities can implement it voluntarily	PAYT not foreseen by national waste tax law, municipalities are not actually allowed to choose a different waste tax than the standard one
<b>Fractions of waste individually measured (direct measure)</b>	Residual waste	Residual waste	// (the identification is voluntary and there is no chamber system to measure volume)
<b>Fractions of waste individually measured (estimation)</b>	//	organic, light-packaging and paper-cardboard as those made to the residual waste fraction, and minimum one per trimester to oil and glass	Residual, Light packaging, Paper, Glass
<b>Way of waste measuring</b>	<u>Volume.</u> Number of residual waste bags collected individually door to door	<u>Volume.</u> Number of openings of 15 l chambers applied to locked collective road containers	<u>Estimation.</u> Number of identified accesses to unlocked underground collective containers
<b>Variable part of the tax</b>	€ 2,30 for each 110 liter bag	€ 2,00 for each opening of a chamber of 15 liters (exceeding 13 openings /trimester included in the fixed tax)	15% of top performers according to the pattern of generation will receive an incentive of € 25/household/month.

In detail:

- for **SEVESO**: payment is made for the reference year, by issuing a bill that can be divided into 1 or more instalments. If this issue only relates to a part of the TARI (waste tax), it may follow a second issue if and as detailed in the Financial Plan of the reference

year, in addition to any balance, which may be issued as an adjustment instalment in the following year.

- b) The municipal regulation of Seveso defines that the waste disposal is paid a tot per litre. In particular, the **blue bag (residual waste)** unit cost is of €/litre 0.02090. It means that for a 110-liter bag the user will pay € 2,299 / € 2.30. This value is the same for domestic and non-domestic users, but, if there is a waste disposal surplus, that is the production beyond the threshold, the domestic users pay a little more than €2,30, while the non-domestic users, pay a cost of 0.0534, i.e. € 6.19 / € 6.20 for each blue bag surplus disposal. In the case of ZAMUDIO pilot, PAYT applies to residual waste and other separately collected recyclables. PAYT gives right to a specific number of quarterly contributions to the residual fraction and whoever try to separate the waste is subject to a reduced rate.
- c) In the case of CASCAIS, the filling sensors are used in order to take track of each opening of the containers and to provide the overall waste level of the bin. Right now, the volunteer citizens are awarded CityPoints based on the usage of the waste management system. More details in Section 2.3.

Note:

- Waste4Think considers all the waste that is being collected by the 4 pilot sites: domestic and waste from commercial and industrial origin with similar characteristics to those of urban waste, including food waste. More detailed information can be found in Section 3.3.4. “Characterization Matrix and Baseline Calculation procedure” of deliverable D1.3.
- The PAYT is based on number of bags collected of a given volume (and charged to the user). The accounts are made on the total costs of the system therefore, implicitly, the average density of the waste collection is used.

## 2.2 Needed steps and synergies

In order to implement these schemes, different tools are needed, including not only the invoicing module addressed by this deliverable D5.1, but also additional equipment or just knowledge sharing, taking into consideration that some of the equipment in some pilot was already deployed but not used for PAYT. The following flow chart summarizes the key milestones for the implementation of PAYT in the three pilots, highlighting the synergies in this respect (grey dotted arrows).

The key issue is that technically the invoicing module, as described in the Grant Agreement, will be different. Instead of a unique solution: SOFTLINE will use its software in Seveso, MOBA will develop an invoicing module to be used in the future in case of a real implementation of PAYT in Cascais, and FDEUSTO will develop a dedicated software from scratch to be used in Zamudio.

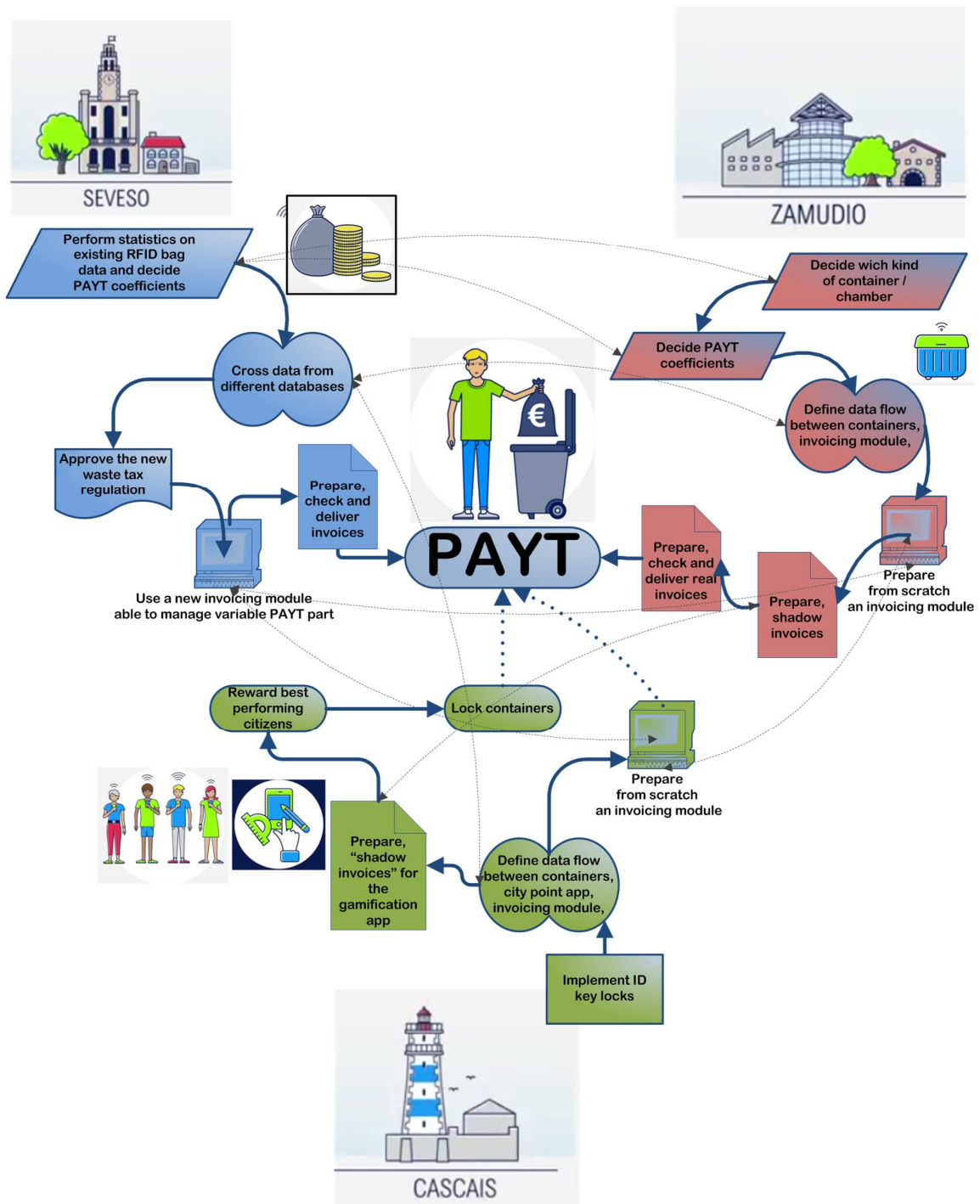


Figure 1 Key steps towards PAYT implementation in the three pilots, and synergies at different stages

However, there are different synergies, depicted in the chart, including knowledge sharing about how to collect data, how long should the transitional phase with “shadow invoices” be, how much to charge for the variable part, what kind of container to use. This coordination and supervision part is carried out mainly by ARS.

This information is used also to avoid duplication of efforts, especially taking advantage of the information gained by Seveso and ARS, being the first pilot to implement PAYT in

Waste4Think, starting from May 2017 (M12). Data collected by Seveso is for instance delivered to Zamudio to identify the typical waste generation of families with a different number of people part of the same households, and information such as density and collection frequency is used to calculate the number of needed road containers to be purchased.



## 2.3 Cascais: towards “Know As You Throw”

In the case of Cascais, the municipality decided to deviate from the strict concept of PAYT, deciding not to implement a real PAYT but rather a benefit scheme which is based on voluntary participation. This is due to legal purposes as a PAYT system would currently require extensive evaluation of waste production (individual) as the cost schemes must be ensured with a weight assessment. It would also be necessary to have the approval of the regulatory body and approval of the Municipality, the service contract owners. This, together with the still not available technological integration would prevent any sort of deployment of the pilot. Volunteers were given an ID key to be used for the underground containers, but they will not be locked, at least in the beginning of the trial, and citizens will be asked to use the key, when opening the lid of the containers, only to identify themselves.

The idea is to send messages to citizens, using the existing CityPoints App<sup>1</sup>, which is fully functional in Cascais, describing their number of openings, and giving real economic benefits (also in the form of bonuses to access municipal services) related to the number of points gained for the accurate use of the waste management system. The CityPoints App is a gamification application (which won an UN’s award on governance) available in the “App Store” and “Play Store”. The App awards points to citizens which participate in environmental or social events/activities. The points can be later redeemed for services, transportation, local commerce, etc.

In the case of Waste4Think, the Cascais team had to program the points system as each bin usage is given one point and individual/collective performance give additional points. This

<sup>1</sup> <https://www.worldsummitawards.org/winner/city-points-cascais/>

meant the integration of the bins key registration and conversion to points by a blacklist, monthly updated to each user (wireless update to their smartphone). This also included the invoice emission which is called the “eco-invoice”. To save paper and the ecological footprint of the system, the team programmed the integration with a monthly invoice emission system (once again inhouse design).

The criteria of points is to actually allow users according to their individual waste production and to give collective bonus points if the collective behaviour is improving (increase of recycling levels). All participants get an in-house developed “shadow invoice” (which we called “eco-invoice” and there is explicit their performance. This allows to highlight how their bad behaviour influences the higher cost for the whole community and how they are paying for the benefit that will be received by the top performers. This concept is somehow leading to a “Know As You Throw”<sup>2</sup> strategy rather than PAYT. This effect will be interesting to be analysed and compared to other experiences; for instance in Seveso the period in which RFID bags were used by citizens only to allow the municipality to test the system, even without communicating individual day by day data, led to an increase of 5 percentage points of separate collection rate. Therefore, the constant communication of structured information to citizens about the waste they deliver and the comparison of the individual results with average / best performers data activates this mechanism, and make citizens feel proactive part in the scheme. Further details of the system in place in Cascais are described in D1.3.

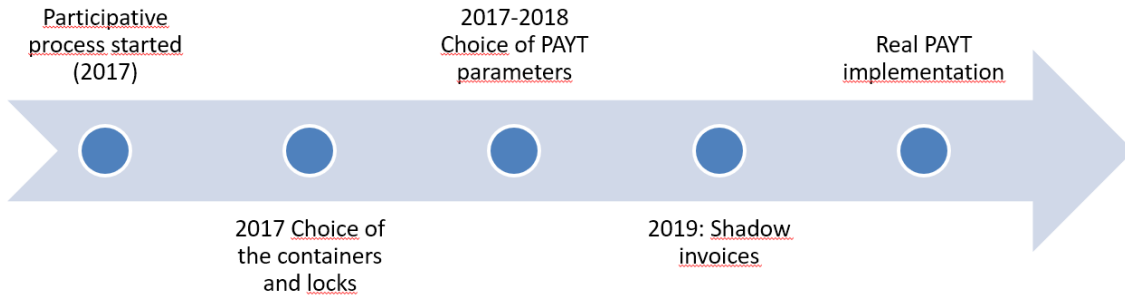
## 2.4 Implementation timeline

The implementation timeline is very different in the three pilots, and this explains why the development timeline of the invoicing module is not going in parallel for the three technology providers. Seveso is the most advanced one with the invoicing module made available by Softline. The development and real usage of the other two invoicing modules is foreseen by the end of the project as shown in the following flowcharts.



<sup>2</sup> [https://en.wikipedia.org/wiki/Hawthorne\\_effect](https://en.wikipedia.org/wiki/Hawthorne_effect)

## ZAMUDIO: Timeline



## CASCAIS: Timeline

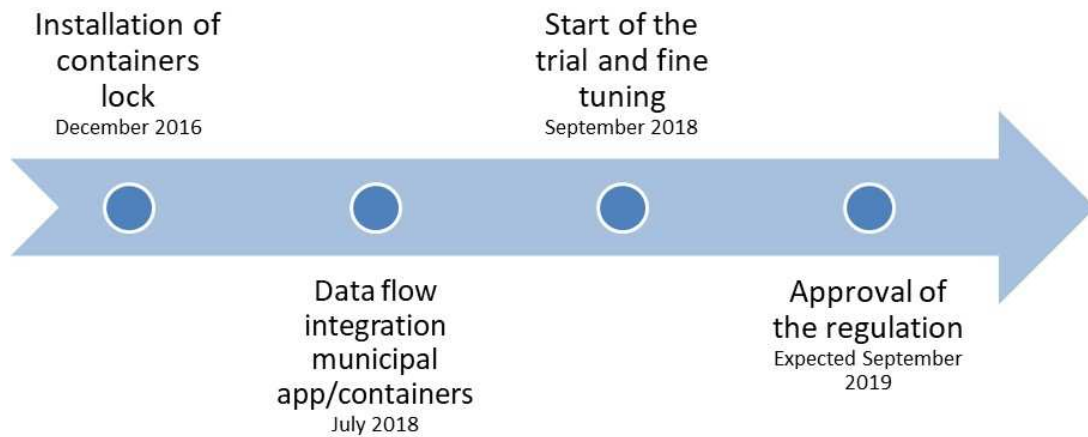


Figure 2 PAYT implementation timeline for the different pilots



### 3. Content and methodology

The technical documentation of the invoice module has been structured in three specific sections:

- *The architecture of the invoice module* provides an overview of the software by introducing the relationship between the environment and the development principles used in component design, defining how the software is divided, describing the functionality of every component and the main interaction between each component which fulfils the functional requirements. Functional Requirements (FRs), as well as the Key Performance Indicators (KPIs) related to each component, are reported during the text descriptions (section 3).
- *Data Interface* shows how the invoice module is related to the external environment and the data and graphical interfaces (section 4).
- *The invoice structure* shows the example invoices created by the different software.

*Note that the architecture of the invoice module and the invoice structure are shown as valid for all the three W4T software implemented and develop for the different pilots. Even though the 3 invoicing programs software share a common architecture in terms of communication with the W4T back-end, the specific implementation of each invoicing program is different. The integration of the three invoice approaches into a single system is not possible due to technical reasons, commercial exploitation, language, technical support, political situation, etc*

The software follows the specific national law and regulation about waste tax. A fundamental step to move towards a PAYT scheme is the possibility to generate clear and immediately understandable invoices for citizens, related to the amount of waste generated according to the local regulation on waste tax. This software will be able to do this, including the use of strong and reliable indicators and a web module that will allow to disclose the main parameters to the apps that will be developed for citizens in the Waste4Think project.

#### 3.1 Methodology

The invoice module is developed by three project partners:

- SOFTLINE will be in charge of the integration of the PAYT module in the WINTARIF software at the Seveso pilot;
- MOBA will be in charge of integration of the PAYT module in the Mawis U2 software at the Cascais pilot;
- FDEUSTO will develop an open source module to be deployed in Zamudio pilot.

Although the three pilots are different among them, Softline, FDeusto and Moba have decided that the software architecture should be the same for all the software. Softline indicates the minimum requirements of the data input, data output and of the algorithms of the invoice module. This will support the integrate approach of the project solutions.



## 4. Security Assessment

### 4.1 Seveso security assessment

Softline Ltd assure data protection safety in accordance with the European Union Regulation n. 679/2016, "General Data Protection Regulation" through appropriate technical and organizational measures, pursuant to art. 32 of the Rules. Specifically, the Company acts by implementing physical and logical security measures:

#### 1. Physical measures:

- To access the offices of Softline S.r.l. two authentications are necessary through an intercom, after which an employee on the first floor takes care of accompanying the visitor from the person in the office with whom he has an appointment.
- The company is on two floors, in two separate apartments, each of which is protected by an armored door.
- Employees are in possession of the keys to access the offices.
- The servers are located in a separate room to which system administrators (specialized personnel) have access.
- The server room is conditioned.
- A UPS is provided to support the server.
- The structure is compliant with Legislative Decree 81/08 - Consolidated safety text updated.

#### 2. Logical security measures:

- Softline operates on servers that reside at the OVH data center, located in France. The provider is ISO 27001: 2013 certified.
- A second server is present in the office that works as a backup. Logical access to this server is only possible by system administrators: the employees in fact connect to the systems residing at OVH.
- The management of backup copies is carried out only with the authorization given by the customers and aimed at testing, servicing and maintenance.
- Logs for access to the operating system are registered.
- Access logs to applications are registered.
- Each operating staff has a nominal password protected user that is changed periodically.
- Periodic training for personnel in the field of privacy is carried out.

- The management of post-contract data (data cancellation processing) regulated by agreements with the customer during the signing of the contract or at the end of the contract.
- Mobile systems are protected by encrypting the operating system (Full Disk Encryption, FDE).

Furthermore, the data are safely managed from their acquisition until they reach the cloud platform (FTPS) for the following reasons:

- About data transfer between vehicle and the cloud server of Gelsia, it's intrinsically secured (encryption) by the mobile phone operator protocols.
- Data are stored in a secure private FTPS area on a daily basis.
- RFID Chips are thermally pasted to the bags on the inner surface. They cannot be detached without breaking the bag. They store a code which is unique and not replicable.
- It is no possible that anyone theft the identity of another citizen and get bags in its name because it is prohibited by regulation but it's of course easy to do; obviously, the other citizen is aware that someone is using his bags (he picked them up for himself from the vending machine by using his own social security card). Other situations are obviously possible (someone using the SS card of another citizen to pick up a roll of bag).
- No one could make its own ibags because RFID chips store a unique code which is not replicable. Fake bags, if possible, will result having a wrong code not linked to any user, and the system will detect this anomaly.
- RFID chips could be disabled by cutting them or maybe strongly folding, but the operator will in most cases realize of this during the collection.

## 4.2 Zamudio security assessment

In this section we present a security assessment of all components in Zamudio Pilot.

- **Cards:** MYFARE cards have already a security layer that does not allow to read or write information in it without the encryption key.
- **E-locks:** E-locks are also key-protected which prevents the modification of the log of openings stored. It is true, however, that the e-lock are weak against spoofing attacks since the communication between e-lock and the truck data app is not encrypted. This way the data exchange between these two elements could be sniffed or a fake e-lock could be created. In both cases, as the communication protocol should be "reverse engineered", the potential gain is very little (the attacker could create fake measurements but never delete), and these measurements could be easily detected, it is not expected that anyone would take the effort. Obviously, as the e-locks are on field, they could vandalized but these would made the container inoperative.

- **Transmission:** Transmission from the truck data app and the back-end is secured using state of the art WIFI encryption. Nevertheless, the system would not be secured against physical access as it would be assumed that trucks are not accessible.
- **Back-end:** In this point, all information is secured following the current state of the art and the security mechanisms detailed in Deliverable D2.1.

For what concern the Security Issues for the Zamudio pilot see the document “D5.1-Private Section Zamudio”.

## 5. The architecture of the invoice module

This section provides an overview of the three software - WINTARIF, Mawis U2 and Zamudio Invoice Module - by introducing the relationship between the environment and the development principles used in component design and by describing:

- How the software is divided;
- The description of the functionality of every component;
- The main interaction between each component, which fulfils the functional requirements.

As mentioned in paragraph 3.1 “Methodology”, the three software have the same architecture and follow the minimum requirements of data input, data output and algorithm necessary to create an invoice module able to generate clear and immediately understandable invoices for citizens, related to the amount of waste generated according to the local regulation on waste tax.

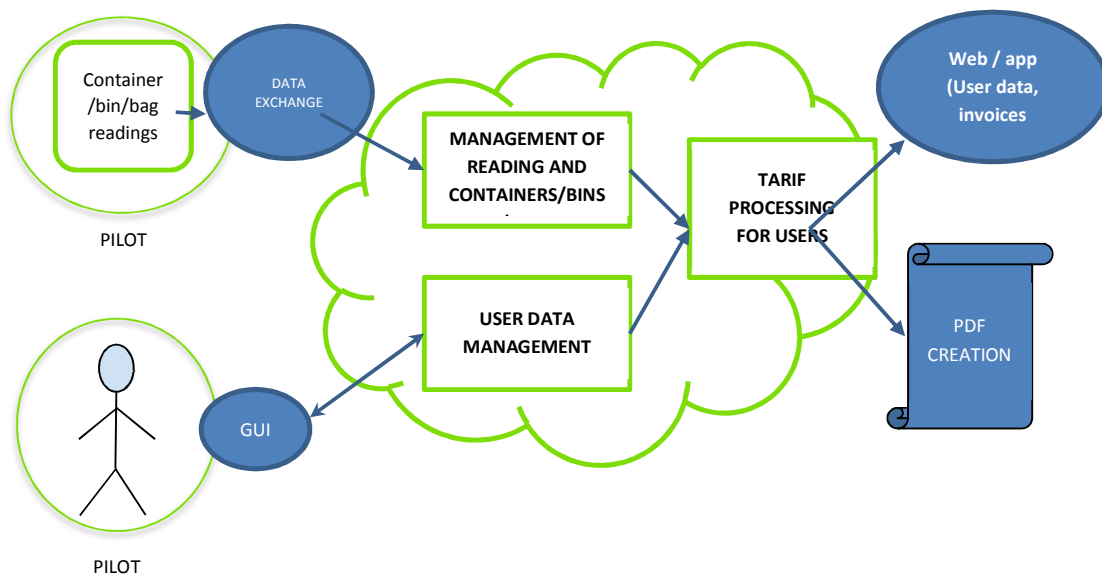


Figure 3 Generic aarchitecture of a pilot system

**Minimum requirements for a billing form:**

- 1) User data,
- 2) containers used with volume,
- 3) fixed costs and variable costs,
- 4) Readings of contributions made by users.

Tariff model could provide a fixed part plus a variable. The fixed part could be greater than zero (according to legislation and choices of the municipality).

- Fixed part: if it is greater than zero it can be a total fixed costs / utility costs divided by domestic and non-domestic. Or it may be based on the volumes of the contents of which it is equipped with users.
- Variable part: quantity for euro to kilo estimated.

Output will be the calculation expressed in fixed and variable quota plus elements that expresses the invoice: transfer period, identification data invoiced, and details of the contributions by date of contribution.

## 5.1 WINTARIF software – Seveso Pilot

WINTARIF Software provided by SOFTline and the Waste Tariff office of the Seveso Municipality managed the client personal data regarding property details and user addresses (which may differ from the property address). WINTARIF calculates the exact rate on waste disposal detected for every single user. Gelsia ltd, which is the Waste Management Company of the Municipality, manages each distribution phase using portable devices, as well as automatic distributing machines and manages waste disposals.

A data exchange is needed between the Municipality of Seveso, which uses WINTARIF software, and Gelsia in order to have a correct use of the whole system.

As the invoice module must consider different subjects, such as the Waste Collection Company “Gelsia”, the Municipality of Seveso, the citizens and a third party which provides the services, in this case SOFTline,- the approach that SOFTline uses is based on different graphical interfaces modulated according to the profiles.

In fact, the employees of the municipality have access to the WINTARIF software via pc. Regarding Gelsia, it was decided to offer a WINTARIF as a web service in order to give them the opportunity of independently managing the import and export files. Finally, the waste tariff users can view the situation of their waste disposal and the tariffs applied via an app (Android and iOS).

The software is implemented for different reasons:

1. The implementation of the data exchange link the Gelsia bag rolls distributors and WINTARIF. This link required the development of ad hoc procedures to send and

receive personal data of the users between SOFTline and Gelsia and records of the delivered and collected bags. Synchronization between the WINTARIF database and the Gelsia database allows the distribution of bags from the bag rolls distributors located in the municipal territory. All the personal data are sent every day on a FTPS area and automatically received by Gelsia systems with a contextual update on the distributors.

2. The method for the calculation of the waste tariff now considers different components never implemented before and the module is fully configurable in a way that can be adapted to the different rules of the majority of Municipalities without the need for additional programming or maintenance. In the specific case of the Municipality of Seveso, the tariff calculation is based on two different variable parts:
  - Variable 1 - on the basis of the ministerial coefficients for the types of differentiated waste.
  - Variable 2 - on the basis of undifferentiated waste for domestic users and on the basis of surpluses for non-domestic users.

The first PAYT invoice for domestic users was printed in November 2017, while for non-domestic users in December 2017. In order to issue the invoices, much effort was placed in testing and putting into production the PAYT method used in Seveso. Other method will be tested and produced within the project time-table, In fact since SOFTline provides design, strategic – directional and IT consulting on waste tariff management, it has developed different PAYT method for different customers (Municipalities) based on various scenario, considering: a) the fixed part of the tariff based on Ministerial coefficient depending on the produced level of waste delivery related to the type of user (domestic or non-domestic) to square meters and number of household; b) the variable part of the tariff is calculated using different methods of waste readings and calculating the quantity of only one type of waste produced or the quantities of various type of waste or, furthermore, considering the variable part of the tariff divided into a fixed one and a variable one (as for Seveso).

3. The implementation of the Interface for sending waste production data according to a structure is being defined for sending waste production data according to a structure to be defined with the Project Partner number 19 – ENGINEERING, for the population of the Open Source FIWARE platform. The **Integration of Wintarif with W4T backend happens through the NGSConnectorAPI** that is a RESTful web service that allows authorised Waste4Think users to create, update and retrieve Waste4Think context entities in the Back-End platform.(see **Deliverable 2.3, Section 6.2.1**). The entities uploaded every day are WasteTransaction, DepositPoint, Agent. Within this information, the only personal data regard the waste collection point of the users (address of the users. SoFTine uses FIWARE web service to upload and update Seveso data thorough.

Figure 4 shows the whole architecture of the Seveso pilot system and how the WINTARIF

software is connected to other components, while Figure 5 shows the details of the architecture system and the functionalities of the components of the system and WINTARIF itself. This architecture is also explained in Deliverable 1.3.

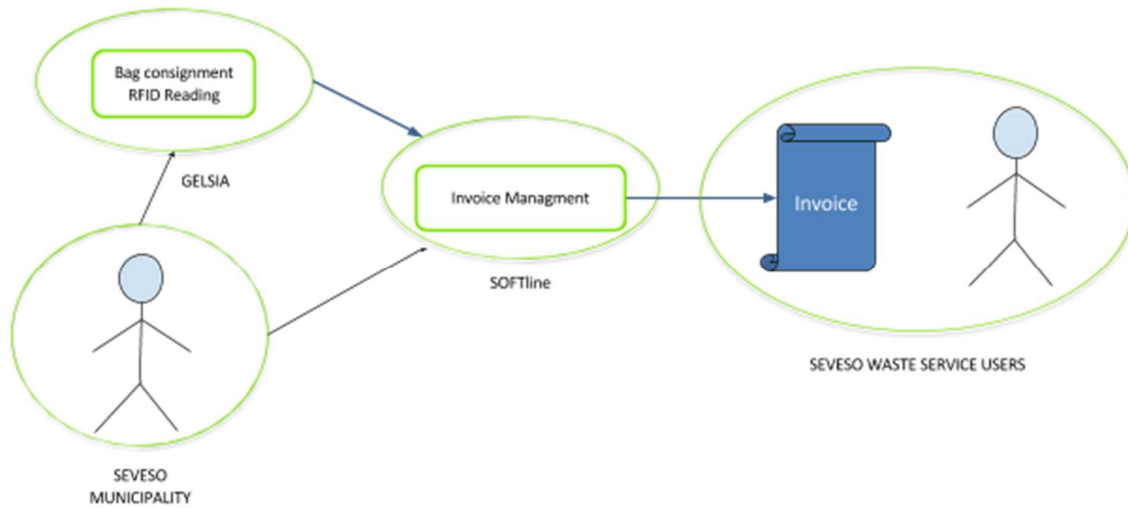


Figure 4 Architecture of the Seveso pilot system

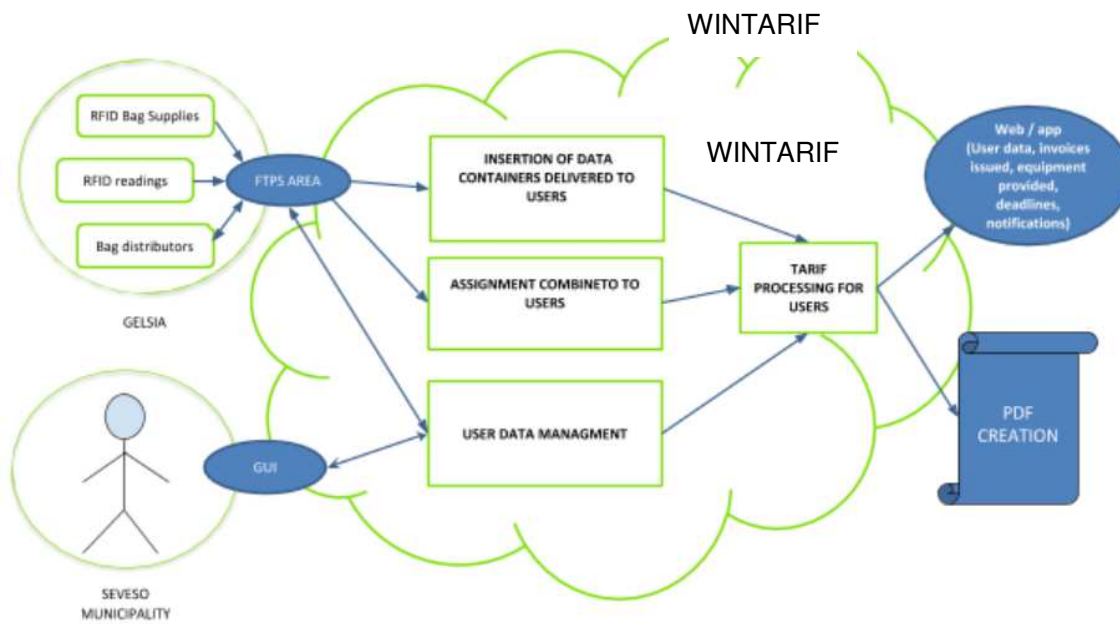


Figure 5 Detail of the architecture of the Seveso pilot system

The invoice module includes the following components:

1. User data management - management of user data;
2. Insertion of data containers delivered to users - management of containers \ bags;
3. Assignments related to users - reading management;
4. Tariff processing for users - invoice management.

### 5.1.1 TARIFF PROCESSING FOR USERS – INVOICE MANAGEMENT

Figure 6 shows the components of WINTARIF connected to the invoice management.

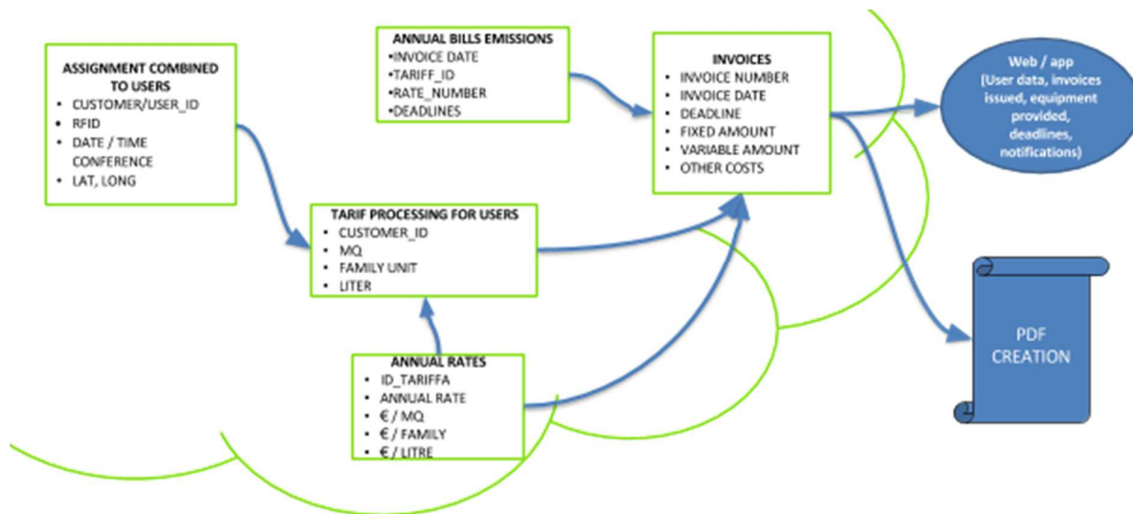


Figure 6 Architecture about the invoice module

### Description and functionality

This WINTARIF module deals with invoice calculation.

### Requirements

- R1\_NFR1.1 - The system must be auditable-
- R2\_FR3.1 - Be able to calculate taxes following different PAYT schemes.
- R2\_NFR3.1- Implement the calculation method established by Municipality Regulation.
- R2\_NFR3.2 - Generation of transparent invoices.

### Input

- Data on users' utilities.
- Data on the municipal budget for municipal waste.

- Data on containers associated to users.
- Data on waste disposal carried out by users.

## Output

Invoice

## KPI

Result	Social Action Name	KPIs
R16 (Economic instruments)	PAYT	Urban residual waste per-capita (estimated at the beginning of the project and every six months).
		Number of domestic and non-covered by incentive schemes, such as PAYT schemes.

## Data Model

Tables 2 reports the requested data necessary for the invoice management. These tables are simplified and represent the essential. The requested data are:

- 1) **ANNUAL BILL EMISSION** for the invoicing
  - a. Dates of the issued invoice: INVOICE DATE.
  - b. ID Numbers of the tariffs applied to a specific user of a specific waste category: TARIFF\_ID.
  - c. Waste tariffs: fixed and variable parts (for the calculation method see the Deliverables 1.3 and 5.3): TARIFF NUMBER.
  - d. Deadlines for the payments: DEADLINE.
- 2) **ANNUAL TARIFF** data allowed by the budget of the Municipality in order to have the coefficients for the fixed and varying parts of the tariffs, the categories (domestic and non-domestic) etc...
  - a. ID Numbers of the tariffs applied to a specific user of a specific waste category: TARIFF\_ID.
  - b. Annual budget/tariffs decided by the Municipality: ANNUAL TARIFFS.
  - c. The value of the fixed quota of the tariff based on property area: €/mq.
  - d. The other quota of the fixed tariff based on family unit: € / FAMILY.
  - e. The variable costs of the tariff based on deliveries: €/litre.



- 3) **TARIFF PROCESSING FOR USERS** where the parameters are defined based on the data obtained during the year:
- ID numbers of the customers'/users': CUSTOMER\_ID.
  - Square meters of the domestic and non-domestic users: MQ.
  - Number of family members who live in the waste taxed property: Number of Persons per Family.
  - Quantity of waste produced: LITRE.
- 4) **INVOICES**
- Number of the invoices: INVOICE NUMBER.
  - Date of the invoices issued: INVOICE DATE.
  - Deadlines for the payment of the tariffs: DEADLINE.
  - Fixed parts of the tariffs: FIXED COSTS.
  - Variable parts of the tariffs: VARIABLE COSTS.
  - Other expenses, such as penalties, interests applied etc: OTHER COSTS.

*Tables 2 Data model necessary for the invoices*

<b>ANNUAL INVOICE EMISSIONS</b>	
•	INVOICE DATE
•	TARIFF_ID
•	RATE_NUMBER
•	DEADLINES

<b>ANNUAL RATES</b>	
•	TARIFF_ID
•	ANNUAL RATE
•	€ / MQ
•	€ / FAMILY
•	€ / LITRE

<b>TARIF PROCESSING FOR USERS</b>	
•	CUSTOMER_ID

- MQ
- Number of Person per Family
- LITRE

INVOICES	
•	INVOICE NUMBER
•	INVOICE DATE
•	DEADLINE
•	FIXED COSTS
•	VARIABLE COSTS
•	OTHER COSTS

Table 3 summarizes the relation between the main components of the software and its functionality.

Table 3 Relation between software module and functional requirements

	R1_FR1.1.2	R1_NFR1.1	R1_FR3.3	R2_FR3.1	R2_NFR3.1	R2_NFR3.2
	Allow to identify the user by an iBag (RFID)	The system must be auditable	Allow to report incorrect use of a container or bag	Be able to calculate taxes following different PAYT schemes	Fulfilment with the calculation method established by the Municipality Regulation	Generation of transparent bills
User data management	X		X			
Insertion of data containers delivered to users	X	X	X			
Assignment combined to users	X		X			
Tariff processing for users		X		X	X	X

## 5.1.2 USER DATA MANAGEMENT - MANAGEMENT OF USER DATA

Figure 7 shows the component of WINTARIF that is connected to GELSIA system of reading of the waste collection bags. GELSIA is the waste collection company of the Municipality of Seveso and this connection is made by a File Transfer Protocol (FTPS).

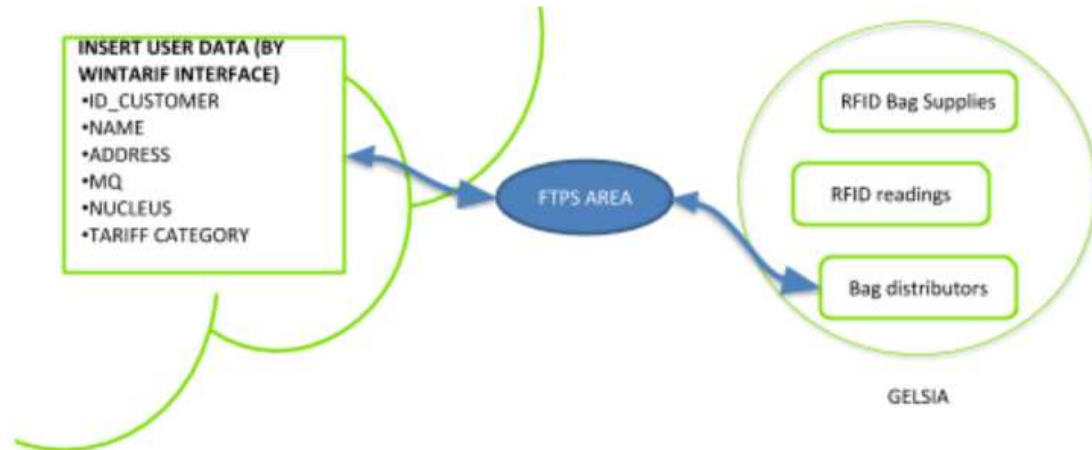


Figure 7 Architecture of User Data Management

### Description and functionality

The user data management is the WINTARIF module that deals with the management of users data. These data are historical records with incoming variations: balances, termination, expiry, etc...

### Functional Requirements

R1\_FR1.1.2 - Allow to identify the user by an iBag (RFID).

R1\_FR3.3 - Allow to report incorrect use of a container or bag.

### Input

Statements by users.

### Output

Data for the invoices of the user positions.

### KPI

Nobody.

### Data Model

The following Table 4 reports the data model of the user data management module and the required data are:



Table 4 Data model of the User Data Management

INSERT USER DATA (BY WINTARIF INTERFACE)	
•	ID_CUSTOMER
•	NAME
•	ADDRESS
•	MQ
•	FAMILY UNIT
•	TARIFF CATEGORY

### 5.1.3 INSERTION OF DATA ABOUT BAGS DELIVERED TO USERS - MANAGEMENT OF CONTAINERS \ BAGS

Figure 7 shows the components of WINTARIF related to data that connect bags/containers with their proper users.

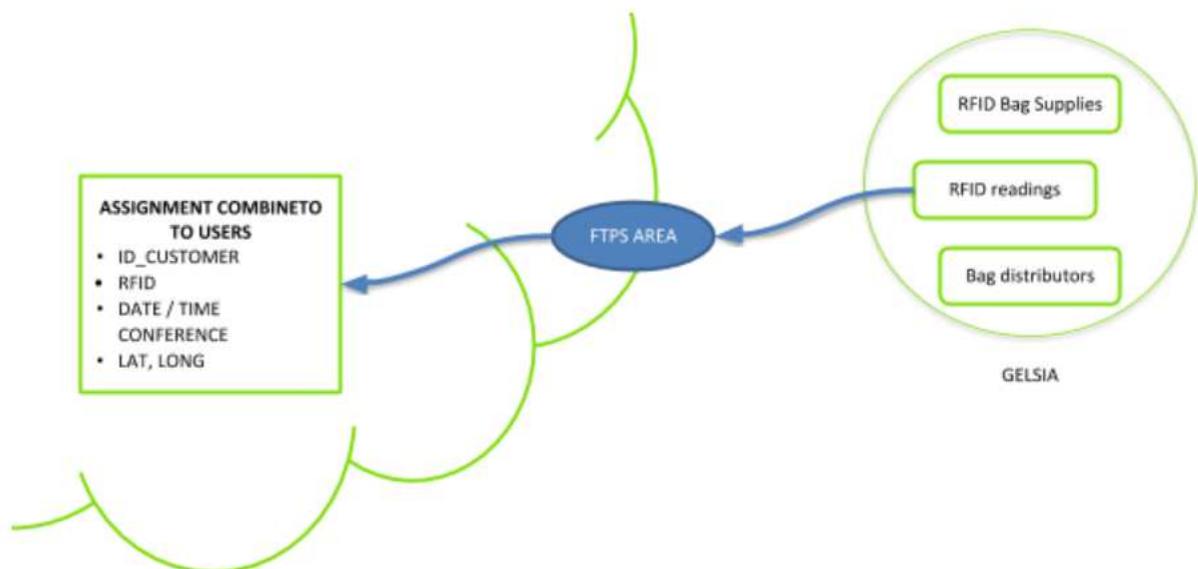


Figure 9 Architecture about the insertion of data related to bags and their users/customers

### Description and functionality

The insertion of data about bags delivered to the users (or collected bags by the operators) is the WINTARIF module that deals with the management of waste bags collection data and the consignment of bag rolls.

This module contains the historical data about the associations between the containers or rolls of bags and the users/customers.

### Functional Requirements

R1\_FR1.1.2 - Allows to identify the user by an iBag (RFID);

R1\_NFR1.1 - The system must be auditable;

R1\_FR3.3 - Allows to report incorrect use of a container or bag;

### Input

Data coming from the INTERFACE DATA EXCHANGE of CONTAINERS/BAGS. In particular the required data are:

- **Bag distribution**
- **RFID Bag Supplies**

### Output

Data for the invoices of the users'/customers' positions relating to the association of containers and bags.

### KPI

Nobody.

### Data Model

The Table 5 reports the data model of the containers or bags to be used and the required data are:

- 1) ID Number of the containers or bags – CONTAINER/BAG ROLL\_ID;
- 2) Serial numbers of the containers or bag rolls - SERIAL\_NUMBER;
- 3) RFID tags related to a bag or a container – RFID;
- 4) Volume of the containers or bags – VOLUME;
- 5) Colours of the containers or bags – COLOUR;
- 6) Types of collected waste (paper, glass, undifferentiated, etc...).

*The*

Table 6 is the data model of the containers or bags delivered to users and the required data are:

- 1) ID Number of the containers or bags – CONTAINER/BAG ROLL\_ID;
- 2) ID numbers of the customers or users of the waste collection: CUSTOMER\_ID;
- 3) Dates of the delivery of bags/containers of waste collection: DELIVERY\_DATE;
- 4) Dates referring to when users return the containers: RETURN DATE.

Table 5 Data model of the Containers or Bags

INSERTION OF DATA ABOUT CONTAINERS/BAGS TO USE
<ul style="list-style-type: none"> <li>• CONTAINER/BAG ROLL_ID</li> <li>• SERIAL_NUMBER</li> <li>• RFID</li> <li>• VOLUME</li> <li>• COLOUR</li> <li>• WASTE TYPE</li> </ul>

Table 6 Data model of the Containers or Bags delivered to users

INSERTION OF DATA ABOUT CONTAINERS/BAGS DELIVERED TO USERS
<ul style="list-style-type: none"> <li>• CONTAINER_ID/BAG_ID</li> <li>• CUSTOMER_ID</li> <li>• DELIVERY DATE</li> <li>• RETURN DATE</li> </ul>

Gelsia periodically provides to WINTARIF the data related to the deliveries of RFID bags to the users of Seveso. The data are periodically deposited on the SFTPS site. WINTARIF, in turn, periodically imports these files and records the deliveries of the bags / containers.

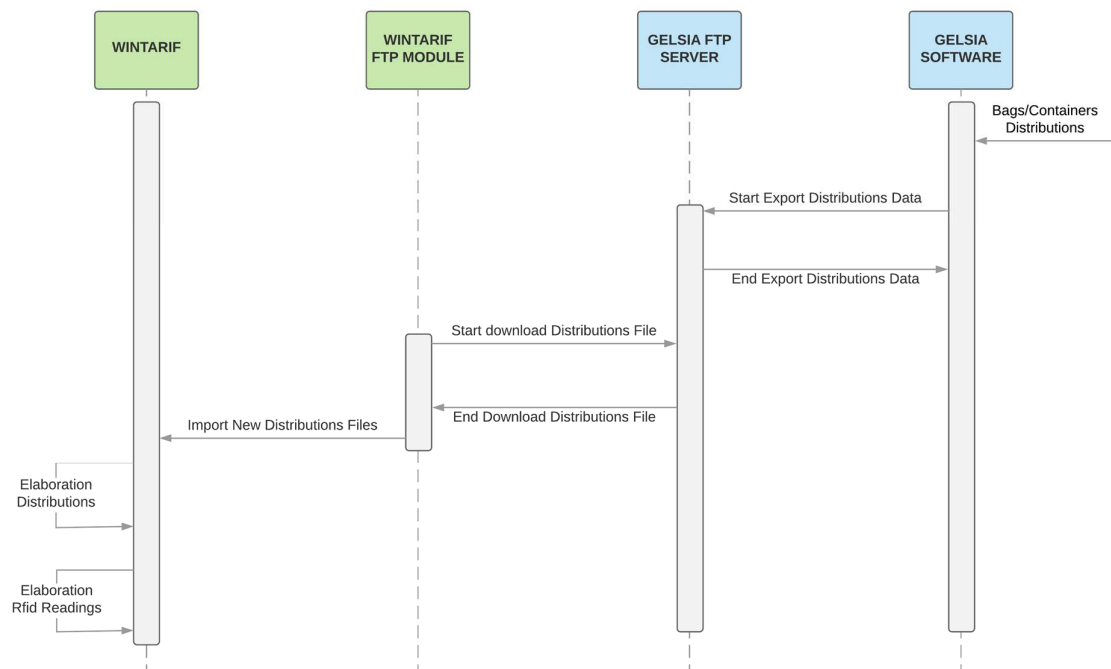


Figure 1 Sequence diagram about data exchange for the bag distribution

#### 5.1.4 ASSIGNMENT RELATED TO USERS - READING MANAGEMENT

Figure 10 shows the WINTARIF component for the reading management.

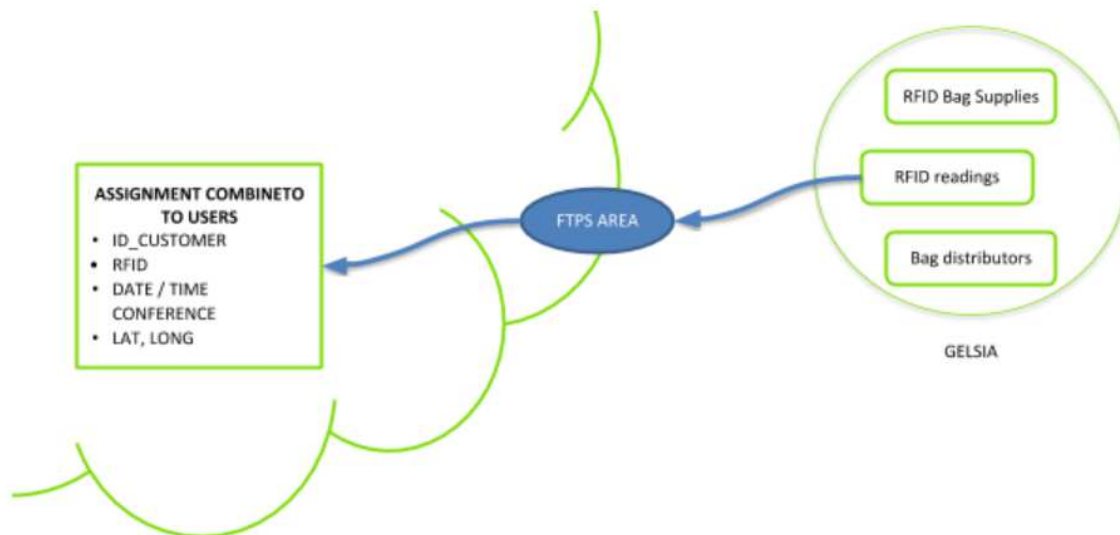


Figure 10 Architecture about the assignment combined to user

#### Description and functionality

The assignment combined to user is the WINTARIF module that deals with the management data about the emptying of containers (or collection bags) and the delivery of bag rolls. This form contains historical data about all the associations between the containers, bags, related rolls of bags and the citizens.

#### Functional Requirement

R1\_FR1.1.2 - Allows to identify the users by an iBag (RFID).

R1\_FR3.3 - Allows to report incorrect use of containers or bags.

#### Input

Statements by users/customers

#### Output

Data for the invoices of the users' positions.



## KPI

Result	Social Action Name	KPIs
R16 (Economic instruments)	PAYT	Number of RFID bags collected compared to the number of delivered bags.
		Average percentage of bags collected for domestic users (for each category) to be compared to European cases.
		Average percentage of bags collected for non-domestic users (for each category) to be compared to European cases.

## Data Model

Table 7 is the data model of the containers or bags delivered to users and the required data are:

1. The ID numbers of the users/customers: CUSTOMER\_ID;
2. Readings of RFID tags (bags or containers) made by vehicles on the territory (also geographical coordinates may be available) RFID;
3. Dates and times of the waste disposal: DATE / TIME DISPOSAL;
4. References to the Latitude and Longitude of the waste disposal: LAT, LONG.

*Table 7 Data model of the assignment combined to users*

ASSIGNMENT COMBINED TO USERS	
•	CUSTOMER_ID
•	RFID
•	DATE / TIME DISPOSAL
•	LAT, LONG

Gelsia periodically provides WINTARIF with the data related to the RFID readings it receives from its vehicles operating in the Seveso municipality.

Periodically, Gelsia deposits a file containing the RFID readings recorded on the FTFS SOFTLINE area. This file is in the format shown in the Record of data related to waste collection" given in chapter 6.1.2 "Data exchange interface of containers".

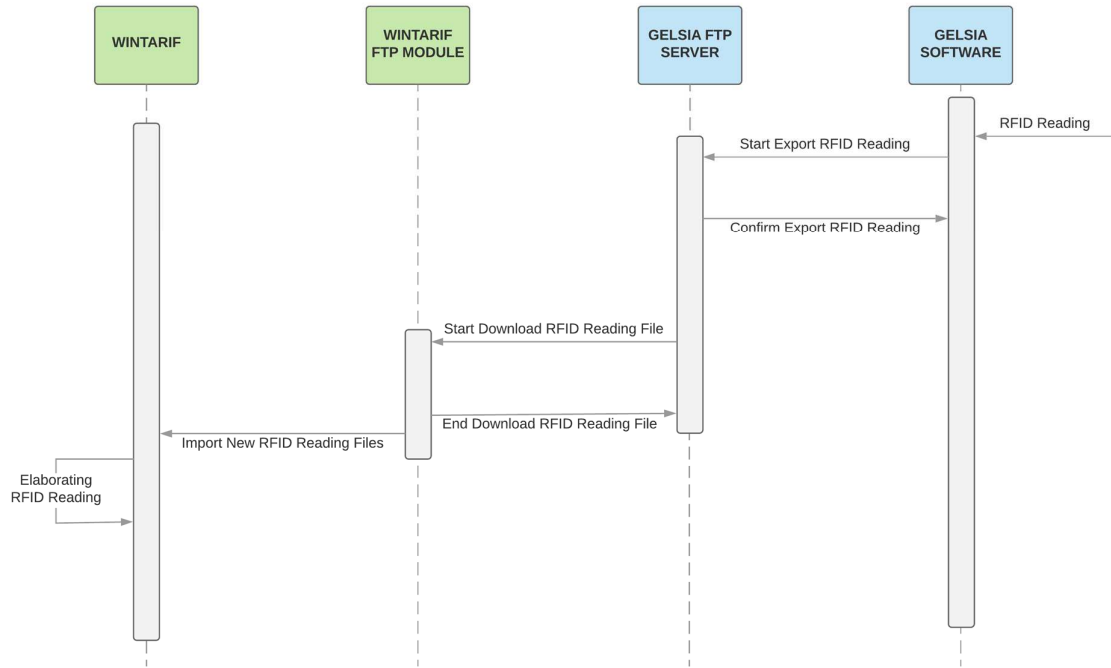


Figure 11 Sequence diagram about data exchange for the RFID readings

## 5.2 MOBA – IT tools for the “Pay as You Through” (PAYT) scheme in Cascais

This implementation should comply with the following Functional Requirements:

R1_FR1.1.1	Allow to identify the users by an ID card (NFC)
R1_FR1.2	Monitor the delivery of waste (control access)
R1_FR1.3.1	Identify the type of waste deposited (estimation based on the users good behavior assumption)
R1_FR1.3.5	Get the localization where the waste is deposited
R1_FR4.4	Allows to create automatic reports in PDF, Excel and CSV
R1_FR5.3	Data Transmission to the Server (for MOBA components)
R1_FR5.3.1	Secured data transmission for PAYT
R2_FR3.1	Be able to calculate taxes following different PAYT schemes
R2_NFR3.1	Fulfilment with the calculation method established by the Municipality Regulation
R2_NFR3.2	Generation of a transparent bills

### 5.2.1 INTRODUCTION

MOBA has provided the tools to help the Waste Collection Companies invoicing properly to the users based on the PAYT scheme of the municipality. Within the Waste4think project, the pilot of Cascais does not contemplate an individual PAYT scenario but the above-explained collective PAYT method focused towards a Know-As-You-Throw philosophy. Notwithstanding, the solution provided in Mawis U2 includes the possibility to add calculations of the user invoices based on a standardized formula which will take into account all Invoicing data and different configurable coefficients. In order to adapt it to the different municipalities needs, only configuration changes will be required, but not specific software programming. This will allow a fast, easy and inexpensive adaptation to the different municipality scenarios.

Two different solutions will be available:

- Web Services Standard Interface to export the Invoicing data to an external Invoicing software. It can be exported the raw data but also the result of a waste price calculation per user.
- Invoicing functionality in order to calculate the invoices in Mawis U2 and the printing of invoices.

There will be defined which are all the Invoicing data affected. Among other, it will include:

- Number of collections
- Type of waste
- Domestic / Commercial
- Quantity: the filling sensors provide the overall waste level of the bin
- Number of inhabitants

- Space (m2)
- Exceptions
- Other under study

In the particular case of the Pilot in Cascais, the invoicing will not be made on MOBA's platform (Mawis) but with the Cascais Ambiente (EMAC from now on) ERP software. The agency that takes care of such kind of invoicing in Cascais is the municipal water utility. Hence, EMAC will be responsible of providing the necessary information to the mentioned institution so that they can invoice the users at a monthly rate. So, the transfer of necessary data from the chambers to the EMAC ERP will be done by a Web Services Interface.

The role of MOBA in this scenario is to collect data from the Waste Locks. Meaning that all the chambers' usages shall be stored in the database with information of the user, the date/time of the lock opening (user's identification since there is no blocking of the bin, just the reader to let the user voluntarily identify himself/herself) and the specific chamber/bin involved. The latter will provide the type of waste. Furthermore, all these data will be helpful to calculate the taxes/costs that shall be considered for the invoicing. The tools to calculate the PAYT taxes will be also included in MOBA's platform.

### 5.2.2 DATA RELIABILITY AND SECURITY

Data storage in MOBA fulfils the national law at every level in terms of security. The MOBA MAWIS system is a system using Approved assessments and criteria "Information Technology Evaluation Criteria (ITSEC)" and "Common Criteria". The BSI "The Bundesamt für Sicherheit in der Informationstechnik" regulates and licenses granted data security for products, components and systems. The Common Criteria and ITSEM / ITSEC Certification of MAWIS MOBA system includes the whole system data from the vehicle to office software. This certificate guarantees that there is no possibility of data manipulation to provide a certificate for the legal use in commercial transactions. In addition, MOBA stores all the data in a specialized Data Centre that meets the requirements of the category the TIER III. Finally, for the integrations with other platforms, MOBA uses the secured Web Services technology (for instance, by means of https connection and user authentication). Despite this, MOBA does not consider GDPR.

### 5.2.3 SCENARIO

At the very beginning of the W4T, the original idea was to use the chambers from MOBA in order to get the same provider of the hardware and the software. However, due to operational constrains which required equipment compliant with existing operational mechanisms (trucks, lifting cranes, deposit and transportation requirements, hydraulics) and similar appearance with other existing bins in the municipality, EMAC made a public acquisition and decided the chamber's provider to be SOTKON. This brought a delay on the progress because an integration between MOBA and SOTKON is mandatory. Hence, MOBA needs to integrate its platform with the electronics of the SOTKON systems (EMZ). The integration is fully defined and partly fulfilled. Some implementation steps still need to be completed along with the proper testing phase in order to finalize it. However, as of now the identification of the users is already being stored in the database so that EMAC can account for the participation of the citizens.

On the other hand, for some legal issues, Cascais municipality will not be able to apply a PAYT scheme. Therefore, the scenario will be completely different in Cascais since the above-mentioned data and tools needed for an invoice will not be used as in other municipalities. The solution adopted by EMAC in the Pilot is the so-called “Collective PAYT”. This scheme will not contemplate only the individual participation of each citizen but the collective involvement of the Pilot users. Therefore, the benefits will be tied to good behaviour of the group of users and shall be calculated on the basis of a points system. The better the performance is the higher the bonus (both the individual and the collective). In fact, the system is expected to work as an encouragement method to foster the recycling within the users. For that purpose, EMAC presented the CityPoints Cascais App, a mobile gamification application (developed in partnership between the Townhall, EMAC and InnoWave) that will be used among the Pilot citizens which will provide social benefits based on the participation level. This joint development has ensured a fully working App that converts the user registrations into points in the app, potentially worth the same as the fixed rate. This allows for a conversion of the expected financial gain into points.

Additionally, after every 12 months, the saved financial estimation will be invested in collective neighborhood improvements (such as children’s playground equipment, urban furniture, greenspaces, etc.). this will be a more permanent show of the savings impacts.

At the end of the chain, there is a collective shadow invoice with the individual bonus. Meaning that no taxes will be charged to the users but just the corresponding figures will be presented. The invoice is an in-house development which integrates the bin usage information and is converted into points by a programming tool which then emits and automatically sends the invoice to each participating family. This was done internally by EMAC and allows to retrieve and register usage data, benefit estimation and App integration (with the points calculation).

In case there should be an integration with MOBA, it is something that could be analysed and performed but that would remain out of the scope of the W4T. The following Figure 12 shows the different entities that have to collaborate together in order to obtain the necessary data for the Collective PAYT in Cascais.



*Figure 12 Entities involved in the Collective PAYT system in Cascais*

It is worth remarking that, from the very beginning, the role of MOBA is to provide data from the chambers and the tools to measure the taxes to be invoiced on a PAYT scheme. The problem when developing IT tools for such purpose, is that every municipality has its own PAYT scheme and the formula to obtain such taxes is not always the same. Thus, the main

idea is to get a kind of a standard formula to estimate part of the costs and analyse at which extent the system has to be customized for each municipality. However, based on the above-described scenario for this Pilot, EMAC may not use (at least at the beginning) the tools provided by MOBA, only the data from the waste locks. Notwithstanding, within the W4T, MOBA will develop such tools for a real PAYT scheme in case Cascais (or other municipalities) needs them in the future.

With the aim of starting to collect data from the waste locks, until the integration was not operative, EMAC and MOBA had agreed that EMAC would start taking data directly from the SOTKON platform. Then, they would take care of that data together with that of the InnoWave database in a manual manner. This scenario can be seen in Figure 13.



Figure 13 First stage: manual acquisition of data done by EMAC (Cascais Ambiente)

Later, as a second step, once MOBA and EMZ had their platforms operative, EMAC would take the data from the chambers directly from MOBA to get the integrated solution with the other features from Mawis U2. The final result must be the same, which is EMAC getting information from both platforms available to proceed with the consequent shadow invoicing and the incentive/bonus plan for each user. See below the scenario depicted in Figure 14.

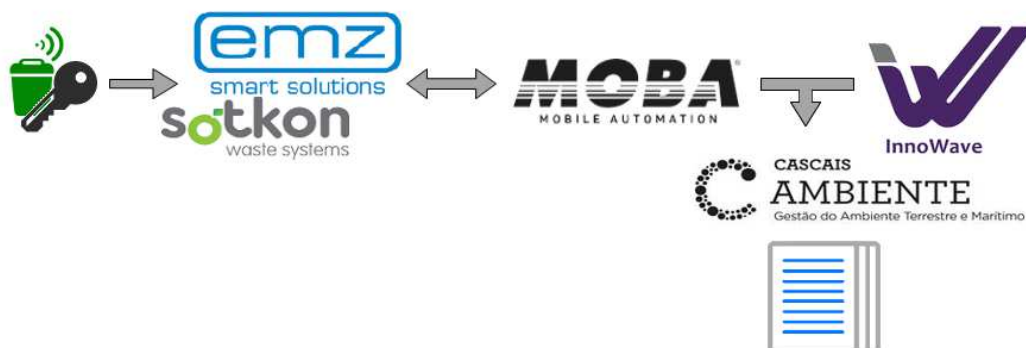


Figure 14 Second stage: integration (MOBA - EMZ) to provide data automatically to EMAC (Cascais Ambiente).

#### 5.2.4 ARCHITECTURE

Once the scenario had been defined and all the parts had agreed to start with the manual extraction of the data, EMAC and MOBA have described the procedure to follow in order to reach the final result expected for both parts.

This section will depict the so-called “Second stage” in 5.2.3. The reader may find the description of the developments to be made in Mawis to provide the necessary information in Cascais. There will be 3 sequential steps described below:

1- **MOBA provides a report on the Mawis web application that contains all the openings of the users. (W4T – Citizen Contributions).**

This first report provides a generic view with all the citizens’ contributions. It can be extracted in either Excel or CSV (see Figure 15) formats. The users from EMAC will use this data together with that of CityPoints App to perform the corresponding calculations.

Figure 15 Input parameters of the W4T - Citizen Contributions report

This report shows a complete list of all the user identifications with the following information:

- Date/time
- Bin ID
- Address of the bin
- Waste lock ID
- Bin Category (e.g. PAP5000 for a Paper/Cardboard bin of 5000 litres)
- Key/TAG ID
- User ID (in Cascais it will be the ID card of each citizen)
- User information (name and address)

The contribution of all the voluntaries is depicted as follows:

Date and time	Item code	Address (of item)	Waste lock	Category	Key	User code	Generating user
18/09/2018 00:02:08		10695 Avenida Doutor Francisco Lucas - Carcavelos-2775 (Lombos Sul)	1CCB62	IND3000	C01756103057	185608990	Paula Novoa, Avenida Doutor Francisco Lucas Pires, 44 (Carcavelos)
18/09/2018 00:04:11	10720	Rua da Flora, 10720 - Carcavelos-2775 (Lombos Sul)	16CB62	IND3000	C01756EF3E56	214126021	José Pedro Canelas, Praceta da Flora, 45 (Carcavelos)
18/09/2018 00:04:48	10720	Rua da Flora, 10720 - Carcavelos-2775 (Lombos Sul)	015D9E	VID3000	C01756EF3E56	214126021	José Pedro Canelas, Praceta da Flora, 45 (Carcavelos)
18/09/2018 00:05:12	10720	Rua da Flora, 10720 - Carcavelos-2775 (Lombos Sul)	155E66	PLA5000	C01756EF3E56	214126021	José Pedro Canelas, Praceta da Flora, 45 (Carcavelos)

Figure 16 Outcome parameters of the W4T - Citizen Contributions report

With such a report it is already possible to assess the contributions of the population that voluntarily participate in the Pilot of Cascais.

**2- MOBA applies the punctuation algorithm that was designed by EMAC and provides the corresponding data in 2 different ways.**

- a. A report in Mawis that will provide the total Points and the bonus (in €) for each citizen.

The Collective PAYT scheme in Cascais will be calculated by means of CityPoints depending on the participation both individual and collective. The punctuation system that EMAC has defined works as follows:

- Each point equals to 0.08€ for the neighbourhood to be invested.
- Each identification equals to 1 CityPoint (with a maximum of 1 per day)
- Additional 5 CityPoints if using more than 22 times/month (individual)
- Collective recycling rate > 20% equals to 10 CityPoints (individual)

The below **¡Error! No se encuentra el origen de la referencia.** displays the current invoice from EMAC to be reused for that report.



Figure 17 Front and rear pages of the Bonus report for Cascais Citizens

As of now, the definition of this proposal is available only in Portuguese. However, it still needs to be revised and discussed by MOBA and EMAC to assess its feasibility. Once accomplished, it will be possible to translate it into English and add it in the current document (in a further revision).

As a summary, below are the definitions of each area:

- Area 1: Citizen's information (Name, address and email)
- Area 2: Document information (User ID, # of document, emission date and month)
- Area 3: Usage information (# of identifications and CityPoints)
- Area 4: Individual performance based on CityPoints
- Area 5: Collective performance based on CityPoints
- Area 6: Monetary contribution (monthly and total aggregate)
- Area 7: Free text area



- b. A report in Excel/CSV format to be sent to InnoWave in order to integrate it in the CityPoints application (W4T – Contributions citizen by card)..

Based on the above-described punctuation method, MOBA will generate a report to be sent (monthly) to InnoWave that will contain the following data:

- NIF (Used ID)
- Number of CityPoints
- Description (Waste4Think Month)
- Example: 55555555L; 8; Waste4think April

ID/VAT	Number of Points	Description (Waste4think Month)
13931	5	Waste4think December
13931	5	Waste4think January
18552	4	Waste4think December
FMM001_SIT	32	Waste4think January
FMM002_SIT	33	Waste4think January

Figure 18 Outcome parameters of the W4T - Contributions citizen by card report

### 3- MOBA has defined and developed the Invoicing PAYT tool in Mawis U2.

This is the tool to calculate the invoicing taxes based on an individual PAYT scheme. In addition, it contemplates the collective-PAYT scenario of Cascais so as to print the “invoices” based on the punctuation method. The idea is to get this as more standard as possible. Meaning that, MOBA plans to get a part of the calculation based on different parameters that are standard in every municipality. The variable part will vary with the rest of parameters that differ amongst the variety of scenarios.

The user can find a new module within the Mawis U2 modules called “Invoicing PAYT”. In this first menu there is a list of projects that have the Invoicing menu activated (all the projects the Mawis U2 user can manage). Below, in Figure 19, one can see one example:



Figure 19 Invoicing PAYT module within Mawis U2

**Note:** “Invoicings” stands for “Invoicing Periods” of the below-listed projects. The system works with periods where you indicate start and end dates and it gives you all the invoices for that period based on the parameters defined at that moment.

It is worth remarking the naming for the projects within Mawis U2 is “companies”. Hence, when the reader sees company in the software it will mean a project. In the case of Cascais, the project is called EMAC but in the examples presented herewith, the name of the companies/projects are “Empresa de Pruebas” and “Empresa demo”. Consequently, one can continue by clicking on the company name with the right-button of the mouse and hitting the “Manage” option. It brings up the “Invoicing Periods” form for that company as shown in Figure 20:

FROM	TO	STATUS	CALCULATION'S START	CALCULATION'S END	VALUE	USER	ADDITIONAL INFORMATION	CALCULATE	CANCEL CALCULATION	PRINT TOTALS	SHOW PERIOD INVOICES	PRINT INVOICES	RECALCULATIONS
01/04/2019 00:00:00	30/04/2019 23:59:59	Completed successfully	13/02/2019 14:29:09	13/02/2019 14:42:22	0	Joan Guasp	Calculation ended: 28022802 (100%)	[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]
26/03/2019 00:00:00	27/03/2019 23:59:59	Pending calculation				Juanjo Rodriguez		[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]
01/03/2019 00:00:00	31/03/2019 23:59:59	Completed successfully	13/02/2019 14:16:21	13/02/2019 14:29:09	0	Joan Guasp	Calculation ended: 28022802 (100%)	[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]
01/02/2019 00:00:00	28/02/2019 23:59:59	Completed successfully	13/02/2019 14:03:11	13/02/2019 14:16:21	0	Joan Guasp	Calculation ended: 28022802 (100%)	[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]
01/01/2019 00:00:00	31/01/2019 23:59:59	Completed successfully	13/02/2019 13:49:39	13/02/2019 14:03:11	6	Joan Guasp	Calculation ended: 28022802 (100%)	[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]
01/12/2018 00:00:00	31/12/2018 23:59:59	Completed successfully	13/02/2019 13:34:38	13/02/2019 13:49:38	26	Joan Guasp	Calculation ended: 28022802 (100%)	[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]
01/11/2018 00:00:00	30/11/2018 23:59:59	Completed successfully	13/02/2019 13:21:13	13/02/2019 13:34:38	0	Joan Guasp	Calculation ended: 28022802 (100%)	[CALCULATE]	[CANCEL CALCULATION]	[PRINT TOTALS]	[SHOW PERIOD INVOICES]	[PRINT INVOICES]	[RECALCULATIONS]

Figure 20 Form for the Invoicing periods of one project/company

This window shows the invoicing periods of the selected company. It can see the date range that will be used for the invoice calculation (1), the actual calculation status (2), the initial and end dates of the invoices' calculations for this period (3), the user that did the last calculation petition (4), the sum of all the values of the calculated invoices in this period (5). The information of the calculation progress is showed in the “Additional information” column (6). There are also the columns used to interact which each invoice period:

- Calculate (7): Only active if the period is in “pending” or “completed” status (with or without errors). Marks the period to start the calculation (or recalculation) of the associated invoices. This process deletes all the generated invoices of this period. It can be a highly cost process.
- Cancel (8): Only active if the period is in “in process” status. It will cancel the running calculation and will return the period data as it was before the start of the calculation.
- Print totals (9): Only active if the period is in “completed” status (with or without errors). Prints the most relevant values of the period, as the initial and end date of the period, the start and end date of the calculation, the number of generated invoices and the total value of those invoices.
- Show period invoices (10): Only active if the period is in “completed” status (with or without errors). Opens the next window, invoices.

- Print invoices (11): Only active if the period is in “completed” status (with or without errors). Prints all the period invoices. This can be a slow process that will generate a big file, so planning is advised.

There is also the recalculations column (12). This column shows if someone performed a recalculation in some individual invoice inside the period, so the data showed in this table and the real data may not coincide. The new and edit buttons (13) are in the bottom left corner and open the invoice period create/edit form. Editing a period will delete all the related invoices. There is also the option to export the data of the table in a document (14).

## EDIT INVOICING PERIOD

When creating or editing (option 13 in Figure 20) an invoicing period, one will be prompted with the following pop-up (Figure 21) menu to select the period’s dates and a list of parameters:

Figure 21 Edit form of an invoicing period

In such menu, one can configure the invoicing parameters affecting the whole project. It means, they will be used in the calculation of all the invoices. In Cascais’ Pilot, the generic parameters are the following:

- CityPoint price: it defines the value of each point for the calculation
- Collective performance: it is a selection option to be checked (or not) by the invoicing responsible that will indicate whether the period has had a good or bad collective performance based on the punctuation definition
- Project initial date: indicates the beginning of the project
- Report text W4T: it allows to write the text to be printed in the invoice report on the rear page. It is a free text parameter.

**Note:** modifying an invoice period will delete all the previously generated invoice for that same period. Hence, it is important for the responsible to be aware of it when performing any modification to an existing period.

In Figure 22 and Figure 23, it can be seen the result of Print totals (9) and Show period invoices (10), respectively:

### Summary of the billing period

<b>Start date of the billing period:</b>	01/04/2019 00:00:00
<b>End date of the billing period:</b>	30/04/2019 23:59:59
<b>Start date of the calculation:</b>	13/02/2019 14:29:09
<b>Date of issue:</b>	13/02/2019 14:42:22
<b>Number of invoices generated:</b>	2802
<b>Total value of the invoices generated:</b>	0

Figure 22 Generic values for the whole invoicing period

Invoices: Empresa de Pruebas (01/04/2019 00:00:00 - 30/04/2019 23:59:59)

LOCATION	CODE	LOCATION TYPE	STATUS	INVOICE NUMBER	CALCULATION'S START	CALCULATION'S END	VALUE	USER	ADDITIONAL INFORMATION	CALCULATE	SHOW INVOICE DATA	PRINT INVOICE
019463 - Castellar del Vallés 4, 9-C - Castellar del	019463	Domestic	Completed successfully	16318	13/02/2019 14:39:50	13/02/2019 14:39:50	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
019489 - Via Rodolfo Hierandi 12, 9-C - Caleactich	019489	Domestic	Completed successfully	16340	13/02/2019 14:39:56	13/02/2019 14:39:56	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
1 - Av. Lluís Companys i Jover, 7, 08172 Sant Cug	1	Domestic	Completed successfully	16457	13/02/2019 14:40:28	13/02/2019 14:40:28	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
019117 - C. SANTS 85, 9-C - Barcelona (D01)	019117	Domestic	Completed successfully	14238	13/02/2019 14:20:10	13/02/2019 14:20:10	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
10448 - R. COMERCIAL 11, 9-C - Barcelona (D01)	10448	Domestic	Completed successfully	14190	13/02/2019 14:20:56	13/02/2019 14:20:56	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
10448 - R. COMERCIAL 11, 9-C - Barcelona (D01)	10448	Domestic	Completed successfully	14191	13/02/2019 14:20:56	13/02/2019 14:20:57	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
10495 - PLA DE PALAU 7, 9-C - Barcelona (D01)	10495	Domestic	Completed successfully	14072	13/02/2019 14:20:26	13/02/2019 14:20:26	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
10597 - LA RAMBLA 23, 9-C - Barcelona (D01)	10597	Domestic	Completed successfully	14026	13/02/2019 14:20:13	13/02/2019 14:20:13	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
10610 - PG. ISABELL II 4, 9-C - Barcelona (D01)	10610	Domestic	Completed successfully	14079	13/02/2019 14:20:28	13/02/2019 14:20:28	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
1065 - LA RAMBLA 125, 9-C - Barcelona (D01)	1065	Domestic	Completed successfully	14022	13/02/2019 14:20:12	13/02/2019 14:20:12	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
1066 - LA RAMBLA 127, 9-C - Barcelona (D01)	1066	Domestic	Completed successfully	14023	13/02/2019 14:20:12	13/02/2019 14:20:13	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
11121 - C. ABAT SAFONT 1, 9-C - Barcelona (D01)	11121	Domestic	Completed successfully	14021	13/02/2019 14:20:12	13/02/2019 14:20:12	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
1150 - C. ABAT SAFONT 1, 9-C - Barcelona (D01)	1150	Domestic	Completed successfully	14047	13/02/2019 14:20:19	13/02/2019 14:20:20	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
1168 - Av. PARAL·LEL 38, 9-C - Barcelona (D01)	1168	Domestic	Completed successfully	14048	13/02/2019 14:20:20	13/02/2019 14:20:20	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
118 - Av. Lluís Companys i Jover, 3, 08172 Sant C	118	Domestic	Completed successfully	14655	13/02/2019 14:40:27	13/02/2019 14:40:27	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13020 - LA RAMBLA 25, 9-C - Barcelona (D01)	13020	Domestic	Completed successfully	14029	13/02/2019 14:20:14	13/02/2019 14:20:14	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13151 - PG. ISABELL II 4, 9-C - Barcelona (D01)	13151	Domestic	Completed successfully	14080	13/02/2019 14:20:28	13/02/2019 14:20:28	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13153 - PLA DE PALAU 2, 9-C - Barcelona (D01)	13153	Domestic	Completed successfully	14071	13/02/2019 14:20:26	13/02/2019 14:20:26	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13176 - C. PRINCESA 1, 9-C - Barcelona (D01)	13176	Domestic	Completed successfully	14164	13/02/2019 14:20:49	13/02/2019 14:20:50	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13179 - C. PRINCESA 11, 9-C - Barcelona (D01)	13179	Domestic	Completed successfully	14165	13/02/2019 14:20:50	13/02/2019 14:20:50	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13187 - C. PRINCESA 29, 9-C - Barcelona (D01)	13187	Domestic	Completed successfully	14166	13/02/2019 14:20:50	13/02/2019 14:20:50	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13225 - C. COMERS 52, 9-C - Barcelona (D01)	13225	Domestic	Completed successfully	14094	13/02/2019 14:20:32	13/02/2019 14:20:32	0	Joan Guasp	Completed successfully	🔍	🖨️	📄
13258 - LA RAMBLA 87, 9-C - Barcelona (D01)	13258	Domestic	Completed successfully	14030	13/02/2019 14:20:14	13/02/2019 14:20:14	0	Joan Guasp	Completed successfully	🔍	🖨️	📄

Figure 23 List of invoices of one period with all the users/homes involved and the amount of points

This window shows all the invoices related with a period. It shows the location related to the invoice (1), as well as a link to load it to the tree, the location type (2), the calculation status of the invoice (3), the invoice document number (4), the start and end calculation's date (5), the calculated value of the invoice (6), the user who generated the invoice (7) and a field with additional information where there are the possible problems that happened when calculating the invoice and stopped the invoice generation (8). There are, as well as in the previous window, various columns with actions to realize on each invoice:

- Calculate (9): Recalculates an invoice, it will delete all the invoice data, but the header will remain, and will generate new data.
- Show invoice data (10): Only active if the invoice is completed without errors. Opens the next window, Invoice data.
- Print invoice (11): Only active if the invoice is completed without errors. Generates a document with the invoice to print it.

The data of the table can be exported to a document (12).

In Figure 24 it can be seen the result of the "Show invoice data (10)" option.

Invoice data: 019463 - Castellar del Vallès 4, 9-C - Castellar del Vallès

**MAIN DATA**

LOCATION: 019463 - Castellar del Vallès 4, 9-C - Castellar del Vallès (Castellar del Vallès) 1

COMPANY: Empresa de Pruebas 2 FROM: 01/04/2019 00:00:00 3 TO: 30/04/2019 23:59:59 4

INVOICE NUMBER: 16318 5 CALCULATION'S END: 13/02/2019 14:39:50 6 VALUE: 0 7

**INVOICE DATA (16)** 8

CONCEPT	VALUE
Name	019463
Address	4, Castellar del Vallès, Castellar del Vallès
Postal Code	08211
E-mail	test@test.de
ID/VAT	12345678A
Release date	13/02/2019 14:39:50
Monthly balance	abril
Oneraments	0

Refresh data Export PDF Export Excel Settings

Figure 24 Invoice Data

This is an informative window where the user can see the invoice's calculated values. It has three parts: the top, where there are the main data of the invoice, such the location (1), the company (2) and the period dates (3) (4). The centre, where there is the header of the invoice with the document number (5), the calculation's end date (6) and the calculated value (7) and the bottom, where there is a table with the invoice's calculated variables (8).

## EDIT INVOICE PARAMETERS PER USER

From a location/user perspective, one can only define the parameters to be accounted for into the PAYT formula. These parameters will define the results based on a variety of possibilities amongst the municipalities. In the example below (see Figure 25), it is shown a dummy example since the Cascais scenario does not include specific configuration per user:

Location: Carrer del Berguedà, Castellar del Vallès , 4 (Castellar del

MAIN DATA ADDRESS DATA CONTACT DATA CUSTOMERS ITEMS TAX ADDRESS SERVICES DISPOSALS

**ATTRIBUTES**

CODE	VALUE
Number of inhabitants	
Surface	

Cancel Settings

Figure 25 Location attributes to be included in the calculation of the taxes

Based on that attributes, the results will vary on every specific case. In fact, they can be changed along and then, the user can re-calculate the invoice for a specific user.

From the user forms, it is possible to check the historic list of invoices that have been generated. See below Figure 26:

🏠 Location: Carrer del Berguedà, Castellar del Vallès , 4 (Castellar del Vallès)

MAIN DATA ADDRESS DATA CONTACT DATA CUSTOMERS ITEMS TAX ADDRESS SERVICES DISPOSALS CARDS STATISTICS COMPANIES ATTRIBUTES INVOICES

INVOICES (6)		1	2	3	4	5	6	7	8	9	10	11
FROM	TO	COMPANY	STATUS	INVOICE N.	CALCULATION'S START	CALCULATION'S END	VALUE	USER	ADDITIONAL INFORMATION	CALCULATE	SHOW INV.	PRINT INV.
01/04/2019 00:00...	30/04/2019 23:59:59	Empresa de Prue...	Completed successfully	16318	13/02/2019 14:39:50	13/02/2019 14:39:50	0	Joan Guasp	Completed successfully	🗑️	🔍	🖨️
01/03/2019 00:00...	31/03/2019 23:59:59	Empresa de Prue...	Completed successfully	13516	13/02/2019 14:26:40	13/02/2019 14:26:40	0	Joan Guasp	Completed successfully	🗑️	🔍	🖨️
01/02/2019 00:00...	28/02/2019 23:59:59	Empresa de Prue...	Completed successfully	10714	13/02/2019 14:13:42	13/02/2019 14:13:42	0	Joan Guasp	Completed successfully	🗑️	🔍	🖨️
01/01/2019 00:00...	31/01/2019 23:59:59	Empresa de Prue...	Completed successfully	7912	13/02/2019 14:00:46	13/02/2019 14:00:46	0	Joan Guasp	Completed successfully	🗑️	🔍	🖨️
01/12/2018 00:00...	31/12/2018 23:59:59	Empresa de Prue...	Completed successfully	5110	13/02/2019 13:47:17	13/02/2019 13:47:17	0	Joan Guasp	Completed successfully	🗑️	🔍	🖨️
01/11/2018 00:00...	30/11/2018 23:59:59	Empresa de Prue...	Completed successfully	2308	13/02/2019 13:32:10	13/02/2019 13:32:10	0	Joan Guasp	Completed successfully	🗑️	🔍	🖨️

Figure 26 List of all the invoices of one specific user

This table shows the location invoices, identified by the dates that are used to calculate the invoice (1), the company where the invoice belongs (2), the calculation status (3), the invoice document number (4), the calculation start and end dates (5), the calculated value of the invoice (6), the user who launched the calculation request (7) and additional information about the calculation (8). There is also the option to recalculate the invoice (9), although that will cause that all the previous values will be lost, with no option to recover them. There is also the option to open a window with the invoice details (10) or to generate a document to print the invoice (11).

## RESULTING INVOICE REPORT

The platform Mawis U2 gives the possibility to extract the information in 3 different formats (PDF, Excel and CSV). However, the report defined for the Cascais solution has raised a problem in terms of size and computational requirements. Thus, MOBA has analysed different possibilities and have finally decided to implement one new report format.

Although PDF is an open and standard format to store digital documentation, it presents disadvantages in terms of necessary time for its generation and a potentially big document size when it brings together many pictures. Each invoice report for the W4T pilot in Cascais has two pages that are composed of big-sized pictures. On the testing period with such graphic format, it took 0.75 seconds (generation time) and a size of 779 KB (0.76 MB) per invoice.

Though, at a first glance, it might not seem an issue, tests had been made with a sample of 2.000 invoices that has resulted in a generation time of 25 minutes and a PDF of 1.520 MB (1.48 GB).

Many tests have been made generating different types of PDF documents with different compression levels. None of them ended up with a satisfactory outcome when generating a big number of documents (necessary in an invoicing process), neither in terms of time nor in terms of size and quality of the pictures. The quality has become also an upgradeable value in such a pictured report.

Further tests and analyses led to use a different format that can be exported afterwards into PDF (by means of one light and free executable software) that solves all three problems at a time:

- Fast generation of 2.000 invoices: 7 seconds vs. 25 minutes for the PDF
- Generated document content size of 4,000 pages: 6.5 MB vs. 1.48 GB for the PDF
- Image quality: higher due to lower compression

With this new native format, once downloaded, it is possible to print it or convert it to PDF obtaining the same result as through a generation of the PDF document directly by Mawis U2.

Consequently, the raw format has been integrated and implemented within Mawis U2 to provide a better user experience and avoid the system to go down when many invoices had to be extracted. The result can be seen in the below Figure 27 and Figure 28, with the front and rear pages of the report, respectively:



Figure 27 Front page of the Invoice report for Cascais



#### Projeto Waste4Think

É um projeto europeu, que visa encontrar soluções baseadas em tecnologias de informação que possibilitem a melhoria em todas as fases de gestão de resíduos, com especial foco na participação dos cidadãos para a construção de cidades mais sustentáveis e ecológicas.

Além de Cascais este projeto está a acontecer em 3 cidades europeias, Zamudo (País Basco), Seveso (Itália) e Halandri (Grécia).

#### Como funciona

Por cada utilização do identificador no contenedor (máximo de 1 por dia), das ilhas ecológicas do Barrio da Torre e da Quinta de São Gonçalo ganha 1 Citypoint.

Ao registar pelo menos 22 utilizações em dias distintos durante o mês em análise, ganha um bônus de 5 citypoints.

Atualmente o Bairro da Torre e a Quinta de São Gonçalo tem uma taxa de reciclagem de cerca de 20%, caso essa taxa seja incrementada cada participante inscrito no Waste4Think receberá um bônus de 15 citypoints por mês.

A poupança estimada na gestão de resíduos com o aumento da taxa de reciclagem será investida em equipamentos públicos para o seu bairro.

O projeto Waste4Think terá uma duração de 12 meses.

#### O que são Citypoints

Citypoints são incentivos obtidos através de aplicação móvel de smartphone que podem ser trocados por serviços ou produtos descritos na aplicação.

#### Como usufruir dos citypoints

Deverá descarregar a aplicação e efetuar o registo na aplicação "City Points Cascais" disponível no Google Play ou na App Store.

A Cascais Ambiente valoriza a participação e envolvimento público. Trabalhamos em conjunto para melhorar o ambiente no nosso concelho e no mundo!



Figure 28 Rear page of the Invoice report for Cascais

**Note:** the text in the rear page is defined as a company attribute for the invoicing process. The solution has been adapted to include one free text parameter into the report.

Finally, the integration of MAWIS with the W4T-backend is detailed in Deliverable 2.3.



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The dissemination of results herein reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains



## 5.3 Invoicing module - Zamudio Pilot

### 5.3.1 ARCHITECTURE

FDEUSTO's invoicing model will covering the following FR for Zamudio's pilot:

R2_FR3	Calculate the taxes to be charge to the citizens (invoicing module)
R2_FR3.1	Be able to calculate taxes following different PAYT schemes
R2_FR3.1.1	Be able to calculate taxes following a PAYT scheme including incentives for the use of the different prevention and recycling actions
R2_FR3.1.2	Be able to calculate taxes following a PAYT scheme base on the amount of waste generated
R7_FR1.4	Provide information about the PAYT system implemented
R7_FR1.5	Provide access to the invoices
R7_FR1.5.1	Review the vouchers received and redeemed so far
R7_FR1.5.2	Provide a gamification experiences to improve the awareness of the citizens
R1_NFR1.1	The system must be auditable
R2_NFR3.1	Fulfilment with the calculation method established by the Municipality Regulation
R2_NFR3.2	Generation of a transparent bills

*Key steps towards PAYT implementation in the three pilots, and synergies at different stages* provides a diagram that contextualizes the Invoice module in the general architecture of Waste4Think. In particular, the invoicing module is set in the front end. Information from the sensors (particularly from the e-locks) is sent to the context broker that will redirect it at least to the CEP and to the persistence layer. A set of rules in the CEP engine process the openings using information from the Zamudio's ERP (SIGECART) and Inventory (SGMNET). This way, a "virtual meter" is created. The information calculated this way is then sent back to the context broker to be stored in the persistence layer. The Invoice Module will use the information stored in the persistence layer to perform the PAYT calculations. Finally, the information is sent to the Consorcio de Aguas Bilbao Bizkaia (CABB) in order to print and collect the invoices. Finally, any incidence will be informed to the Municipal Incidence Tracking System (JAGON).

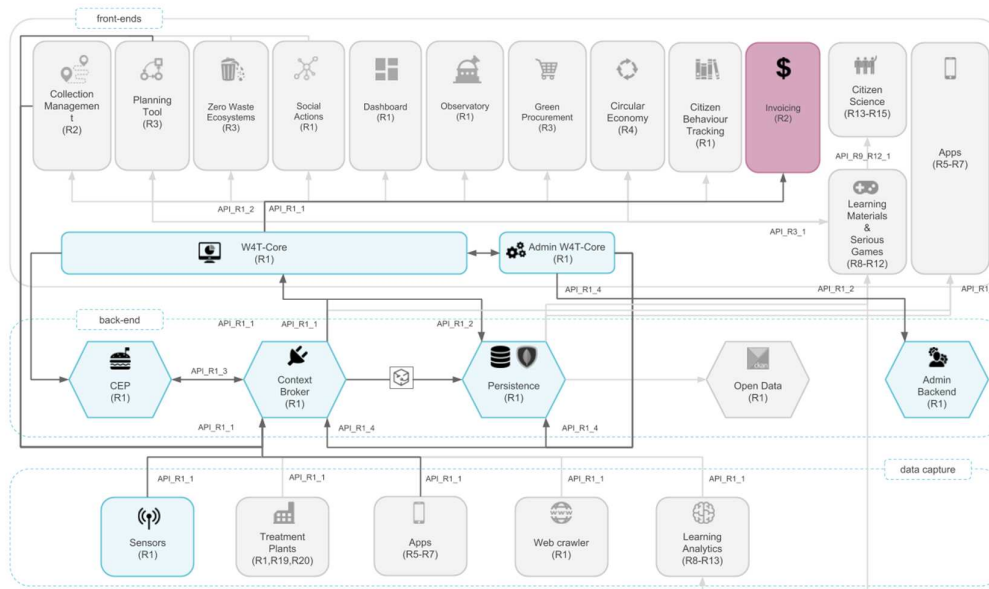


Figure 29 FDeusto's Invoice module architecture in relation with Waste4Think one

Physical data flow represents the physical flow of information. To use a container, a citizen needs to use a card that contains its Contract Number (ICT in Section G.3.1 Deliverable D2.1, confidential Annex provided in Deliverable D3.1). This information is stored in the electronic lock and is retrieved by the Truck Data App every time the bin is collected by the truck. Please consult Annex G of Deliverable D2.1 (provided as confidential annex in Deliverable D3.1) for more details on how and what data is retrieved. The information retrieved includes: the timestamp, the ICT and the identification of the e-lock. When the truck arrives to their station, it uploads this information to the back-end using the standards APIs provided by the context broker. Then, a CEP rule is executed (as it is subscribed to this topic in the context broker) in real time and creates a “virtual meter” for every Contract Number that it is storing the measurements for the next invoice (see Section 5.2.2 below). Please note that this rule also transform the “identification of the e-locks” into the “identification of the bin” in order to know what type of waste have been deposited in the transaction (see Figure 31).

## Invoicing

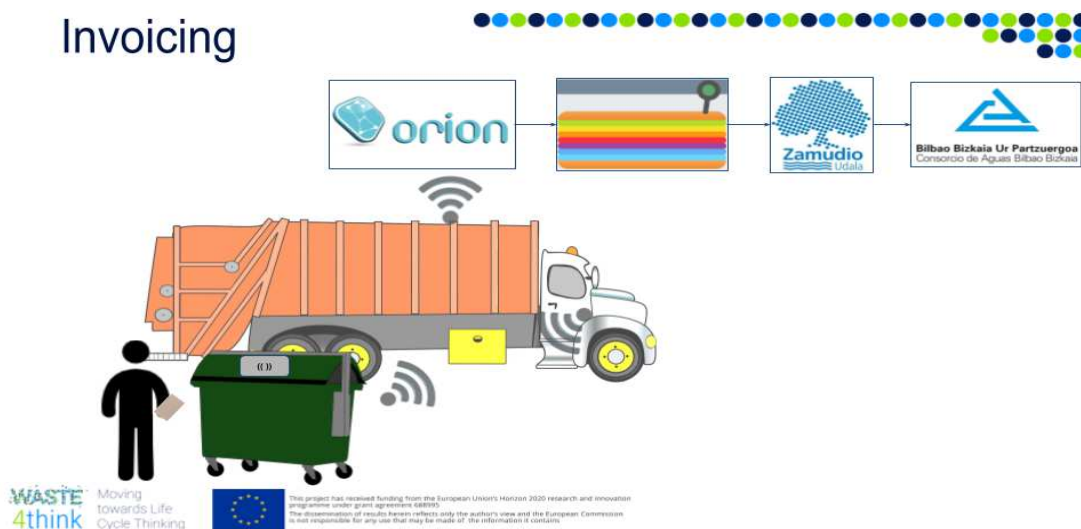


Figure 30 Physical data flow

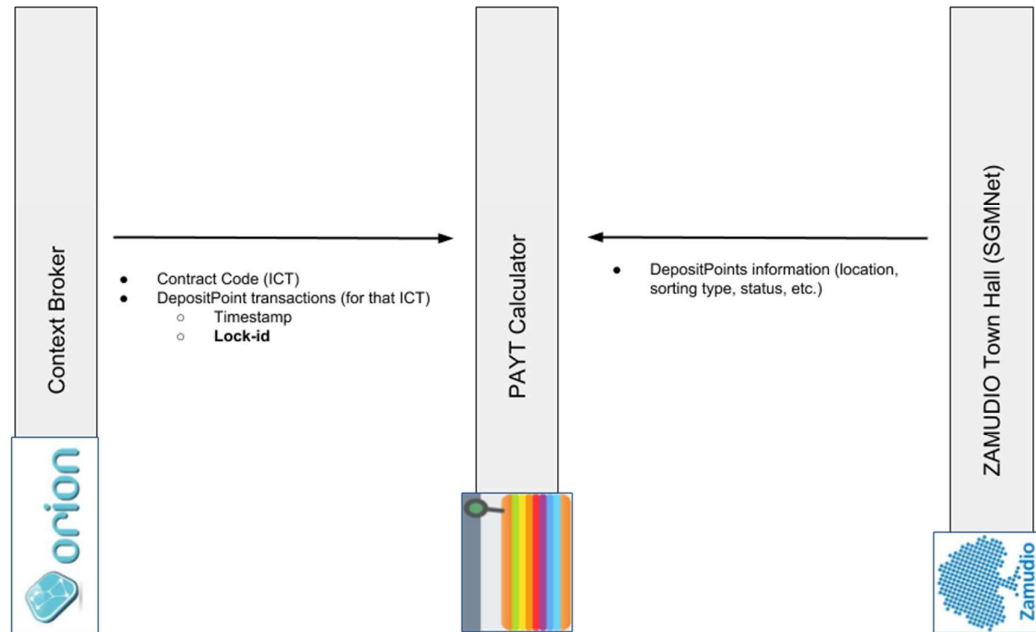


Figure 31 Virtual meter CEP rule flow diagram

Upon request by the town hold, a batch process to calculate the invoices is executed. The town hold provides to it both the information needed to calculate the fixed part of the tax using the APIs and the currently know Contract Numbers. First, it is checked that all Contract Numbers have an invoice already created. If not, a new empty invoice is created, and an alert is raised to the town hold alert system (JAGON) using its API. Moreover, already created invoices of unknown Contract Numbers (or cancelled ones) will also raise alerts.

Then, the information for the fixed part is added to all “virtual meters” and the invoices are calculated and stored in the “virtual meter” using the rules provided in the PAYT formula. Please note that the PAYT formula will be stored as a CEP rule written using the visual programming paradigm (see Deliverable D2.4 for further information about Sandwich CEP engine).

The last task of this batch process is to write a file following the file format provided by the CABB to process the invoices. Nevertheless, in order to ensure the confidentiality of the citizens, the information stored in the system cannot easily identify a taxpayer and so this file cannot be used directly for the CABB. The town hold then needs to transform Contract Numbers into “Taxpayer identification” using the information stored in its ERP and then send this file to the CABB to print and recover the taxes. Logical data flow between CABB, Zamudio Town Hall and invoicing Module represent the complete process.

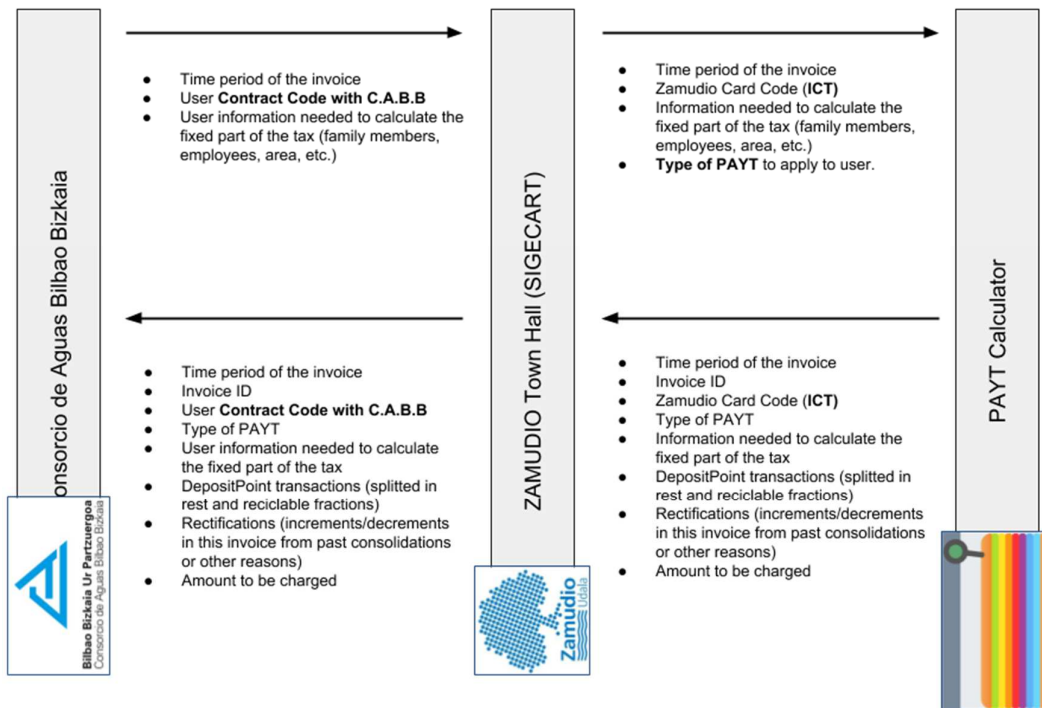


Figure 32 Logical data flow between CABB, Zamudio Town Hall and invoicing Module

Finally, a set of APIs will be created to allows citizens to consult their invoices through the Citizen APP. This APIs will present both a summary of the concepts that produce the invoice (total amount of apertures of the rest bin and the total amount of apertures of the recyclables bins in the case of Zamudio) and a detailed description (the log of apertures). Moreover, other APIs to retrieve statistical information will be provided in order to be used by the gamification aspects of the Citizen APP. See Deliverable D4.11 for more information.

## 6. Data Interface

This section describes how the invoice module is related to the external environment and the interfaces.

### 6.1 WINTARIF data interfaces

The invoice module WINTARIF is connected to the external environment through the following interfaces:

- **GRAPHIC USER INTERFACE (GUI):** allows individuals to interact with the invoice module. People can manage all the billing processes through the graphic interface of the application.
- **DATA EXCHANGE INTERFACE CONTAINERS:** allows the invoicing system to receive and supply the information systems of GELSIA - company that manages the waste collection service and supply the containers on behalf of the Seveso Municipality - for the management of the containers. This interface can be divided into the following components:
  - *Bag roll distributors* manage the exchange of information relating to the delivery to the users/customers of containers and bag rolls.
  - *RFID Bag Supplies* manage the import of data relating to the delivery of the bag rolls made through automatic vending machines available in the municipal territory.
  - *RFID readings* manage the import of data related to RFID tag readings recorded by vehicles during waste collection services.

The interface has been developed through the implementation of an FTPS area in which GELSIA can deposit the data to be provided to the invoice system and receive data related to the positions of the users of Seveso.

- **INTERFACES EXPORT DATA INVOICING:** allow people to provide data on invoices calculated from the invoice module. The data relating to the produced invoices are supplied both in the form of PDF files, which will then be sent to external companies for printing, and delivery to users, both in the form of a web-service to provide such data to web portals or smartphone applications.  
The data made available concern both those created by the invoice and those necessary to calculate the invoice (such as containers and bags that the users are in possession of, emptying or collections registered, etc.).

#### 6.1.1 GRAPHIC USER INTERFACE (GUI).

The graphic interface of the system has been developed to be executed on Windows operating systems of Microsoft.

The graphic development has followed the guidelines provided by Microsoft for the development of applications in the Windows environment.

## 6.1.2 DATA EXCHANGE INTERFACE OF CONTAINERS

The planned operational phases are defined as follows:

1. Alignment of personal data;
2. Update of the RFID bag kit distribution data;
3. Update of RFID bag delivery data;
4. Start-up

For each of the mentioned phases there is a brief description of the fundamental points of the records.

The use of the new RFID technology connected to the bag makes it possible to dispose of the analytical data of both the distribution and the collection. The data can be used both for the analysis of the types of collections and for the correct determination of the Waste Tariffs.

### a) Alignment of personal data

This phase involves the alignment of the personal data of the users of the Municipality of Seveso managed with the WINTARIF software and with the software of Gelsia. In order to guarantee the correct enabling times both in the portable devices and in the vending machines, a daily frequency for registrations was adopted.

There is an FTPS area in which SOFTline provides daily loading of the files with the defined data. The registry update files, contained in a special compressed folder (zip), are the following:

- UserPersonalData.csv
- Street.csv
- UserPropertyData.csv

Below are the records of the individual files, including a brief description should it be necessary to obtain further details of the values to be reported in the files.

#### a.1) User Personal Data

The USER PERSONAL DATA file contains the data of the tax payer and the address of residence.

Table 8 shows the paths for the exchange of user personal data agreed upon with Gelsia. The title row represents:

- FIELD NAME - personal data of the users: type of user - person , company or public administration; ID number of the user; Name; Surname; fiscal Code; VAT number, email, telephone, province, cadastral code, address, house number, etc..
- MANDATORY - which of the above data is mandatory and which is optional.
- DATA TYPE and LENGTH - if a string or a date is required, etc and length.
- FORMAT – the type of format, especially for telephone numbers.
- NOTE – explanation of what to indicate in the FIELD NAME and other fields.

Table 8 Paths for the exchange of personal data agreed with GELSIA

FIELD NAME	MANDATORY	DATA TYPE	LENGTH	FORMAT	NOTE
User type (domestic or non)	REQUIRED	STRING	1		Admitted values: F= person G= Company P= Public Administration
User ID	REQUIRED	STRING	15		User code
Name	OPTIONAL	STRING	100		Only if person
Surname	REQUIRED	STRING	100		Surname of person or Company name
Company name	OPTIONAL	STRING	100		Only for Companies (mandatory)
Fiscal number	OPTIONAL	STRING	16		
VAT number	OPTIONAL	STRING	11		
Family code	OPTIONAL	STRING	9		
Email	OPTIONAL	STRING	80		
Telephone number 1	OPTIONAL	STRING	15	+39xxxxxxxxxxxxx	
Telephone number 2	OPTIONAL	STRING	15	+39xxxxxxxxxxxxx	
Province	OPTIONAL	STRING	2		
Municipal cadastral code	OPTIONAL	STRING	4		
Municipal ISTAT (Italian National Statistics Institute) code	OPTIONAL	STRING	6		
Municipal description	OPTIONAL	STRING	255		
Post code	OPTIONAL	STRING	5		
Street code	OPTIONAL	STRING	5		
Address	OPTIONAL	STRING	80		
Building number	OPTIONAL	STRING	10		
Fax number	OPTIONAL	STRING	15	+39xxxxxxxxxxxxx	

- The USER ID field is mandatory because it is a key to link with the User file. The non-presence of this field in one of the two files, *User Personal data* and/or *User Records* (i.e. every registry must have a user and each user must have a personal data), involves the automatic rejection of the entire load.

## a.2) Street data

Table 9 Paths for the exchange of data related to streets

FIELD NAME	MANDATORY	DATA TYPE	LENGTH	FORMAT	NOTE
Municipal Code	REQUIRED	STRING	6		Municipal ISTAT (Italian National Statistics Institute) code
Street Code	REQUIRED	STRING	15		Street code
Description	REQUIRED	STRING	50		Street name with toponymal

The Road files contain the reference data of the road, not only of the Municipality of Seveso, but of all the roads used.

## a.3) User Records

The file of USER RECORDS contains all the reference data of the users. Table 10 shows the data necessary to define the user and its position for the waste tariff.

- FIELD NAME – all data of the user connected to the waste tariff: user ID; user status; user opening date; user closing date; card; card release date; card disposal date; user Gelsia internal ID; property code; cadastral code; common statistics code (*istat*); province; postal code; street code; address; street number, building and eventual internal number, category code, category description; tariff description; declaration date; registration date; family members; number of family members at date of start; number of family members during and at the end; squares meters, surface area at start date; surface area at end date; percentage of fixed part; percentage of variable part; etc..
- MANDATORY - which of the above data is mandatory and which is optional.
- DATA TYPE and LENGHT – if a string or a date is required etc.. and length.
- FORMAT –type of format, for example the format of the date.
- NOTE – the description of each FIELD NAME and what it means.

Table 10 Data related to the person ad user /customer of the waste tariff

FIELD NAME	MANDATORY	DATA TYPE	LENGTH	FORMAT	NOTE
USER ID	REQUIRED	STRING	50		User ID to be used for external software and for import and export data
USER STATUS	REQUIRED	STRING	40		Status can be Active or Non-active



USER OPENING DATE	REQUIRED	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
USER CLOSING DATE	OPTIONAL	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
CARD	OPTIONAL	STRING	50		Alphanumeric code of the card given to the user
CARD RELEASE DATE	REQUIRED	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
CARD DISPOSAL DATE	OPTIONAL	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
USER GELSIA INTERNAL ID	REQUIRED	STRING	15		User code presented in personal data given by Gelsia and unique in the system
PROPERTY CODE	REQUIRED	STRING	15		Property code that is unique in the system
CADASTRAL CODE	OPTIONAL	STRING	4	+39xxxxxxxxxxxx	
COMMON STATISTICS CODE (ISTAT)	OPTIONAL	STRING	6	+39xxxxxxxxxxxx	
DESCRIPTION OF THE MUNICIPAL	OPTIONAL	STRING	255		Description of the name of the Municipality
PROVINCE	OPTIONAL	STRING	2		The Province must be indicated by its abbreviation (Ex. Milan (MI))
POSTAL CODE	REQUIRED	STRING	5		
STREET CODE	REQUIRED	STRING	15		
ADRESS	REQUIRED	STRING	80		
BUILDING NUMBER	OPTIONAL	STRING	10		
EVENTUAL INTERNAL NUMBER	OPTIONAL	STRING	10		
CATEGORY CODE	OPTIONAL	STRING	5		
CATEGORY DESCRIPTION	OPTIONAL	STRING	255		
TARIFF DESCRIPTION	OPTIONAL	STRING	255	+39xxxxxxxxxxxx	
DECLARATION DATE	OPTIONAL	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
REGISTRATION DATE	OPTIONAL	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
FAMILY MEMBERS	OPTIONAL	STRING	2		

NUMBER OF FAMILY MEMBERS AT DATE OF START	REQUIRED	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
NUMBER OF FAMILY MEMBERS DURING AND AT THE END	OPTIONAL	DATE	10	YYYY-MM-DD	Date must be indicated in the required format (Ex. 2017-01-20)
AREA IN SQUARES METERS	OPTIONAL	STRING	10		
SURFACE AREA AT START DATE	REQUIRED	STRING	10		
SURFACE AREA AT END DATE	OPTIONAL	STRING	10		
PERCENTAGE OF FIXED PART	OPTIONAL	STRING	10		
PERCENTAGE OF VARIABLE PART	OPTIONAL	STRING	10		

- The USER ID field contains the key connection value with WINTARIF. All information related to distribution of the bags and waste disposal is provided with this value.
- The USER GELSIA INTERNAL ID field is the key to linking the Personal data file. The omission of this value in both files, PERSONAL DATA and / or USER RECORDS, involves the rejection of the entire load.
- The PROPERTY CODE field shows the univocal code of the property; it is an obligatory field because it allows to correctly associate the users and the history of variations related to a property.
- The USER CARD field shows the code of the card which enables for collection on mobile devices and distributors of bag rolls

For the Domestic Users, the tax code of the holder of the waste tariff position is used. The data is present on the Regional Service Card and therefore no further supports are required. The data related to the distribution are rendered with the user code selected by the user and therefore no particular developments are required. All other fields are linked to the technical data of the users. For each value, the dates of validity of the individual technical data are also indicated.

#### *a.4) Cadastral Categories*

The Cadastral Categories field refers to a specific table, Table 11 shows examples of codes a definition of the property.

Table 11 Examples of cadastral categories

Code	Description
A/1	Luxury house
A/10	Private office
A/11	Typical housing,
A/1	Civilian housing,
A/2	Low cost housing
A/3	Popular housing
A/6	Rural housing,
A/7	Small independent housing,
A/8	Independent houses, castles –
A/9	Palaces of artist or historic value
B/1	Colleges and educational premises, Orphanages, Elderly homes, convents
B/2	Clinics and Hospitals (non-profit)
B/3	Prisons and reformatories
B/4	Public offices
B/5	Schools and laboratories
B/6	Libraries – museums – galleries - Academies non present in category A/9
B/7	Chapels and Oratories not for cults
B/8	Underground stores for deposit of goods
C/1	Shops and laboratories
C/3	Laboratories for crafts
C/4	Sports premises (non-profit)
C/6	Stalls, Stables, depots, car-parks (non-profit)
D/5	Banks
D/7	Factories

## b) Update of the RFID bag kit distribution data

The phase of the distribution of the kits with the RFID bags is managed both with portable devices and with automatic devices.

To enable the withdrawal, these phases are active:

- Domestic use with fiscal code/health service card and/or Gelsia card.
- Non-domestic use exclusively with Gelsia card.

Gelsia makes available in the FTPS area, with daily frequency, a file containing the details of the distribution made to the users.

The daily file shows the distribution data not provided in previous communications. The file path is that shown in Table 12, where the data exchange related to bag rolls or container distributions are reported.

- FIELD NAME – necessary data of the user and its kit and bag/container: user ID; kit ID; chip ID; delivery date.
- MANDATORY - which of the above data is mandatory and which is optional.

- DATA TYPE and LENGTH – if a string or a date is required etc. and length.
- FORMAT –type of format, for example the format of the date.
- NOTE – the description of each FIELDS and what it includes: key code for external software; barcode of the bags kit; RFID code of the bag

Table 12 Record of data related to the bag/container distributions and bag rolls

FIELD NAME	MANDATORY	DATA TYPE	LENGTH	FORMAT	NOTE
USER ID	REQUIRED	STRING	50		Key code for external software
KIT ID	REQUIRED	STRING	50		Barcode of the bags kit
CHIP ID	REQUIRED	STRING	50		RFID code of the bag
DELIVERY DATE	REQUIRED	DATE	10	YYYY-MM-DD	

The kit consists of 10 bags: in the file there are 10 records for each kit and each with a different value for the chip code.

### c) Update of RFID bag consignment/delivery data

The data collection phase of RFID bags is handled with the reading devices installed on board the truck.

A file containing the details of the contributions made by the users is available in the FTFS area, with daily frequency. The daily file shows the distribution data not provided in previous communications.

The file is shown in Figure 33.

- FIELD NAME – necessary data to waste collection: user code; kit code; chip code; delivery date.
- MANDATORY - which of the above data is mandatory and which is optional.
- DATA TYPE and LENGTH – if a string or a date is required etc. and length.
- FORMAT – type of format, in this case the format of the date.
- NOTE the description of each FIELDS and what it includes: key code for external software; RFID code of the bag.

FIELD NAME	MANDATORY	DATA TYPE	LENGTH	FORMAT	NOTE
CODICE UTENZA	REQUIRED	STRING	50		codice chiave per software esterno
CODICE CHIP	REQUIRED	STRING	50		codice RFID del sacchetto
DATA CONFERIMENTO	REQUIRED	DATE	10	YYYY-MM-DD	

Figure 33 Record of data related to waste collection

## d) Start-up period

Before being able to apply the automatic updating, mechanisms specified in the previous phases, it is necessary to perform a manual alignment of the data in order to:

- Enter the subject code, building code and user code in the active games both in software of the Municipality of Seveso that in the management of Gelsia.
- Close the non-active and no longer present data in the Seveso Municipality software.
- Load the new positions.

Once the phase of the transitional period has been completed, all the data relating to distribution and collection are made available, also complete with the User Code. Specifically, the utilities code is also used for the chips covered by the distribution carried out in the previous project with RFID bags.

### 6.1.3 INTERFACES EXPORT DATA INVOICING

Invoice data will be sent to users in the form of a letter in PDF format that will be produced and will be sent to companies specialized in printing and postal delivery.

Furthermore, such data will be available on web portals and/or on smartphone applications also by web services.

The municipality operators will be able to view the invoice data using the appropriate GUI interface developed for them.

The pdf bill is printed and sent to the user's home via the public or private postal service. In the case of Seveso through the public postal service,

## 6.2 Zamudio's Invoicing datamodel: "Virtual Meter" entity

In this section, we present the extension to the data model presented in Section 7 of Deliverable D2.1 used to store the information needed to issue the PAYT in Zamudio. The information stored here will not only allow to easily performing the calculations of taxes (including potentials amendments made) but also will allows citizens to audit the invoice. In this storage, all the information in order to know how that tax was calculated will be stored but not the invoice itself. Please note that the legal invoice will be issued by the CABB.

id	Unique identifier. Example "client231-2018-3"
type	Invoice
period	Period start and end of the Invoice
contractNumber	Contract number of the user that matches the emitterID of the Transactions collected by the deposit points lock. A number of 24 bits.
paytCode	ID of the PAYT formula used. As there might be a different PAYT to apply to different citizens.

fixedFactors	Structured value representing the factors used for the fixed part of the PAYT such as number of residents/employees, surface of the house/industry, etc. Example: { family : 5, area : 123, income : 23, employees : 24, other : 93 }
refTransactions	List of transaction IDs associated to this contract in this period
rectifications	To apply rectifications (extra or subtract amount). For example, if in a previous invoice there were extra transactions charged, here there can be a -3€ rectification. Array of Structured values containing amount and explanation. Example: { 'Rectification from last trimester incorrect transactions: ID3234, ID5234, ID523' : -2.5, 'Extra charge because of ...' : 1.83, ... }
charge	The amount to be charged to the user. Numeric value in euros.

### 6.2.1 APIS

The following subsections explain the main public APIs that this module will provide.

#### 6.2.1.1 CABB NOTIFICATION TO SIGECART TO CALCULATE INVOICES FOR USERS

A fixed length CSV with the following fields:

- **Client Code:** Number that identify the contract.
- **Taxpayer Name:** String with the full name of the taxpayer
- **ID:** String with the VAT number or ID number of the taxpayer
- **Address:** String with the full address of the taxpayer
- **PAYT type:** Code of the type of tax formula that should be applied
- **Activity:** Code of the type of activity perform by the client (residential, commercial, industrial, etc.)
- **Surface:** Number with the surface of the building.
- **Residents/Employees:** Number with the number of resident or employees

Please note that, as both the CABB and Zamudio are public authorities, they could exchange personal information providing that the objective is to fulfil their responsibilities.

#### 6.2.1.2 SIGECART NOTIFICATION TO CONTEXT BROKER TO CALCULATE INVOICES FOR CONTRACTS

**POST:** fiware/invoices

**PAYLOAD:**

```
[
{ contractID : "ZAM582", periodStart : "DATE", periodEnd : "DATE", paytCode : "P13", fixedFactor1 : X, fixedFactor2 : Y, ... },
{ contractID : "ZAM249", periodStart : "DATE", periodEnd : "DATE", paytCode : "P22", fixedFactor1 : X, fixedFactor2 : Y, ... }
{ contractID : "ZAM953", periodStart : "DATE", periodEnd : "DATE", paytCode : "P22", fixedFactor1 : X, fixedFactor2 : Y, ... }
]
```

Please note that all personal information has been striped and that the Client Code has been translated to the contractID (ICT).

### 6.2.1.3 BACK-END REQUEST TO SGMNET TO UPDATE ITS DEPOSITPOINTS INFORMATION

Direct access to SGMNET database will be provided. A daily/weekly dump of the DepostPoints will be made from SGMNET to the persistence layer.

### 6.2.1.4 SIGECART/CITIZEN APP REQUESTS TO CONTEXT BROKER TO RETRIEVE INVOICE AND TRANSACTIONS INFORMATION

GET:

*fiware/v2/entities?options=values&type=Invoice&contactCode=CONTRACT\_CODE&q=periodStart>DATE&q=periodEnd<DATE*

Response:

```
[
  { @id : "XXX032018" , @type : "Invoice" , periodStart : Date , periodEnd : Date , contractNumber : "CONTRACT_CODE" , paytCode : "P123" , fixedFactors : { fixedFactor1 : X , fixedFactor2 : Y } , refTransactions : ["wt323","wt73","wt943",...] , rectifications : {} , charge : 23.6 } ,
  { @id : "XXX122017" , @type : "Invoice" , periodStart : Date , periodEnd : Date , contractNumber : "CONTRACT_CODE" , paytCode : "P123" , fixedFactors : { fixedFactor1 : X , fixedFactor2 : Y } , refTransactions : ["wt323","wt73","wt943",...] , rectifications : {} , charge : 26.1 } ,
  { @id : "XXX092017" , @type : "Invoice" , periodStart : Date , periodEnd : Date , contractNumber : "CONTRACT_CODE" , paytCode : "P123" , fixedFactors : { fixedFactor1 : X , fixedFactor2 : Y } , refTransactions : ["wt323","wt73","wt943",...] , rectifications : {} , charge : 22.2 } ,
]
```

GET:

*fiware/v2/entities?options=values&type=wasteTransactions&refEmitter=CONTRACT\_CODE&q=timestamp>DATE&q=timestamp<DATE*

Response:

```
[
  { @id : "wt28" , @type : "WasteTransaction" , refEmitter : "CONTRACT_CODE" , timestamp : Date , refDevice : "LOCK_42_ID" , refReceiver : "DEPOSIT_POINT_42_TAG" } ,
  { @id : "wt39" , @type : "WasteTransaction" , refEmitter : "CONTRACT_CODE" , timestamp : Date , refDevice : "LOCK_4_ID" , refReceiver : "DEPOSIT_POINT_4_TAG" } ,
  { @id : "wt89" , @type : "WasteTransaction" , refEmitter : "CONTRACT_CODE" , timestamp : Date , refDevice : "LOCK_10_ID" , refReceiver : "DEPOSIT_POINT_10_TAG" } ,
]
```

### 6.2.1.5 CONTEXT BROKER NOTIFICATION TO SIGECART WITH THE INVOICES IT NEEDS TO COMPLETE AND SEND TO CABB

POST: *sigecart/invoices*

PAYLOAD:

```
[
  { contract_id : "ZAM582" , periodStart : "DATE" , periodEnd : "DATE" , payt_code : "P13" , fixed_factor1 : X , fixed_factor2 : Y , } ,
  { contract_id : "ZAM249" , periodStart : "DATE" , periodEnd : "DATE" , payt_code : "P22" , fixed_factor1 : X , fixed_factor2 : Y , selectiveTransactionCount : 12 , residualWasteTransactionCount : 5 , rectifications[ { "Correction from las trimester" : -3.2 } ] , totalCharge : 15.2 }
  { contract_id : "ZAM953" , periodStart : "DATE" , periodEnd : "DATE" , payt_code : "P22" , fixed_factor1 : X , fixed_factor2 : Y , ... }
]
```

### 6.2.1.6 SIGECART NOTIFICATION TO CABB TO CHARGE USERS

A fixed length CSV with the following fields:

- **Client Code:** Number that identify the contract.
- **Taxpayer Name:** String with the full name of the taxpayer
- **ID:** String with the VAT number or ID number of the taxpayer
- **Address:** String with the full address of the taxpayer
- **PAYT type:** Code of the type of tax formula that should be applied

- **Activity:** Code of the type of activity performed by the client (residential, commercial, industrial, etc.)
- **Surface:** Number with the surface of the building.
- **Residents/Employees:** Number with the number of resident or employees
- **Rest:** Number of apertures of the rest bin.
- **Recyclables:** Number of apertures of all the recyclable bins.

Please note that, as both the CABB and Zamudio are public authorities, they could exchange personal information providing that the objective is to fulfil their responsibilities.

#### **6.2.1.7 ALERT OF A NEW ZERO GENERATOR FROM THE INVOICE CALCULATOR TO JAGON**

Any contractNumber that has not generated any measurements during the period will be reported to JAGON using its API. To this end, a form that has the following fields will be filled in: Title, Location, Type, Description and Photo.

#### **6.2.1.8 ALERT OF AN UNKNOWN GENERATOR FROM THE INVOICE CALCULATOR TO JAGON**

A contractNumber that does not have any Client Code associated in the period will be reported to JAGON using its API. To this end, a form that has the following fields will be filled in: Title, Location, Type, Description and Photo.

The pdf invoice will be submitted to the user via the municipality tax collection service.



## 7. Tariff algorithm

Tariffs are normally defined for specific target groups (please do not confuse them with the targets groups of the project), therefore a municipality can hold a variety of different tariffs at the same time. For example, a specific tariff can be defined for the residential sector in downtown, while a different tariff can be defined for the industrial park or the residential sector in the outskirts of a city.

In general, a tariff is composed of three parts: a fixed part, a variable part and bonuses. The fixed part should only depend on the attributes of the target group, while the variable part should only depend on the use of the waste collection system. Finally, the bonuses will be linked to the achievement of a KPI. In general, the tariff is the sum of fixed and variable part minus the bonuses, but other strategies can be applied.

In some cases, a set of bonuses can be defined along with the tariff to foster a particular good behaviour. The use of bonuses is more frequent with non-PAYT tariffs, but it can also be used in conjunction with PAYT tariffs to further increase its impact. Please, take into consideration that a fine is just a bonus of the opposite sign.

Bonus should have a clear target group and are subject to the achievement of a certain milestone in a KPI on a certain time interval (typically a year).

Some of the concepts taken into consideration to build the fixed part of the tariff are as follows:

- Geographical localization of the property.
- Surface of the property.
- Number of persons registered, or number of persons employed.

On the other hand, some of the concepts taken into consideration to build the variable part are:

- Water consumption (or other proxies).
- Collection frequency or number of uplifts.
- Weight or volume collected

Some of the typical concepts that are prone to be included as bonus are as follows:

- Use of the organic collection system.
- Use of in-situ treatments like auto-composting or other reuse techniques.
- Participation on social campaigns.

The above concepts can be encapsulated in the following abstract formula:

$$\text{tariff}_T(t_{ini}, t_{end}; c, d, e, k; a, u, w) := h(f(c; a), v(d; u(t_{ini}, t_{end})), b(e; k; w(t_{ini}, t_{end})))$$

where  $T$  identify the target group,  $t_{ini}$  and  $t_{end}$  represent the initial and end date of the bill,  $f$ ,  $v$  and  $b$  are three functions that represent the fixed and the variable part respectively (in general they are just the scalar product  $f(c; a) := c \cdot a$  and  $b$  the bonus earned,  $h$  is another function that represents the final tariff (in general just the sum of the previous two minus the third one),  $c$ ,  $d$  and  $e$  are the fixed parameters (with respect to  $a$ ,  $u$ ,  $k$  and  $w$  but that can depend on external factors) of  $f$ ,  $v$  and  $b$  (that typically represent the unitary cost) and,  $a$  denotes the values of the attributes of the taxable person,  $u(t_{ini}, t_{end})$  the number of uses of the system

made during the billing period and  $k$  denotes the parameters of the bonuses and  $w(t_{ini}, t_{end})$  the values of the KPIs used to.

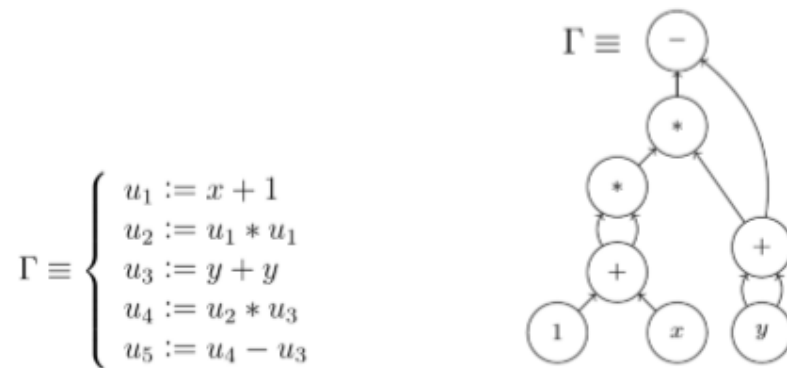
Please note that  $b$  could be further expanded to:

$$b(e;k;w(t_{ini},t_{end})) := \sum \beta(e_i;k_i;w_i(t_{ini},t_{end})) \quad i \in B$$

where  $B$  denotes the set of potential bonuses,  $\beta$  is a function that gives the bonus earned from the results achieved,  $k$  is the set of parameters used to determine if the milestone has been achieved,  $e$  denotes the parameters of the bonus earned, and  $w$  denotes the values achieved in the KPI associated with the bonus over a specific time period. Please note that  $\beta$  usually takes the following form:

$$(w_i(t_{ini}, t_{end}) > k_i) \text{ then } e_i \text{ else } 0$$

Under this model, a tariff is defined by the four functions  $f$ ,  $g$ ,  $b$  and  $h$ . An easy way of storing this function in a database is by means of a Straight Line Program (SLP) [22]. This data structure has been found to have great properties to efficiently store and compute algebraic problems [23] as well as artificial intelligence problems [22]. An slp consists of a finite sequence of computational assignments where each assignment is obtained by applying some functional to a set of arguments that can be variables, constants or pre-computed results. Figure 50 contains an example of an SLP that compute the function  $2(x + 1)^2 - 2y$ .



As seen in the left side of Figure 50, this function representation can be easily stored in a database as a list of triplets. In this project, we propose to store these three functions as three SLP that can be easily compiled as CEP functions. The functional used to build the SLPs will be restricted to the arithmetic functions plus the min and max functions. This way, an SLP can code any piecewise rational function. The variables on which the SLP will operate will be of the following type:

- **fixed constants** (with respect to both  $a$ , the set of attributes of the taxable person and  $u$ , the uses of the collection system) ( $c$  and  $d$  in the previous notation).
- **pointers to attributes** of a taxable person ( $a$  in the previous notation).
- **pointers to the results of the CEP** calculation of the uses in a certain period of time ( $u$  in the previous notation).

Therefore, following the mentioned schema the data model for Tariff would be as follows:



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 688995  
The dissemination of results herein reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains

- **FixedTariffConcept:** It will receive the target group entity and will calculate some fixed concepts according to the static properties of the entity.
  - id: Unique identifier.
  - type: Entity Type. It must be equal to `FixedTariffConcept`.
  - name: Name given to the tariff concept.
  - description: Description of the tariff concept.
- **VariableTariffConcept:** It will receive a time serie of elements related to the target group entity and will calculate some variable concepts according to those elements.
  - id: Unique identifier.
  - type: Entity Type. It must be equal to `VariableTariffConcept`.
  - name: Name given to the tariff concept.
  - description: Description of the tariff concept.
- **Bonus:** Bonuses decrease the tariff fixed or variable concepts subtracting a value or by multiplying the tariff by a number lower than 1. It is very important to store both the sources of the funding and the total budget of the bonus to be able to manage its implementation.
  - id: Unique identifier.
  - type: Entity type. It must be equal to `Bonus`.
  - name: Name given to the bonus concept.
  - description: Description of the bonus and how to apply it.
- **Tariff:** The tariff is composed of a fixed part and a variable part. Additionally, it has the following attributes:
  - id: Unique identifier.
  - type: Entity Type. It must be equal to `Tariff`.
  - name: Name given to the tariff
  - description: Text describing the tariff.
  - targetGroup: Text describing the entities that are the target of this strategy.
  - periodicity: How often the tariff is calculated.
  - unit: Units of the tariff.
  - fixedConcepts: List of `FixedTariffConcept` that describe the fixed part of the tariff
  - variableConcepts: List of `VariableTariffConcept` that describe the variable part of the tariff

## 7.1 Seveso pilot: notice of payment structure

Italian Municipalities are not like Companies. The two have different fiscal management systems. Because of this, Seveso cannot issue a waste tariff invoice but a notice of payment that allows for debt collection.

The application of the TA.RI. (Waste Tariff) runs from the first day of possession or tenancy of property by the customer/user and continues until its termination. Each user is required to declare the situation of the occupied premises, every variation and the end of the possession or tenancy period of the property. For **transparency**, the notice of payment includes each of

these conditions required for the calculation, as well as the unit price of the fixed and variable quotas of the tariff.

TA.RI. is based on the Municipal Regulation for the application of the tariff to cover the costs of the urban and special waste management service. The tariff consists of a fixed part, determined in relation to the essential components of the cost of the service and a variable part, commensurate with the quantities (presumed or measured) of waste delivered and the service provided.

The tariff is divided into household (residential) and non-domestic (shops, public activities, crafts, industrial activities, offices, etc.) and is applied to anyone who owns or holds property or uncovered areas, both private or public, and which produce solid urban waste and / or similar waste.

For households, in addition to the area of the dwelling, the number of family members is considered. For shops and economic or productive activities, the second parameter, in addition to the surface area, is the commercial category, to which different coefficients of potential productivity of waste are associated, classified according to the type of activity carried out.

In order to know the chosen method for this calculation, it is possible to read the Deliverable 5.3, which explains the calculation of the fixed and variable parts of the Pay As You Throw (P.A.Y.T) system for the Municipality of Seveso. Figure 34 shows a sample of a TA.RI. (Waste Tariff) payment notice printed for Seveso users.

Each municipality decides annually how many invoices to issue per year, the period and the payment deadline (example: 30 days from the date of issue). The bill can generally be paid in different ways.



**COMUNE DI SEVESO**  
 Viale Vittorio Veneto, 3/5 - 20822 Seveso (MB)  
 P.Iva : 00720300961 - C. Fiscale : 01650780156  
 Tel: 0362-5171 - Fax 0362-509033  
 Email: protocollo@comune.seveso.mb.it  
 PEC: comune.seveso@pec.it

Codice Cliente **0000000000000000**  
 Codice Documento **0000000000**

EMISSIONE
ACCONTO 2017 Quota fissa anno 2017 Prima quota variabile 2017


MARIO ROSSI  
 VIA ROMA 1  
 20822 SEVESO MB

## TARI

INTESTATARIO	AVVISO
MARIO ROSSI VIA ROMA 1 20822 SEVESO MB	Ai sensi dell'art. 1, commi 639 e seguenti, della L. n. 147 del 27.12.2013 è stata istituita l'imposta unica comunale (IUC) che si compone della tassa sui rifiuti (TARI) cui il presente avviso bonario si riferisce.
<b>AVVISO DI PAGAMENTO PROVVISORIO</b> AVVISO DI PAGAMENTO PROVVISORIO n. WT43 del 3/1/2018 CONGUAGLIO NON DOMESTICHE TARI 2017 + ECCEDENZE	L'amministrazione comunale ha adottato il Regolamento per la disciplina dell'imposta unica comunale "IUC" con delibera del consiglio comunale n. 9 del 30/03/2017 ed ha approvato per l'anno 2017 le tariffe Tari a misura con delibera di consiglio comunale n. 10 del 30/03/2017.
<b>PAGAMENTI</b> BP 2 RATE + RATA UNICA Importo totale dovuto € 186,00 con rata unica entro il 28/02/2018 oppure con rate singole 1) € 83,00 entro il 28/02/2018 2) € 83,00 entro il 30/04/2018	La riscossione del tributo avviene mediante emissione di avviso bonario relativo all'intera annualità per la quota fissa e la prima quota variabile anno 2017, ed è pagabile in rate utilizzando i 2 bollettini postali allegati, oppure in unica soluzione, rivolgendosi all'ufficio Tributi che provvederà alla stampa del bollettino pagabile entro il 31.05.2017. <b>Si prega di non utilizzare bollettini in bianco.</b> La seconda quota variabile, calcolata sulla base del numero di conferimenti effettuati con sacchi blu, verrà emessa nel mese di novembre e sarà relativa al periodo maggio-ottobre. Gli ultimi due mesi verranno invece conguagliati nella prima bolletta del 2018. Il contribuente deve comunicare all'ufficio tributi del Comune di Seveso la cessazione, l'inizio o la variazione relativa all'utilizzo di un immobile mediante l'apposito modulo pubblicato sul sito <a href="http://www.comune.seveso.mb.it">www.comune.seveso.mb.it</a> .
	Per ogni altra informazione consultare il sito <a href="http://www.comune.seveso.mb.it">www.comune.seveso.mb.it</a> oppure rivolgersi all'Ufficio Tributi in V.le Vittorio Veneto 3.
	Si evidenzia che: - lo sportello dell'ufficio Tributi è aperto al pubblico nei seguenti orari: lunedì e martedì 9:00-12:00 giovedì 15:30-18,30 venerdì 9:00-13:00 - per informazioni telefonare al numero 0362517246-285 negli orari di apertura al pubblico. - qualsiasi reclamo o contestazione o comunicazione deve essere recapitato al Comune di Seveso, Viale Vittorio Veneto, 3/5 - 20822 Seveso (MB), oppure può essere inviato al numero di telefax 0362 509033 oppure può essere inviato alla casella di posta elettronica <a href="mailto:tributi@comune.seveso.mb.it">tributi@comune.seveso.mb.it</a> ; - il responsabile del procedimento e del tributo è la Dott.ssa Monica Mariani.

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Figure 34 A sample of waste tariff payment notice – page 1

 <b>COMUNE DI SEVESO</b> Viale Vittorio Veneto, 3/5 - 20822 Seveso (MB) P.Iva : 00720300961 - C. Fiscale : 01650780156 Tel: 0362-5171 - Fax 0362-509033	Codice Cliente <b>0000000000000000</b> Codice Documento <b>0000000000</b>																																
	<b>Documento:</b> AVVISO DI PAGAMENTO PROVVISORIO n. WT43 del 3/1/2018 CONGUAGLIO NON DOMESTICHE TARI 2017 + ECCEDENZE Modalità di pagamento: BP 2 RATE + RATA UNICA <b>Intestatario:</b> MARIO ROSSI - VIA ROMA 1 - 20822 SEVESO MB - C.F.: XXXXXX00X0X000X																																
	<b>DETTAGLIO TARI COMUNE DI SEVESO</b>																																
	<b>Acconto 2017</b>																																
Utenza non domestica Id utenza: 2210770 MARIO ROSSI - VIA ROMA 1 - Cat: 18 ATTIVITA' ARTIGIANALI TIPO BOTTEGHE: FALEGGNAME, IDRAULICO, FABBR, ELETTR																																	
<table border="1"> <thead> <tr> <th>Descrizione</th> <th>Periodo</th> <th>gg</th> <th>q.ta</th> <th>Prezzo unitario €</th> <th>Riduzione %</th> <th>Importo €</th> <th>Trib. Prov %</th> </tr> </thead> <tbody> <tr> <td>QUOTA FISSA</td> <td>01/01/17-31/12/17</td> <td>365</td> <td>MQ 95</td> <td>1,00571</td> <td></td> <td>95,54</td> <td>5,00</td> </tr> <tr> <td>QUOTA VARIABILE</td> <td>01/01/17-31/12/17</td> <td>365</td> <td>MQ 95</td> <td>0,79768</td> <td></td> <td>75,78</td> <td>5,00</td> </tr> <tr> <td colspan="6"><b>Totale 2017</b></td> <td><b>€ 171,32</b></td> <td></td> </tr> </tbody> </table>	Descrizione	Periodo	gg	q.ta	Prezzo unitario €	Riduzione %	Importo €	Trib. Prov %	QUOTA FISSA	01/01/17-31/12/17	365	MQ 95	1,00571		95,54	5,00	QUOTA VARIABILE	01/01/17-31/12/17	365	MQ 95	0,79768		75,78	5,00	<b>Totale 2017</b>						<b>€ 171,32</b>		
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<table border="1"> <thead> <tr> <th>Descrizione</th> <th>Periodo</th> <th>gg</th> <th>q.ta</th> <th>Prezzo unitario €</th> <th>Riduzione %</th> <th>Importo €</th> <th>Trib. Prov %</th> </tr> </thead> <tbody> <tr> <td>UTENZA: 2210770 - ECCEDENZA PRODUZIONE LITRI EFFETTIVI: 6 X 110 = 660,00 LITRI COMPRESI IN QUOTA VARIABILE: 366,00 ARROTONDAMENTO ATTUALE</td> <td></td> <td></td> <td>LT 294</td> <td>0,02090</td> <td></td> <td>6,15</td> <td>5,00</td> </tr> <tr> <td></td> <td></td> <td></td> <td>N. 1</td> <td>-0,35000</td> <td></td> <td>-0,35</td> <td>0,00</td> </tr> </tbody> </table>	Descrizione	Periodo	gg	q.ta	Prezzo unitario €	Riduzione %	Importo €	Trib. Prov %	UTENZA: 2210770 - ECCEDENZA PRODUZIONE LITRI EFFETTIVI: 6 X 110 = 660,00 LITRI COMPRESI IN QUOTA VARIABILE: 366,00 ARROTONDAMENTO ATTUALE			LT 294	0,02090		6,15	5,00				N. 1	-0,35000		-0,35	0,00									
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3944 - TRIBUTO PROVINCIALE	<b>0,88</b>																																
TOTALE DOCUMENTO	<b>6,00</b>																																
NETTO DA PAGARE	<b>186,00</b>																																

Email: protocollo@comune.seveso.mb.it - PEC: comune.seveso@pec.it

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Figure 35 A sample of waste tariff payment notice – page 2

### 7.1.1 NOTICE OF PAYMENT - FIRST PAGE

Figure 36 shows the first page of a notice of payment and the different sections are explained as follows:

- 1) Section 1 – Details of the Municipality, such as name, address, VAT number, fiscal Code, phone number, fax number, e-mail, PEC.

- 2) Section 2 – User ID given by WINTARIF software to the waste tax user and Document ID.
- 3) Section 3 – Name, Surname and Address of the waste tariff holder that maybe different from the address of the apartment or commercial property of the holder.
- 4) Section 4 - This part of the document concerns the issue of the data regarding the notice of payment, that is the period for which the user must pay the tariff. In this example, only the fixed quota was to be paid in May 2017, while in November 2017 the tariff was calculated including the variable costs.
- 5) Section 5 - This section includes the payment notice given to the user, describing, for transparency, the part of municipal regulation related to the calculation of the waste tariff and whom to contact in case of termination, start or changes of terms related to the property. Finally, there is a list of the opening hours, the telephone numbers and the names of persons in charge of the waste tariff office.
- 6) Section 6 – Here it is possible to read the user personal data related to the property and the related type of payment. This could relate to the tariff during a reporting period, as well as to payment balances and/or excesses regarding the use of bags and not only for the payment of the current period of the year.
- 7) Section 7 – this part of the payment notice reports the details of the payment, such as the total amount, eventual instalments and deadlines.

 <p><b>COMUNE DI SEVESO</b>  Viale Vittorio Veneto, 3/5 - 20822 Seveso (MB)  P.Iva : 00720300961 - C. Fiscale : 01650780156  Tel: 0362-5171 - Fax 0362-509033  Email: protocollo@comune.seveso.mb.it  PEC: comune.seveso@pec.it</p>	<p><b>1</b></p> <p><b>2</b></p> <p>Codice Cliente      0000000000000000  Codice Documento      0000000000</p>
<p><b>4</b></p> <p><b>EMISSIONE</b>  ACCONTO 2017  Quota fissa anno 2017  Prima quota variabile 2017</p>	<p><b>3</b></p> <p>MARIO ROSSI  VIA ROMA 1  20822 SEVESO MB</p>
<p><b>6</b></p> <p><b>INTESTATARIO</b>  MARIO ROSSI  VIA ROMA 1  20822 SEVESO MB</p> <p><b>AVVISO DI PAGAMENTO PROVVISORIO</b>  AVVISO DI PAGAMENTO PROVVISORIO n. WT43 del 3/1/2018 CONGUAGLIO NON DOMESTICHE TARI 2017 + ECCEDEENZE</p>	<p><b>5</b></p> <p><b>TARI</b></p> <p><b>AVVISO</b></p> <p>Ai sensi dell'art. 1, commi 639 e seguenti, della L. n. 147 del 27.12.2013 è stata istituita l'imposta unica comunale (IUC) che si compone della tassa sui rifiuti (TARI) cui il presente avviso bonario si riferisce.</p> <p>L'amministrazione comunale ha adottato il Regolamento per la disciplina dell'imposta unica comunale "IUC" con delibera del consiglio comunale n. 9 del 30/03/2017 ed ha approvato per l'anno 2017 le tariffe Tari a misura con delibera di consiglio comunale n. 10 del 30/03/2017.</p> <p>La riscossione del tributo avviene mediante emissione di avviso bonario relativo all'intera annualità per la quota fissa e la prima quota variabile anno 2017, ed è pagabile in rate utilizzando i 2 bollettini postali allegati, oppure in unica soluzione, rivolgendosi all'ufficio Tributi che provvederà alla stampa del bollettino pagabile entro il 31.05.2017. <b>Si prega di non utilizzare bollettini in bianco.</b></p> <p>La seconda quota variabile, calcolata sulla base del numero di conferimenti effettuati con sacchi blu, verrà emessa nel mese di novembre e sarà relativa al periodo maggio-ottobre.</p> <p>Gli ultimi due mesi verranno invece conguagliati nella prima bolletta del 2018. Il contribuente deve comunicare all'ufficio tributi del Comune di Seveso la cessazione, l'inizio o la variazione relativa all'utilizzo di un immobile mediante l'apposito modulo pubblicato sul sito <a href="http://www.comune.seveso.mb.it">www.comune.seveso.mb.it</a>.</p> <p>-----</p> <p>Per ogni altra informazione consultare il sito <a href="http://www.comune.seveso.mb.it">www.comune.seveso.mb.it</a> oppure rivolgersi all'Ufficio Tributi in V.le Vittorio Veneto 3.</p> <p>Si evidenzia che:</p> <ul style="list-style-type: none"> <li>- lo sportello dell'ufficio Tributi è aperto al pubblico nei seguenti orari:  lunedì e martedì 9:00-12:00  giovedì 15:30-18,30  venerdì 9:00-13:00</li> <li>- per informazioni telefonare al numero 0362517246-285 negli orari di apertura al pubblico.</li> <li>- qualsiasi reclamo o contestazione o comunicazione deve essere recapitato al Comune di Seveso, Viale Vittorio Veneto, 3/5 - 20822 Seveso (MB), oppure può essere inviato al numero di telefax 0362 509033 oppure può essere inviato alla casella di posta elettronica <a href="mailto:tributi@comune.seveso.mb.it">tributi@comune.seveso.mb.it</a>;</li> <li>- il responsabile del procedimento e del tributo è la Dott.ssa Monica Mariani.</li> </ul>
<p><b>7</b></p> <p><b>PAGAMENTI</b>  BP 2 RATE + RATA UNICA  Importo totale dovuto € 186,00  con rata unica entro il 28/02/2018  oppure con rate singole  1) € 83,00 entro il 28/02/2018  2) € 83,00 entro il 30/04/2018</p>	

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Figure 36 Example of Different part of a waste tariff notice of payment – page 2



## 7.1.2 NOTICE OF PAYMENT – SECOND PAGE

The second page of the notice of payment reports payment specifications. Various examples follow with different combinations of payments and users.

### A) EXAMPLE N.1

Figure 37 shows an example of the second page of the notice of payment for the waste tariff (TA.RI.). It is possible to note:

- a) **The first section** gives the same information of sections 1-2-3-4 reported in page 1 of the notice of payment. In this case, the notice of payment is for a domestic user and refers to the year 2017.
- b) **The second section** shows details of the payment. In fact, the title of this part is “DETAIL OF TARI (WASTE TARIFF) OF THE MUNICIPALITY OF SEVESO. For simplicity, this section is divided into three parts, each of which gives specific information.

#### **Section 2.1** describes the specifics of the **2017 ADVANCE PAYMENT**.

It concerns the DOMESTIC user, which has the USER ID number 948, PAOLO VERDI is her name and her property is located in VIA TORQUATO TASSO 1 (personal data and data related to the property). Note that the reported address in section 1 regards the delivery address of the user.

Then, there are other description:

- **Fixed amount**
  - 1R category: i.e. Household 1;
  - Family unit: 1;
  - Period: from 19/09/2017 to 31/12/2017;
  - Days: 104;
  - Quantity: area, 94 square meters;
  - Unit price: 0.66437;
  - Reduction: -;
  - Amount € 17.79;
  - Provincial surcharge: 5%;
- **Variable amount**
  - 1R category: i.e. Household 1;
  - Family unit: 1;
  - Period: from 19/09/2017 to 31/12/2017;
  - Days: 104;
  - Quantity: N.1;
  - Unit price: €41,11777;
  - Reduction: -;
  - Amount: € 11,72;
  - Provincial surcharge: 5%;
- **Blue bag of 110 LT (collected: 5)**
  - Period: from 01/11/2017 to 31/12/2017;
  - Days: 61;
  - Quantity: 660 Litres;

- Unit price: €0,02090;
- Reduction: -;
- Amount: € 13,79;
- Provincial surcharge: 5%;
- **Total amount of 2017**
- €43,30

This detailed description shows:

- The category of the domestic or non-domestic user, as well as every variation regarding the user's property, i.e. the family unit;
- The area of the property;
- Eventual variations from of categories and the period of time the user was classified in a specific category;
- Finally, the number of the collected blue bags (undifferentiated waste) as well as the volume of one bag.


Thanks to these descriptions, the user informed of the calculations used for the tariff amount and its correctness.

#### **Section 2.2** describes **OTHER COSTS**

- **Actual approximated amount:**
- Period: -;
- Days: -;
- Quantity: N.1 ;
- Unit price: -€0,47000;
- Reduction: -;
- Amount: -€0,47;
- Provincial surcharge: -;

#### **Section 2.3** describes the **SUMMARY:**

- TARI: €42,83;
- Provincial surcharge: €2,17;
- Total of the document: €45,00;
- Net fee: €45,00;



**COMUNE DI SEVESO**  
Viale Vittorio Veneto, 3/5 - 20022 Seveso (MB)  
P.IVA : 00720300981 - C. Fiscale : 01659780158  
Tel: 0362-5171 - Fax 0362-509033

Section 1

Codice Cliente      0000000000000808  
Codice Documento    0000000000

**Documento:** AVVISO DI PAGAMENTO PROVVISORIO n. WT6988 del 22/1/2018 CONGUAGLIO DOMESTICHE ANNO 2017  
**Modalità di pagamento:** BOLLETTINO POSTALE

**Intestatario:** PAOLO VERDI - VIA TORQUATO TASSO 1 - 20822 SEVESO MB - C.F.: .....

---

**DETTAGLIO TARI COMUNE DI SEVESO**

Acconto 2017

Section 2.1

Section 2

Descrizione	Periodo	gg	q.ta	Prezzo unitario €	Riduzione %	Importo €	Trib. Prev %
Utenza domestica Id utenza: 948 PAOLO VERDI- VIA TORQUATO TASSO 1							
QUOTA FISSA - CAT: 1R NUCLEO RES. 1	19/09/17-31/12/17	104	MQ 94	0,66437		17,79	5,00
QUOTA VARIABILE	19/09/17-31/12/17	104	N. 1	41,11777		11,72	5,00
SACCO BLU 110LT (Numero conferimenti=6)	01/11/17-31/12/17	61	LT 660	0,02090		13,79	5,00
<b>Totale 2017</b>						<b>€ 43,30</b>	
<b>Totale acconto 2017</b>						<b>€ 43,30</b>	

Altri Importi

Section 2.2

Descrizione	Periodo	gg	q.ta	Prezzo unitario €	Riduzione %	Importo €	Trib. Prev %
ARROTONDAMENTO ATTUALE			N. 1	-0,47000		-0,47	0,00

**RIEPILOGO**

3944 - TARI	42,83
3944 - TRIBUTO PROVINCIALE	2,17
<b>TOTALE DOCUMENTO</b>	<b>45,00</b>
<b>NETTO DA PAGARE</b>	<b>45,00</b>

Section 3

Email: protocollo@comune.seveso.mo.it - PEC: comune.seveso@pec.it

Pagina 2 di 2

Figure 37 Example of a Domestic user waste tariff notice of payment – page 2

## B) EXAMPLE N.2

The pages of the notice of payment are the same for every kind of user and for every amount so that the description of the three parts of the second section of page 2 follows, as it concerns the details for the calculation of the waste tariff:

### Section 2.1 describes the specifics of the **2017 ADVANCE PAYMENT**.

It concerns a NON-DOMESTIC user, which has the USER ID number 2210770, MARIO ROSSI is his name and his property is situated in VIA ROMA 1 (personal data and property address). The ID property Category is 18: craft shops, such as small shops: carpenters, plumbers, blacksmiths, electricians.

Then, there are other descriptions:

- **Fixed amount**
  - Period: from 1/1/2017 to 31/12/2017;
  - Days: 365;
  - Quantity: area, 95 square meters;
  - Unit price: €1,00571;
  - Reduction: -;
  - Amount € 95,54;
  - Provincial surcharge: 5%;
- **Variable amount**
  - Period: from 1/1/2017 to 31/12/2017;
  - Days: 365;
  - Quantity: area, 95 square meters;
  - Unit price: €0,79768;
  - Reduction: -;
  - Amount € 75,78;
  - Provincial surcharge: 5%;
- **Total amount for 2017**
  - €171,32

### Section 2.2 describes **OTHER COSTS**

- **User ID: 2210770 - PRODUCTION SURPLUS**
  - Period: -;
  - Days: -;
  - Quantity: 294 Litres; (A-B)
  - Unit price: €0,02090;
  - Reduction: -;
  - Amount: € 6,15;
  - Provincial surcharge: 5%.
- **(A) Actual Litres (of bags): 6 bags x 110 litres each=660,00.**
- **(B) Liters included in variable quota: 366,00.**
- **Approximated amount**

- Period: -;
- Days: -;
- Quantity: N.1;
- Unit price: -€0,35000;
- Reduction: -;
- Amount: -€ 0,35;
- Provincial surcharge: -;

**Section 2.3** describes the **SUMMARY**:

- TARI: €177,12;
- Provincial surcharge: €8,88;
- Total in the document: €186,00;
- Net fee: €186,00;


 <b>COMUNE DI SEVESO</b> Viale Vittorio Veneto, 3/5 - 20822 Seveso (MB) P.Iva : 00720300961 - C. Fiscale : 01650780156 Tel: 0362-5171 - Fax 0362-509033	<b>Section 1</b>						
	Codice Cliente <b>0000000000000000</b> Codice Documento <b>0000000000</b>						
<b>Documento:</b> AVVISO DI PAGAMENTO PROVVISORIO n. WT43 del 3/1/2018 CONGUAGLIO NON DOMESTICHE TARI 2017 + ECCEDEENZE Modalità di pagamento: BP 2 RATE + RATA UNICA <b>Intestatario:</b> MARIO ROSSI - VIA ROMA 1 - 20822 SEVESO MB - C.F.: XXXXXX00X0X000X							
<b>DETTAGLIO TARI COMUNE DI SEVESO</b>							
<b>Section 2.1</b>							
<b>Acconto 2017</b>							
Utenza non domestica Id utenza: 2210770 MARIO ROSSI - VIA ROMA 1 - Cat: 18 ATTIVITA' ARTIGIANALI TIPO BOTTEGHE: FALEGNAMI, IDRAULICO, FABBR, ELETTR							
Descrizione	Periodo	gg	q.ta	Prezzo unitario €	Riduzione %	Importo €	Trib. Prov %
QUOTA FISSA	01/01/17-31/12/17	365	MQ 95	1,00571		95,54	5,00
QUOTA VARIABILE	01/01/17-31/12/17	365	MQ 95	0,79768		75,78	5,00
<b>Totale 2017</b>						<b>€ 171,32</b>	
<b>Totale acconto 2017</b>						<b>€ 171,32</b>	
<b>Altri importi</b>		<b>Section 2.2</b>					
Descrizione	Periodo	gg	q.ta	Prezzo unitario €	Riduzione %	Importo €	Trib. Prov %
UTENZA: 2210770 - ECCEDEENZA PRODUZIONE LITRI EFFETTIVI: 6 X 110 = 660,00 LITRI COMPRESI IN QUOTA VARIABILE: 366,00 ARROTONDAMENTO ATTUALE			LT 294	0,02090		6,15	5,00
			N. 1	-0,35000		-0,35	0,00
<b>RIEPILOGO</b>							
3944 - TARI						<b>177,12</b>	
3944 - TRIBUTO PROVINCIALE						<b>0,88</b>	
<b>TOTALE DOCUMENTO</b>						<b>6,00</b>	
<b>NETTO DA PAGARE</b>						<b>186,00</b>	
<b>Section 3</b>							
Email: protocollo@comune.seveso.mb.it - PEC: comune.seveso@pec.it							
Pagina 2 di 2							

Figure 38 Example of Non-Domestic user waste tariff notice of payment – page 2

## 8. Reliability, fairness, safety and transparency

### 8.1 Software infrastructure used by WINTARIF

The **safety** and **reliability** of the systems are guaranteed by the adoption of dedicated servers located at one of the main European providers. The provider guarantees compliance with the various data security regulations and the environments in which servers are located.

To ensure all the criteria of **transparency** and **data security**, the access to these data of the system is provided for different categories, which are:

- 1) System administrator category. Different persons are in this category and they are divided into groups of access and the activities that the user can make depend on the group itself.
- 2) Category of the municipality operators. Different persons use the WINTARIF system in the municipality to manage customers/users procedures. These users are divided into groups to define which system sessions they can access and what operations they can do.
- 3) Customer/User category. Also this category is made by different groups of users who have access to data exchange services.

**Reliability and fairness:** The specific weight of samples of the waste disposal in different zones of the territory is the innovative parameter to be used to measure the losses of the reading measurement which is described in the Deliverable 1.3 – Paragraphs 4.10.9.

Furthermore, to guarantee the different principles of **safety**, **reliability**, **transparency** and **data security**, the following choices have been made:

4. Adoption of a complete log systems on all data changes involved in billing.
5. SOFTIne and Gelsia have automated all data exchanges on the FTPS area to avoid human intervention and errors.
6. All data are always imported from the FTPS area (container/bag rolls delivery/collection and RFID readings) and are validated before being used for billing. Any anomalies are highlighted to the municipality operators so that the data can be corrected.
7. Use of the "wizard" programs in the graphical interfaces. This choice simplifies the complex operations that human operators must perform more frequently.
8. Synchronization between the Wintarif database and the Gelsia database allow the collection of bags from the automatic distributing machines in the municipal territory. All the personal user data are sent, every day, on an FTPS area and automatically received by Gelsia systems with contextual updates on the bag roll distributors.
9. Interface for sending waste production data according to a structure to be defined with the Project Partner number 19 – ENGINEERING, for the population of the Open Source FIWARE platform.

## 9. Conclusion

This technical report is due for the explanation of waste invoicing modules for domestic and commercial users. The developed software are three in virtue of the three different pilots where the PAYT system – or something – Seveso, Cascais and Zamudio.

The involved Partners have been developed modules that are fully configurable in a way that can be adapted to the different rules of most Municipalities without the need of additional programming or maintenance ensuring the reliability, safety, fairness and transparency of the systems.

In Seveso the Wintarif invoice module is ready and being tested since November 2017. The integration between Wintarif and Fiware is based on the Data Model described in D2.1 and happens through the NGSICconnectorAPI described in D2.3, Section 2.6.1.

In Cascais: MOBA developed the Invoicing module within MawisU2 platform providing the tools to launch the reports defined by EMAC for the Collective PAYT system used in Cascais. Only the WasteTransactions between Users and Bins are registered into FIWARE database based on the Data Model described in D2.1 but without personal data, in fact only the key ID used by the citizens and the timestamps of the identifications are considered. The integration between MOBA and FIWARE is described in D2.6 and also in D2.3.

In Zamudio: PAYT configure is already implemented. The communication with the electronic lock and weighing system of the truck is tested in a controlled environment. Awaiting the full integration when the containers are deployed throughout the pilot in order to test the whole system.

Due to the delay in the tender for the containers in Zamudio, a single shadow invoice test is planned on October 2019. This shadow invoice will be delivered along the water bill, which is the form in which the citizens are being currently billed about the waste management service.



## 10. Comments from External Reviewers for Version V10 of this document

### 10.1 External Reviewer #1: ZABALA

DATE: 26/10/2018

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the format of the document correct?	X		4	Try to apply uniformity in the tables format and in the spacing between paragraphs (in terms of number of blank lines)
Does the format of the document meet the objectives of the work done?	X		5	
Does the index of the document collect precisely the tasks and issues that need to be reported?	X		5	
Is the content of the document clear and well described?	X		5	
Does the content of each section describe the advance done during the task development?	X		5	
Does the content have sufficient Technical description to make clear the research and development performed?	X		5	
Are all the figures and tables numerated and described?	X		5	Yes. There are only two figures that still to be numbered.
Are the indexes correct?	X		5	
Is the written English correct?	X		5	
Main technical terms are correctly referenced?		X		There are no references at all
Glossary present in the document?	X		5	

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Partner: Zabala

## 10.2 External Reviewer #2: SEVESO

DATE: 29/10/2019

Issue	Score		Comments
	Yes	No	
Is the format of the document correct?	X		3 It's a draft, partly unformatted and not so clear in the structure. Executive summary missing
Does the format of the document meet the objectives of the work done?	X		4
Does the index of the document collect precisely the tasks and issues that need to be reported?	X		4 There's only an error at 7.2, the following are 5.1.1 and 5.1.2 instead of 7.2.1 and 7.2.2.
Is the content of the document clear and well described?	X		4
Does the content of each section describe the advance done during the task development?	X		4
Does the content have sufficient technical description to make clear the research and development performed?	X		4
Are all the figures and tables numerated and described?	X		4 At page 10 the n° of the figure is missing and It's not indicated in the index.
Are the indexes correct?	X		4 There's an error at 7.2, the following are 5.1.1 and 5.1.2 instead of 7.2.1 and 7.2.2.
Is the written English correct?	X		4
Main technical terms are correctly referenced?	X		4
Glossary present in the document?	X		4 Some technical terms missing

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Partner SEVESO

## 10.3 External Reviewer #3: BCNecologia

DATE: 31/10/2018

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the format of the document correct?	X		4	It is made with the Deliverables template, still some comments in the draft to be deleted. Index to be improved (may be due to versions problems google docs to word version)
Does the format of the document meet the objectives of the work done?	X		5	The document includes all the information described on the GA
Does the index of the document collect precisely the tasks and issues that need to be reported?	X		4	It has an extensive index where it describes all the issues that will be developed in the document, tables and figures list also available. Some mistakes in the titles numeration.
Is the content of the document clear and well described?	X		4	It is very well explained and organized, although it is a technical report, is written in a language that can be understood perfectly. Still some titles format mistakes in the current version.
Does the content of each section describe the advance done during the task development?	X		5	Yes.
Does the content have sufficient technical description to make clear the research and development performed?	X		4	The content of this deliverable are quite complex due to the necessary integration of PAYT system and waste management differences in each pilot. In addition, there are other complexity issues due to the differences between pilots for the invoicing software and information sources, but it is well explained across the document.
Are all the figures and tables correctly enumerated and described?	X		5	Yes. Only some tables without title.
Is the written English correct?	X		5	Yes. Some slight writing errors
Are the main technical terms correctly referenced? (through a glossary and/or cites to relevant sources)	X		4	There is a glossary with main acronyms described, but some additional information could be added for a clear understanding, especially some technical acronyms.

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Partner BCN