

Action A1.3.2 Study for full-scale assessment of PAYT schemes

DELIVERABLE A1.D7

Study for the full-scale implementation of PAYT in the
Municipality of Vari, Voula, Vouliagmeni

Beneficiary Responsible: ERS, Beneficiaries involved: MoVWV, MEEN, HRA

Summary

This Deliverable is the complete final study for the implementation of Pay as You Throw (PAYT) in the municipality of Vari Voula Vouliagmeni (VWV). This Final Deliverable consists of the following chapters:

- ✓ **Chapter 1** presents the scope and the objectives of the Deliverable.
- ✓ **Chapter 2** presents and analyzes the special characteristics of the municipality of Vari-Voula-Vouliagmeni (VWV) and applies the methodology of selection of the PAYT scheme, as proposed by LIFE 07ENV/GR /000271 and has been further developed in another another deliverable of this project LIFE18 IPE/GR/000013. From the use of the methodology, the hybrid PAYT with BAG for the municipality of VWV is selected as the most suitable PAYT scheme. In a *Hybrid PAYT scheme with Bag*, PAYT with Bag is applied to small waste producers, the PAYT with Bin to large waste producers and the PAYT with Card for public bins.
- ✓ **Chapter 3** presents the methodology for the implementation of the Integrated PAYT (I-PAYT) scheme, which includes changes in all stages of waste management in the municipality of VWV, in order to maximize the result of the *Hybrid PAYT scheme with BAG*. Specifically, subsection 3.1 presents in detail the methodology for selecting streams of recyclable materials for separate collection. Subsection 3.2 presents a brief description of the collection of all materials in conjunction with how to apply the *Hybrid PAYT with BAG*. Subsection 3.3 presents: a) how and what actions the municipality should implement to inform the citizens, b) an innovative methodology is proposed to reward the residents for their proper participation in the I-PAYT, and c) it is proposed how to organize the monitoring and control of the correct implementation of I-PAYT in the municipality. Subsection 3.4 presents the



analysis of quantitative and financial data for the implementation of I-PAYT in the municipality of VV. The analysis identifies: a) the needs of the municipality in each type of bins for all categories of its buildings, b) the parameters for the management of recyclable, food waste and residual waste in the municipality, and c) analyzes the budget lines of the municipality and estimated the individual cost categories in waste management.

- ✓ **Chapter 4** presents the projected quantitative and financial results of the implementation of the I-PAYT in the municipality of VV in the year 2023. These results concern: a) the analytical quantities for waste production and recovered materials, b) Waste management costs for the Zero Reference Scenario of VV in the years 2019-2040 c) Detailed cost of collection of recyclable, organic and mixed materials, other management costs, d) Estimates of needs for all types of equipment and personnel, e) Estimates the funds for the supply of additional equipment, and f) allocates the total costs to Municipality, PRO's and Citizens, where the cost of the municipality will be paid through PAYT.
- ✓ **Chapter 5** describes the PAYT scheme with a Bag, and analyzes the following: a) the characteristics of the prepaid bag are presented, b) how it can be made available to citizens, c) issues related to VAT and *General Data Protection Regulation (GDPR)* issues, d) issues related to the charging of Fixed and Variable Costs, e) determination of the final charging cost of the Prepaid Bag and Prepaid bin, f) Determination of the charge of the Prepaid Card, g) comparison of the cost with the Zero Reference Scenario and I-PAYT for the years 2019-2040, and h) Also, the viability analysis of I-PAYT is presented.
- ✓ **Chapter 6** presents the sensitivity analysis of I-PAYT for 2023 for 10 possible factors that may have a significant impact on the total cost of I-PAYT. It was found that the most important factors that significantly affect the viability of I-PAYT are: a) the possibility of avoiding the purchase of the Prepaid Bag, b) The collection times and c) the possibility of a second shift for the collection vehicles. Proposals were also made for investigation by the municipality to address possible negative factors.
- ✓ **Chapter 7** presents a summary of the Deliverable and the most important conclusions and findings for the effective implementation of I-PAYT in the municipality of VV.

From the analysis it is clear that the benefits from the implementation of I-PAYT are significant at many levels for the municipality. The main points and conclusions of the analysis are as follows:



Characteristics of municipality

- Based on the amount of waste generated, the municipal buildings were classified into three categories: A) Residential buildings, shops and offices with low waste production, corresponding to about 10,664 buildings, B) Buildings with companies with many employees and medium waste production, corresponding to about 721 buildings, C) Buildings with very high waste production, concerning restaurants, hotels, hospitals or other businesses, corresponding to about 332 buildings. The characteristics of the three categories of buildings appeared to be compatible with the application of different approaches in relation to PAYT.
- The vast majority of buildings (approximately 11,383 buildings of Categories A + B), are spread throughout the municipality of BBB, generate about 60% of all waste, while ~ 35% is generated from ~ 332 buildings of mainly health interest and the remaining max 5% is produced from public places (squares, main roads, parking lots, public beaches).
- In the buildings of Categories A + B, a single PAYT scheme should be applied, in line with the geographical distribution of the buildings, as well as with the small number of households per building. Given the vast majority of residential buildings, the index of the number of households per building, it PAYT scheme with Bag is extremely favorable given these characteristics.
- In the Category C buildings a PAYT scheme should be applied that is compatible with the PAYT scheme in the buildings of Categories A + B. Therefore, in the evaluation of the PAYT scheme with a bag, it should be considered that in the buildings of Category C there will be prepaid bins of a specific volume and collection frequency so that the schemes may be complementary.

Selection of PAYT scheme in the municipality of VVV

For the selection of the basic PAYT scheme in the houses, the methodology of multi-criteria analysis was applied, proposed in LIFE 07 / ENV / GR / 000271 HEC-PAYT and which was improved in the present LIFE in the Deliverable A3.D4-b. Based on the results of the analysis, the following were proposed:

- The application of the PAYT scheme with Prepaid Bag in homes and in small businesses and shops is the most appropriate PAYT scheme. The collection of the Prepaid Bag should be consistent with the way of collecting the other currents (recyclable materials & organic).
- The Prepaid Bag can be collected Door - Door either mechanically with bins, or manually from residential buildings or commercial buildings (offices, shops) or



mixed buildings up to about 4-5 floors or with 5 or less premises (independent properties).

- The Prepaid Bag can be collected Door - Door mechanically in bins from residential buildings or commercial buildings (offices, shops) or mixed-use buildings with 5 or more floors, or with 6 or more premises.
- In the cases of buildings with healthcare or in the cases of very large producers (approximately 330 points) instead of the Prepaid Bag it is more convenient and cheaper to use a Prepaid Bins with a specific volume and collection frequency that will be exclusive use for each contracting company. If in some of the 332 points of health interest it is not technically possible to use a Prepaid Bins, then a Prepaid Bag can be used.
- Finally, it is proposed the application of the PAYT with Card in the public bins of the municipality with the use of smart bins.

Methodology for the implementation of I-PAYT

In combination and in cohesion of the PAYT scheme selected, with all the methods applied in overall waste management, Integrated implementation of PAYT with separation at source (I-PAYT) resulted as highly favorable, where it is supplemented with rewarding actions and controls. Below are the main points of the methodology of application of I-PAYT.

- It is proposed to apply a Hybrid PAYT with Bag, where: a) in homes and small businesses and offices Door - Door of the Prepaid Bag outside the buildings (in an individual bin or without a bin) will be collected, b) in larger business or residential buildings will enter the Prepaid bags (shared bin) will be collected, c) In restaurants, hotels and other large waste producers the PAYT with Prepaid Bin will be applied, d) Finally, in public bins or Recycling Corners the PAYT with Card and use of smart bins will be applied.
- Based on the proposed hybrid PAYT scheme, a proposal was made for the methods and streams for the collection of recyclable and organic materials. A detailed examination was carried out into the number and type of discrete recycling streams, and it was proposed: a) the separate collection in the same stream of Plastic, Metal and dual/composite Packaging (PMD), b) the separate collection of Paper, and c) the separate collection of glass in a separate bell type bin. Given the final decision in September 2021 to include glass packaging in deposit return, either a more dispersed bell-bin collection system will be put in place or remaining glass containers could be collected with PMD or a combination of both. Finally, the separate collection of food waste (organic) with a brown bin per building was included in I-PAYT.



- The methodology of implementation of I-PAYT is supplemented: a) with a proposal for integrated and continuous implementation of Communication actions and encouragement of citizens to participate in I-PAYT, b) with a specific proposal of Rewarding citizens for each point of proper participation in I-PAYT, concerning the Prepaid Bag, the recycling streams and the separation at source of the organic, and c) by creating a body of Auditors in the municipality to monitor all aspects of the I-PAYT.

Expected results of I-PAYT implementation

From the processing and analysis of the data of the municipality of VVW, the methodology of application methods was applied to the I-PAYT and the following was determined for 2023:

1. **Building & population data:** Estimation of building and population data, as well as the quantitative needs of all types of bins per building category.
2. **Production & recovery of materials:** The production and recovery of materials in the municipality of VVW for the years 2019 and 2023 (Table 4.1a). 2023 is considered to be the first year of operation of I-PAYT. It was estimated that the waste production of the municipality of VVW in 2023 will be approximately 47,500 t / y, while with the operation of the I-PAYT, the level of total diversion from treatment - landfill (separation at source) can exceed 37%, due also to the great recovery of green waste (pruning).
3. **Zero Scenario:** The long-term cost (2019-2040) of the solid waste management (SWM) of the Zero Scenario of the municipality of VVW was estimated, where it was considered that the municipality remains at the level of DSP (16% recycling and 9% composting) of the year 2019 and that it will not create Green Point (Table 4.1b). The Zero Scenario took into account the savings of the municipality from the operation of the waste transfer station (SMA) and the reduction of the cost of electricity, due to the replacement of the old LED lamps. Based on the Zero Scenario, it is estimated that the SWM cost over time will increase, due to population growth and processing & landfill fees. It was estimated that it is very likely that the municipality will have to increase its Municipal Fees by 2028 by more than 17%, from the level of 2021.
4. **Cost of SWM:** a) The recycling cost was determined for each category of expenses (Table 4.2), where for 2023 it was estimated at 12.47 € / c / y (Collection Scenario D), b) the cost of organic management for each category of expenses (Table 4.3), where for 2023 it was estimated at € 27.80 / c / y, c) the cost of mixed waste



management for each category of expenses (Table 4.4), where for 2023 it was estimated at € 106.03 / c / y, d) the remaining costs (administrative, electric lighting, street cleaning, electricity provider billing, other compensatory) (Table 4.5), where for 2023 it was estimated at 73.33 € / c / y. The total cost of SWM for 2023 is the sum of (a) + (b) + c) + (d) and was determined at the total amount of 11,019,455 € / y or 246.89 € / t or 219,64 € / c / y.

5. **Cost of municipal SWM:** Part of the cost of SWM is paid by the packaging PROs, and another part is paid directly by the citizens and concerns the cost of plastic bags for the collection of recyclable materials and the supply of electricity supplier. Table 4.10 presents this division and finally the cost of SWM that the municipality is called to cover through the I-PAYT was estimated for 2023 at € 10,314,379 / y or at € 231.10 / t or at € 205.59 / c / y.
6. **Staff - equipment - initial capital needs:** Tables 4.8a-4.8c identify the needs for staff, equipment, as well as the initial new capital, required for the supply of additional equipment and consumables. The needs have been identified for 4 collection scenarios and the municipality can choose the scenario it deems most appropriate. The staffing needs range from 114-121 people (depending on the collection scenario), while the municipality in 2021 employs about 106 cleaning workers. The needs of all types of vehicles (A / F, construction machinery, trains, bicycles - controls, special vehicles for recycling) are estimated at 56-60 vehicles, depending on the collection scenario, of which the municipality is estimated to have in 2023 approximately 34 vehicles. The needs for bins (kitchen bins, brown bins, recycling bins, waste bins) are estimated at 45,851 bins, of which the municipality currently has about 8,235 bins. Finally, the implementation of I-PAYT will require a large amount of consumables (bags and PAYT cards). In order for the municipality to implement the I-PAYT, it will be required to invest a significant amount, estimated between 4,000,000 and €4,500,000 €, depending on the collection scenario it chooses.
7. **The Prepaid Bag:** All the features that the Prepaid Bag (PB) must meet are presented (Table 5.2), and it is suggested to use 4 sizes of 10, 20, 35 and 60 liters and to be of the "shirt" type so as not to have side seams which tear, and can be easily transported and tied. It was proposed that they be made available residents in many ways (Table 5.4) over time. It is estimated that the PBs should not be charged with VAT and that it should not be considered a violation of privacy laws should the auditors open them to investigate any delinquent behavior of citizens. Also, there should be no issue concerning privacy laws for the provision of details



for the supply and the Prepaid Card. The state should consider whether any legislation is needed to address the above issues.

8. **Fixed and Variable Costs of I-PAYT:** It is proposed to apply the charging and collection of I-PAYT with dual charging. The Variable Cost is proposed to be set at 44% of the cost of SWM without lighting costs (ELF), while the remaining 56% of the cost of SWM together with the ELF to be the Fixed Cost of I-PAYT (table 5.5). If the application of I-PAYT in the municipality with a prepaid bag / Bins / Card shows to over-yield or under-yield monetary resources to the municipality, then the Fixed Cost may be reduced or increased next year without changing the prepaid charge Bag / Bins / Card. Thus, the charge of the Prepaid Bag / Bins / Card can be kept constant for several years without endangering the income of the municipality. This stabilization mechanism is shown in Table 5.16. Gradually, and depending on the problems with securing the collection of fees, in theory all the SWM costs could be transferred to the cost of the Prepaid Bag, Bins or Card and in the Fixed Cost only the ELF could remain.
9. **Fixed Cost Charging I-PAYT:** A much fairer way has been proposed for charging Fixed Costs and collecting them through electricity providers. Three charge rates per square meter of premises (properties) are proposed, which are related to the amount of waste production. The low rate should be applied in the category of premises A1 and A2 of table 2.2 (houses & small shops and offices), the medium rate should be applied in the category of premises B of table 2.2 (Activities with > 30 employees - crafts, services, offices and very large mixed-use buildings) and the large rate should be applied to category C premises of Table 2.2 (Large waste producers: The criterion is to need a separate exclusive bin / dump). The ratio of the three factors is proposed to be 1 - 5 - 10, in order to reflect the amount of waste produced per unit area, from the three categories of waste producers. The proposed Fixed Cost charge was applied to the MoVVV data and is presented in Table 5.7.B along with the present charge and the charge per electricity meter. The comparison of the final charges of the Fixed Cost with the three charges is contained in Table 5.7C, where it seems that, in the most fairly proposed way, in the vast majority of premises, the charge of the Fixed Cost will be reduced and be increased in a small percentage premises.
10. **Prepaid Bag Charge:** It was estimated that the Variable Cost of I-PAYT will be paid through a Prepaid Bag by 60%, with Prepaid Bins by 35% and by a Prepaid Card by 5% (Table 5.10). Based on the volumes and the serviceability of the houses, the



possible consumption of PB by the households was estimated (Tables 5.9, 5.3 and 5.10) and the final charging prices (Table 5.11), for the PB of 60 lt, the charge of 2.00 is proposed. € / pc., of 35 lt the charge of 1.20 € / pc., Of 20 lt the charge of 0.70 € / pc. and 10 lt the charge of 0.40 € / pc. This charge provided that the entire Variable Cost would be charged even if 13.90% of users avoid using PB (see below C-PAYT viability analysis and parameter sensitivity analysis).

11. **Prepaid Bins Charge:** Based on the cost per liter of waste, the Prepaid Bins charge for large waste producers (restaurants, hotels, etc.) was determined. The charge was determined for all possible collection frequencies and all possible bins in terms of capacity in Table 5.12 of this deliverable.
12. **Charging of households and businesses with I-PAYT:** Table 5.13 estimated the total charge of municipal fees in three ways: a) With the existing way of charging, b) Through I-PAYT, as analyzed, and c) With charge per electricity meter. The main finding is that: a) By charging I-PAYT if households, small and medium-sized businesses do very good Separation at Source the cleaning fees they pay today will be significantly reduced, while if they do not do separation at source they will pay more than today. B) The companies, which are medium producers of waste, if they do not separate at source will pay a little more than today, while if they separate at source well they will pay a little less than today. C) Finally, the big waste producers, if they do not separate at source, they will pay more than five times the fees from today, while if they source separate well, they will pay more than double the fees from today.
13. **Prepaid Card Charge:** Based on the cost per liter or per weight, the amount and charge of the Prepaid Card in Table 5.14 in € / lt and in € / kg for all cards with different purchase costs have been determined.
14. **I-PAYT viability paramaters:** The factors that can negatively affect the viability of I-PAYT are: a) the compression of waste in the PB, which can reach 40% and which has been taken into account in the cost of the prepaid bag , b) Avoidance of Purchase of PB and use of other bags without fees, which is provided for in the charge of PB up to an avoidance rate of ~ 14%, c) Disposal of waste elsewhere, which creates high costs for the municipality, and which is expected to be treated with controls and sanctions, d) Transport outside the municipality, which does not increase costs for the municipality, but weakens and gives a bad reputation to the implementation of the PAYT to a large extent and can also be treated with controls and sanctions, e) Fixed charge of Prepaid Bag / Bins / Card, and mainly of the PB,



which is achieved with the compensation mechanism by increasing or decreasing the Fixed Charge in the under-yield or over-yield of I-PAYT, so that the charge of the Prepaid Bag / Bins / Card remains constant (Table let 5.15).

15. Zero Scenario vs I-PAYT: The main finding from the time evolution of costs in the Zero Scenario and I-PAYT is that: I-PAYT starts in 2023 at 11% more expensive than the Zero Scenario (ZS), but quickly reduces the difference and from 2028 the I-PAYT is becomes more and more economical than the ZS. In the long run, I-PAYT can be 5-6% cheaper than ZS (Table 5.16). The calculations depend on various factors, but can be constantly re-evaluated and continuous time comparisons are made between ZS and I-PAYT.

Sensitivity analysis

A sensitivity analysis was performed on 10 parameters that were judged to have a significant impact on the financial data of the implementation of I-PAYT. The results of the Sensitivity Analysis are presented in Table 6.1. The main conclusions are the following:

- **Percentage of Avoidance of use of PB (“cheating”):** The most important viability factor, with a very negative effect on I-PAYT, is the Percentage of Avoidance of use of PS (cheating). It was estimated in Table 6.1 that even with cheating equal to 13.90% the municipality will be able to collect all the costs of I-PAYT. In the case of cheating over 13.90% then the municipality will have a deficit in its budget, while in case of cheating less than 13.90% it will have a surplus.
- **Collection times (sec):** The point-to-point travel times during collection (recycling, organic or mixed) seem to be the second most important factor in the viability of I-PAYT. A possible redesign of the entire collection program in view of the I-PAYT could see practical possible changes in this direction.
- **Hours of vehicles per day (h / d):** It is the third most important factor in the viability of I-PAYT. If the pickup trucks operated in two shifts per day, then a very significant cost reduction could be achieved.
- **Percentage of separation at source:** The overall percentage of source separation for recyclable and organic materials is the best Indicator for the success of I-PAYT.