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## ***Waste Management System***

***Designing an alternative price mechanism to the flat-rate based program for the city of  
Usti nad Labem, Czech Republic***

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# Outline

Introduction

Project Identification

Objective

Methodology of the Study

Financial Analysis

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# Study Location



Inhabitants: 819, 450.00  
(8% of the Czech Republic),  
population density of 153.6  
inhabitants per km<sup>2</sup>  
covers area of 5,335 km<sup>2</sup>  
(6.8 % of the Czech  
Republic).  
It has 46 cities, with urban  
population of 80.7 %, and  
354 villages  
Waste tonnes /Year per  
person: 0,5

Source: Source: CENIA  
Czech Environmental Information Agency  
[http://www.cenia.cz/\\_C12571B20041F1F4.nsf/index.html](http://www.cenia.cz/_C12571B20041F1F4.nsf/index.html) 15.09.2010

## MSW Management in Usti Region

The collection of municipal waste is provided mainly by external private contractors but also by public companies;

municipalities are responsible for household waste and also for hazardous waste from households (legal monopoly).

inhabitants of Usti nad Labem are obliged to pay “local fee“ for the municipal waste, setting by Generally binding legal regulation (No. 4/2007) on local fee for the collection, transport, sorting, recovery and disposal municipal waste.

In the Czech Republic there are three types of municipal waste fee: payment, local fee, fee for municipal waste.

Regulation of waste management in Czech Republic redefined in the Act 185/2001 with Which reforms in order to achieve an improved waste collection and disposal.

# European Regulatory Framework

Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste (in force)

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and revising certain Directives (Dir.2006/12, Dir.91/689/CEE, Dir.75/439/CEE): (by December 2010)

## **Article 1-Subject definition and Scope-**

This Directive lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use.

**Art.3.9: 'Waste management'** means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker;

**Article 4-Waste hierarchy-**The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:

- (a) prevention;
- (b) preparing for re-use;
- (c) recycling;
- (d) other recovery, e.g. energy recovery; and
- (e) disposal.

When applying the waste hierarchy, Member States shall take measures to encourage the options that deliver the best overall environmental outcome. This may require a life cycle approach to the overall impacts of the generation and management of such waste, which will result in a development of waste streams separately from the current residual waste

## Problems to solve in Czech Republic in Waste Service

1. Waste management: **no separate collection and landfilling**. Almost 80% production of municipal waste is landfilled: the city isn't able to fulfil the national and regional goal which is reduction of the amount of waste generated by the households;
2. The Act on waste enables the municipalities to select tools to finance the service, but mostly payments are fixed and don't stimulate to produce less amount of waste. **Citizens have no signals that are desirable to produce less waste and simultaneously profitable.**

## Project Identification

This investment consists in the implementation of **PAYT system**, characterized by doors to doors collection and quantity-based tariffs;

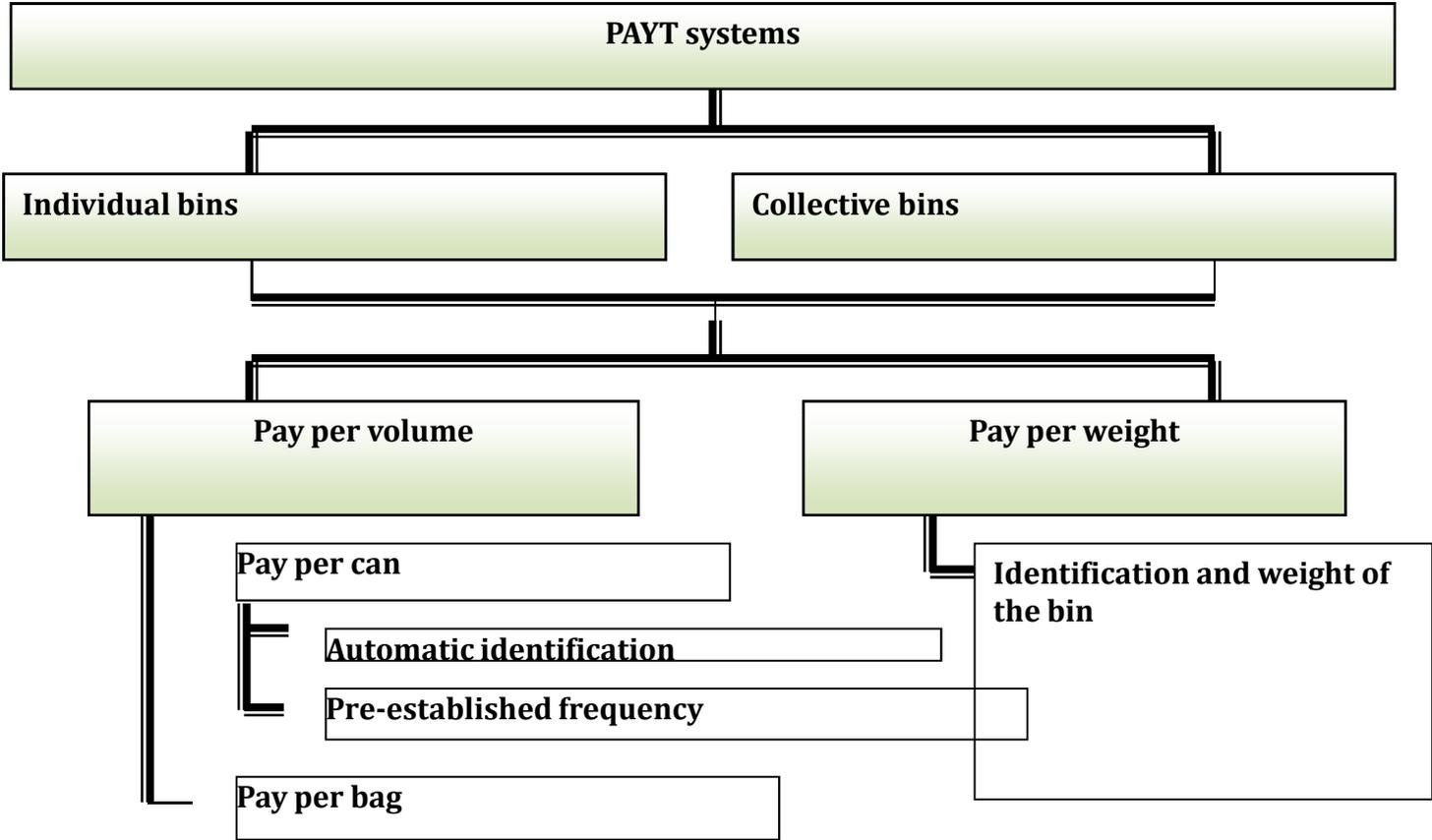
This project arises from the idea of improving municipal waste management system in the city of Usti nad Labem (Usti region), actually based on landfill system, which is not compatible with the European union policy in waste management.

We consider a financial plan made by a public company (see the coming slides)

**Pay-As-You-Throw-Systems (PAYT) or unit pricing allow to attribute to each user a cost commensurate according to the actual amount of waste generated. It is not just a fairer system but also creates an incentive among taxpayers towards reducing and recycling waste.**

# Implementation of a PAYT system

## Modalities for the implementation of a PAYT system



Source: Adapted from Reichenbach (2004)

# Objectives

PAYT system main goals are the implementation of an effective recycling system and the possibility for the authority to charge quantity-based tariff, with associated efficiency implications.

General objectives are:

the development of a modern local waste management sector;

the reduction of health risks linked to an uncontrolled management of municipal waste;

the reduction of polluting emissions such as water and air pollutants;  
innovation in technologies for waste collection and treatment.

## Methodology

In order to assess the financial viability of these two scenarios, we computed for:

- the profit and loss;

- the cash flow following the standard accounting method and further derived the Financial Net Present Value (FNPV);

- the differential net cash flow will emphasize the outcomes comparing the status quo option with our ones.

Source: .....

# Key results

**Table 9 Differential cash flow**

|                                  | YEARS        |            |            |            |            |            |     |            |
|----------------------------------|--------------|------------|------------|------------|------------|------------|-----|------------|
|                                  | 0            | 1          | 2          | 3          | 4          | 5          | ... | 15         |
| Net cash baseline scenario       | - 275.081,38 | 286.377,90 | 249.358,42 | 565.105,34 | 637.653,46 | 810.712,70 |     | 946.841,51 |
| net cash PAYT scenario           | 83.854,11    | 85.531,19  | 85.958,85  | 86.388,64  | 86.820,59  | 87.254,69  |     | -          |
| Differential cash flow           | - 358.935,49 | 200.846,71 | 163.399,57 | 478.716,70 | 550.832,87 | 723.458,01 |     | 946.841,51 |
| Discount factor                  | 1,00         | 0,91       | 0,82       | 0,75       | 0,68       | 0,62       |     | 0,23       |
| Discounted diferencial cash flow | - 358.935,49 | 182.322,72 | 134.648,98 | 358.102,04 | 374.045,25 | 445.957,73 |     | 221.777,96 |
| NPV                              | 4.406.183,76 |            |            |            |            |            |     |            |

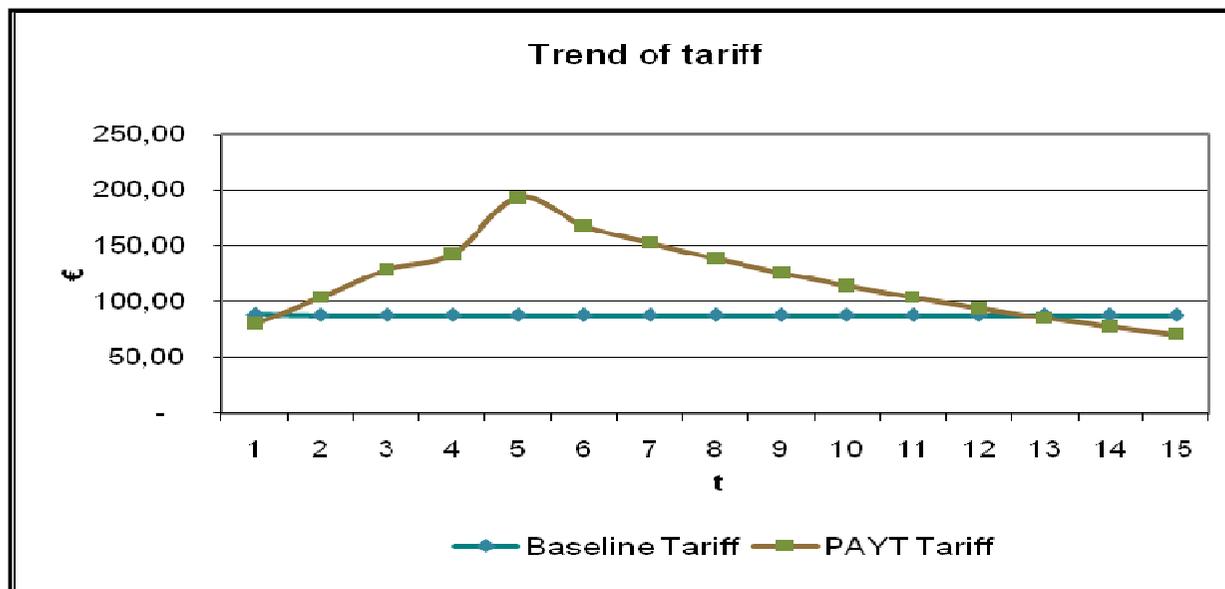
**Table 10 Tariff**

|                       | YEARS      |              |              |              |              |              |     |              |
|-----------------------|------------|--------------|--------------|--------------|--------------|--------------|-----|--------------|
|                       | 0          | 1            | 2            | 3            | 4            | 5            | ... | 15           |
| Costs to cover        | 275.081,38 | 5.034.475,42 | 4.785.473,52 | 4.421.129,84 | 4.357.160,78 | 4.169.234,06 |     | 4.001.972,40 |
| Discount factor       | 1,00       | 0,91         | 0,82         | 0,75         | 0,68         | 0,62         |     | 0,23         |
| Discounted revenue    | 275.081,38 | 4.570.148,35 | 3.943.456,58 | 3.307.207,83 | 2.958.747,31 | 2.570.020,82 |     | 937.378,92   |
| Total amount of waste |            | 60.807,53    | 57.767,15    | 58.055,98    | 58.346,26    | 58.638,00    |     | 58.638,00    |
| Residual              |            | 56.794,23    | 37.895,25    | 25.602,69    | 20.712,92    | 13.252,19    |     | 13.252,19    |
| Tariff on residual    |            | 80,47        | 104,06       | 129,17       | 142,85       | 193,93       |     | 70,73        |

# Tariff

Tariff is calculated based on the overall operating costs divided by the total waste generated each year in the baseline scenario;

The amount of waste has a linear increase—in that, the rate of waste production rises at the same rate of population growth. Whereas in the PAYT scenario, the tariff is adjusted on an annual basis depending on the total amount of residual waste produced and hence, implying that a pro-recycling behaviour provides an incentive to households to reduce their wastes



Source: Authors' calculations

## Expected outcomes

Economic impacts on the local economy (in terms of revenues and employment: more recycles means more secondary material to sell and more employees in the recycling sector, even if Prices are strongly correlated with international market prices of raw materials and energy );

savings in raw material consumption (such as, for example, metal and metal compounds, glass, plastics, etc.);

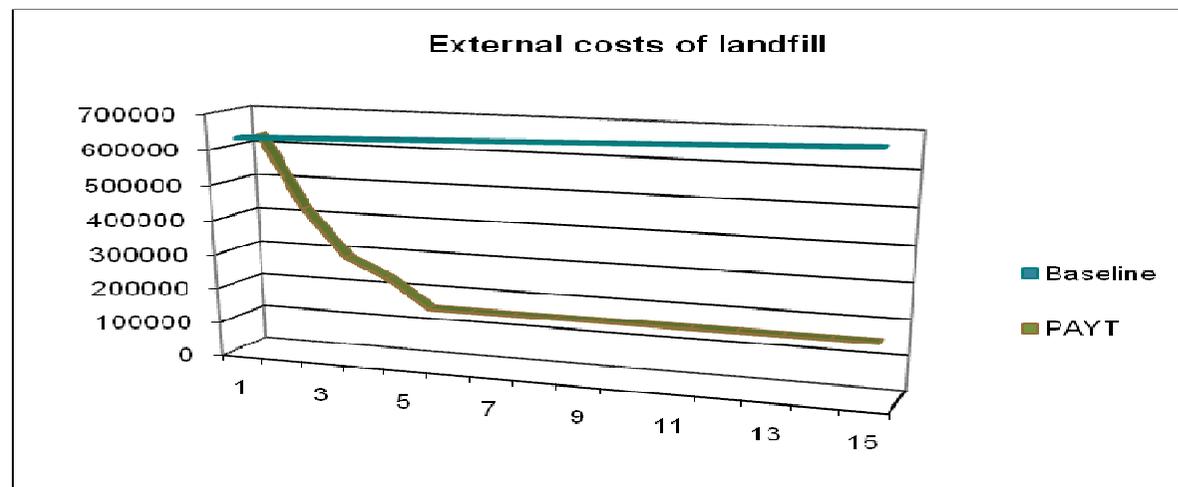
reduction in air, water and soil pollutants and types of environmental damage to soil and groundwater avoided.

# External costs of landfill

Even if we have not explicitly considered negative externalities associated to waste disposal, which, if included in the analysis, should make the investment in the PAYT system even more desirable, according to Eunomia (2009) data about the external costs of landfill, in PAYT scenario we have a remarkable saving of that.

Table 11 External costs

|                                      | YEARS |           |           |           |           |           |     |           |
|--------------------------------------|-------|-----------|-----------|-----------|-----------|-----------|-----|-----------|
|                                      | 0     | 1         | 2         | 3         | 4         | 5         | ... | 15        |
| External costs of landfill (with)    |       | 631.855,7 | 635.014,9 | 638.190,0 | 641.381,0 | 644.587,9 |     | 677.552,2 |
| External costs of landfill (without) |       | 628.712,1 | 419.500,4 | 283.421,8 | 229.292,1 | 146.701,7 |     | 146.701,7 |
| Saving                               |       | 3.143,6   | 215.514,5 | 354.768,3 | 412.088,9 | 497.886,2 |     | 530.850,5 |



## Recommendations (1)

We recommend that other complementing programs that are uniquely suited to recycling and waste prevention should be introduced in conjunction with the PAYT system.

-For instance, a Deposit-refund system (DRS), applicable to certain type of materials such as glass and plastic bottles, may also be adopted in addition to the PAYT system.

Although several factors may affect the feasibility of these programs, their successful implementation may ultimately serve as a blueprint for other municipalities in Usti region to follow.

## Recommendations (2)

About regulatory framework...

public administration may decide to make a tender, in order to favour competition *for* the market in collection services.

Public administration should consider the financial plan as starting point to establish criteria, concerning tariffs: obviously firms have to present plans with lower tariff, compared to the ones setting out by public administration and possibly increase the quality in providing services.

*Thank you !  
Questions?*

## References

- ☐ Puig Ventosa, I. (2002) Pago por generación de residuos municipales en Torrelles de Llobregat. Equipamiento y Servicios Municipales. 104
- ☐ Puig Ventosa, I. (2008) Charging systems and PAYT experiences for waste management in Spain. Waste Management, 28: 2767 – 2771
- ☐ Reichenbach (ed.). (2004) Handbook on the implementation of Pay-As-You-Throw as a tool for urban waste management. Proyecto de R+D+I financiado por la Comisión Europea (contrato nº. EVK4-CT-2000-00021),.
- ☐ Krajský úřad Ústeckého kraje - Hodnotící zpráva odpadového hospodářství v roce 2009
- ☐ Belli, Pedro; Anderson, Jock; Barnum, Howard; Dixon, John; Tan, Jee-Peng (1997). Handbook on economic analysis of investment operations. World Bank, available online
- ☐ European Commission, Directorate General Regional Policy (2008). Guide to COST-BENEFIT ANALYSIS of investment projects. Available online