Evaluation of Waste Management Policy and Policy Instruments : Three case studies

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Evaluation of Waste Management Policy and Policy Instruments

Three Case Studies

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Report written as part of project HOLIWAST:
Holistic Assessment of Waste Management Technologies

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Preface

This report presents the results of the second part of the Work Package 1 of the two-year research project entitled Holistic Assessment of Waste Management Technologies (HOLIWAST), funded by the European Commission. The HOLIWAST project is a collaborative effort of partners in seven Member States (Austria, Germany, Denmark, Finland, Italy, Poland and Sweden). Among them, the Swedish partner - the International Institute for Industrial Environmental Economics at Lund University – is the author of this report. The report was originally submitted as a project report in 2007 and was subsequently modified, taking into consideration inputs from the project partners and the European Commission.

The author of the report would like to thank the partners of the HOLIWAST project and especially Kim Christiansen of 2.-0 LCA consultants in Denmark, Alina Rejman-Burzynska and Eugieniusz Jedrysik of Central Mining Institute (GIG) and Marco Ricci and Valentina Caimi of Scuola Argaria del Parco di Monza (SAPM) for their collaboration, inputs and supports in conducting the case studies in the three communities. My cordial gratitude is extended also to the 31 interviewees in the three case countries, who provide materials constituting the essential building blocks of this paper. The full responsibility for the content of the report remains, however, with the author.

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1 Introduction

This report presents the results of the second part of the Work Package 1 of the two-year research project entitled Holistic Assessment of Waste Management Technologies (HOLIWAST), funded by the European Commission. The HOLIWAST project is a collaborative effort of partners in seven Member States (A, D, DK, F, I, PL and S). Among them, the Swedish partner - the International Institute for Industrial Environmental Economics at Lund University – is the author of this report.

This introductory chapter describes the background and the purpose of the second part of the Work Package 1 of the HOLIWAS project, its scope and limitation and the methodology used. The last section provides the structure of the report.

1.1 Background

Despite various efforts taken in the last several decades, overall waste generation is still increasing, with the significant contribution of the increase of municipal solid waste.[1] Due to the increase of the absolute amount of waste generated, the absolute amount of waste landfilled has not decreased. This is despite the increase in recycling and incineration.

Waste management is a classical area where subsidiarity principle applies. In the EU context, many of the practical solution to implement the Directives are left in the hands of Member States, and the central government of the Member States often leave rooms to local governments to implement their own waste management plan. The local communities seek to adopt the solution that suits their conditions most. This means that policies and approaches taken in different EU Member States and in different communities vary.

The decision makers at the local communities are often most knowledgeable of the local context. However, they may not be aware of the development and solutions taken outside of their communities to deal with similar issues that they face. Identifying the optimal waste management strategies for a local community may not be a straightforward task considering the necessity of evaluating the situation from various dimensions of sustainable development. The selection they need to make is not limited to technological solutions. They also need to select the policy instruments that would help make the most out of the technological solutions they make.

Recognising these challenges, the HOLIWAST project was launched with the following primary objectives:

- To provide a multidisciplinary (environmental, economic, social) comparison of different waste management technologies.
- To identify how the most appropriate technologies can be implemented within an integrated waste management framework, for different socio-economic context.
- To evaluate the opportunity of policy instruments for promoting these technologies and supporting decision makers in waste management.

[1] Between 1995 and 2003, the generation of municipal waste in EU-25 increased by 19%, which is coupled with the growth of economy. It is predicted that MSW is increased by 42.5% by 2020 compared to 1995 levels (COM (2005) 666 final, 5).

Work Package 1 (WP1) of the project has the overall objective of *providing insights into the environmental effectiveness of policy instruments related to waste management applied in selected socio-economic contexts*. The study presented in this report is the second step to fulfil this task. It builds onto the first step of WP1 in which selected waste management policies and policy instruments in Europe were reviewed.[2] It is conducted in close collaboration with project partners conducting other Work Packages as elaborated further below.

1.2 Purpose

The purpose of the second part of Work Package 1 of the HOLIWAST project is to *evaluate the environmental effectiveness of the policy instruments related to waste management implemented and/ or discussed in the three case communities, which are Torino, Italy, Katowice, Poland and Tølløse, Denmark.*

In order to attain the aforementioned purpose, the following research questions need to be addressed:

1. What are the national, regional and local government policies and structure in place/discussed that shape the existing/future waste management systems?

2. What are the existing waste management systems in the three case communities, and what changes have been discussed?

3. What have been the results of the respective waste management systems in terms of environmental effectiveness?

4. How might the government policies influence the selection of waste management systems in the respective communities as well as their environmental effectiveness?

1.3 Scope and limitation

The study focuses on the waste management policies and systems in the three case municipalities in three countries: Torino, Italy, Katowice, Poland and Tølløse, Denmark. They were selected during the development phase of the HOLIWAST project and represent three different types of communities in Europe: a rural area in northern Europe (Tølløse), a midium-sized city in a new EU Member State (Katowice) and a large city in southern Europe (Torino). Differences of these communities are utilised to highlight the characteristics stemming from the features of measures taken in each community identified during the study. The findings are compared to the cases where the same/ similar instruments are introduced to the extent possible in order to contribute to the development of general knowledge in this research arena. However, the primary aim of the study is to provide detailed empirical evidence from the cases.

Among various waste streams, the scope of the HOLIWAST project is limited to municipal waste, which can be defined as *waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households.*[3] Within the

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[2] The first step of the Work Package 1, "Waste management policies and policy instruments in Europe. An overview", was conducted with the aim to *provide an overview of municipal solid waste management policies of the European Union and highlight the potential of selected existing policy instruments in reducing environmental impacts related to municipal waste generated in Europe, focusing on their implication to local governments.*

[3] Excerpt from the definition of mixed municipal waste as found in Art. 3.3 of the Directive 2000/76/EC on the incineration of waste.

municipal waste, it was agreed in the HOLIWAST first progress meeting[4] that the following waste is covered under the project: mixed waste, mixed secondary materials (plastics, metal, glass, paper, composite packaging) biological waste (including garden & park waste), manually collected road waste, market waste, textile, batteries, fluorescent tubes, small waste electrical and electronic equipment (WEEE) and oil and fat. Among these waste streams, those that are handled by the respective case municipalities are discussed in each case study.

Concerning government policies and division of responsibilities, national, regional and local policies that shape the waste management system taken in the respective case communities are considered. Given the nature of this project, special attention is given to the policies that can be implemented at the local level. The allocation of responsibilities among the government institutions is investigated in order to understand the decision making powers local government in the respective communities has related to waste management. Information gathering in these regards are significantly limited by the unavailability of the legislation and other policy documents in English, despite the assistance from the project partners from the three countries where case communities are located.

With all the case communities being part of EU, national, regional and local policies are affected by EU policies. References are made to the related EU policies as appropriate. However, EU policies governing the waste streams discussed within this project are described in the first report of WP1 and will not be repeated here.

Concerning waste management systems of the case communities, focus is given to the actors in charge of various stages of waste management – collection, recycling and disposal, as well as transportation in between – and their responsibility. The detailed description and discussion of the technologies used in selected communities are handled in other Work Packages and are not within the scope of this work. The focus of this package is instead roles, perception and interactions of actors involved in the respective stages of waste management.

With regard to goal-attainment evaluation (see Section 1.4), the overall goal of an environmental intervention – contributing to the reduction of environmental impacts from society – is to be achieved in a long-term and is affected by various other interventions as well as factors (see further below). Methods of the evaluation of overall environmental impacts of different operations which the environmental intervention – say, source separation target – have been debated at lengths. The overall environmental impacts of the current operation of the three case communities as well as that of alternative solutions are scrutinised in the rest of the work packages of the HOLWAST project, and is not within the scope of this work. The focus of this work is rather whether an environmental intervention in question – for instance, door-to-door collection and source-separation system – has contributed to the immediate goal of the intervention – source-separation of recyclables from the residual waste.

In many cases, several policy instruments are combined in one government intervention. For instance, a take-back requirement of products given to producers (administrative instrument) are combined with an advance disposal fee system (economic instrument), information campaign to consumers and information requirement to recyclers (information instruments) within one program based on extended producer responsibility (EPR). Even one single policy instrument may contain elements of several instruments. For instance, the recycled material content requirement (administrative instrument) can be used in public procurement (economic instrument). Moreover, in addition to government interventions, there are a number of factors

[4] Held in Orléans, France 1-3 March 2006 with the participation of all the project partners.

– convenience, cost, societal expectation, consumer demands, to name but a few – that influence behaviour of different addressees (citizens, industry, etc). Thus, concerning attributability assessment (See Section 1.4), the study does not seek to attribute the effectiveness to one policy instrument, or to suggest the degree of influence of the policy instrument in numerical term. Instead, some of other influencing factors identified in the cases are discussed to indicate the relative importance of the policy instruments in achieving the result and to illustrate how a policy instrument may be affected by these factors.

1.4 Research approach and methodology

As agreed upon in the project, the study took an *instrumental case study* approach. The case study approach is chosen, as the phenomenon under investigation is complex and consists of variables that cannot be isolated (Yin, 2003, p.xi). It is an approach well used in evaluation research (Yin, 1994, p.15; Stake, 1995, p.xii; Weiss, 1998, p.261). In an *instrumental* case study, the aim is to use the findings of the cases for something other than an understanding of the case itself such as to obtain insights into the research questions or contribute to a general understanding (Stake, 1995, p.3). The focus is on the research questions, which should be explored through the cases, not the case *per se* (Stake, 1995, p.16).

Semi-structured, in-depth interviews to the total of 31 stakeholders in the selected communities – government officials of different levels, politicians, people actually handling waste, citizens – constitute the primary basis of the study. This is complemented by review of *existing literature* (waste management plan, legislation, books, academic articles, newsletters), as well as *written materials* obtained from the interviewees and project partners from Denmark, Italy and Poland (2.-0 LCA consultants, SAPM: Scuola Agraria del Parco di Monza and GIG: Główny Instytut Górnictwa =Central Mining Institute).

Information related to the respective case communities were gathered in close collaboration with the aforementioned three project partners. Concerning interviews, the type of people the author of the report wishes to interview as well as an interview guide that contains issues to be addressed in the interview were communicated to the three partners. They subsequently were in touch with the contact persons in the case communities to identify the appropriate interviewees.

The actual interviews at the respective communities took place in the duration of 2 to 5 days in the following timing: Tølløse, Denmark: January and July 2006; Torino, Italy: early April 2006; Katowice, Poland: late April 2006. The lengths of the interviews ranged from 10 minutes to 3 hours. All the interviews were conducted in English and in person, and are accompanied by the project partners from the three case countries. Except for a few interviews where interviewees themselves replied in English, the interviews were translated by the project partners. The list of these interviewees, their affiliation and the timing and place of the interviews are found in the Appendix.

After the interviews meeting notes from each interview were summarised and were sent to the interviewees and project partners of the respective countries for verification. In summarising the meeting notes, additional questions were also put together. In the case of Italy and Poland, answers to these questions were collected by the project partners. As for Denmark, an additional study visit was made to conduct a few more interviews.

Information collected from the three case studies was subsequently analysed following the research questions presented in Section 1.2. Regarding the waste management systems in

place/ under discussion (the second research question), the system was divided into smaller elements from two angles: activities and type of responsibilities.

With regard to the activities, they were divided into *collection* and *recycling and disposal*[5]. Meanwhile, borrowing the typologies suggested by Lindhqvist (1992) for EPR programs, the author tried to distinguish *who* is engaged in three dimensions of the activities – *physical management, financial mechanism and informative provision and management*–, and *how* they are fulfilling their tasks. In addition to these responsibilities, a crucial element of an effective government intervention is *authorisation* of conducting certain tasks such as waste collection and disposal, as well as *monitoring and enforcement* of the implementation of the responsibilities given to the respective actors. This analytical approach, as summarised in Table 1-1, has been useful in further clarifying how an EPR programs works, and is deemed useful for the analysis of waste management systems in general.[6]

Evaluation of the environmental effectiveness concerns whether and by how much the goals of an environmental intervention have been attained. This can be considered from two viewpoints: 1) whether the outcomes are in accord with the goals (*goal-attainment* evaluation), and 2) whether the outcomes are produced by the intervention (*attributability* assessment) (Vedung, 1997: 37-39, see Figure 1-1).

In this work, government interventions affecting the case communities are also analysed from these two angles. With regard to the attributability assessment, not only positive outcomes but also the negative outcomes, such as non-occurrence of certain actions, are considered. In other words, how the policy instruments present in the case communities may have promoted or hindered the development of waste management system and the attainment of results, are analysed. In both goal-attainment evaluation and attributability assessment, the focus of the analysis is the immediate goal of the intervention in question (see Section **Error! Reference source not found.**)

Table 1-1: Elements of a waste management system investigated in this study

Type of responsibility	Activities		
		Collection	Recycling & disposal
	Physical management	Element 1	Element 5
	Financial mechanism	Element 2	Element 6
	Information provision and management	Element 3	Element 7
	Authorisation, monitoring and enforcement	Element 4	Element 8

(source: adapted from Tojo, 2004)

[5] In this document, following the definition found in the proposal to the revised framework directive on waste, recycling means "the recovery of waste into products, materials or substances whether for the original or other purposes. It does not include energy recovery" (COM(2005)667final). The term "recycling" in this document does not include incineration with energy recovery. Incineration, including that with energy recovery, is discussed together with other means of waste disposal, such as landfill. When pre-sorting takes place prior to recycling but at the recycling site (as opposed to source separation measures by consumers), it is also discussed together with recycling and disposal.

[6] For further discussion on the analysis of EPR programs, see, for example, Tojo (2004).

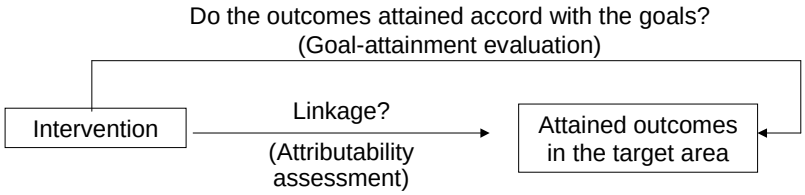

Figure 1-1: Effectiveness evaluation (adapted from Vedung, 1997)

1.5 Structure of the report

Following this introductory chapter, Chapter 2, 3 and 4 presents the case study of Torino, Italy; Katowice, Poland and Tølløse, Denmark, respectively. Each Chapter consists of the following element:

1. Government organisational structure and policies related to waste management

2. Existing waste management systems and changes that have been discussed

3. Results of the waste management systems in terms of waste hierarchy (goal attainment evaluation)

4. The role of identified policy instruments in influencing the waste management systems and results obtained (attributability assessment).

Concerning government organisational structure and policies, the author first introduces how responsibilities concerning waste are distributed among various government entities. The description of policies affecting waste management follows.

Activities constituting waste management systems are divided into 1) collection and 2) recovery and disposal, and their four dimensions – a) physical management, b) financial mechanisms, c) information provision and management and d) authorisation, monitoring and enforcement – are analysed (see Section 1.4).

The report ends with a concise concluding section (Chapter 5).

2 Case Study 1: Torino, Italy[7]

Italy divides itself into 20 regions, which consists of 108 provinces (a few more are about to be appointed) and 8101 municipalities. The total population of the nation is 58.5 million.

Torino Municipality lies within Torino Province located in the north-west Italy near the Alps. It is a historical city originally founded in 3rd Century BC and served as the capital of Savoia dynasty in 1280 and the first capital of Italy in 1861 (Citta' di Torino, n.d.). Being the base of the car manufacturer FIAT and Lancia, it grew as an industrial city in the 20th century (Citta' di Torino, n.d.). The population of Torino Municipality is approximately 900 000 – 430 000 men and 470 000 women – and constitutes about 433 000 households.[8]

Among the 10 waste management districts that Torino Province developed, Torino Municipality, being the largest municipality in the Province, constitutes one single district on its own. In Torino Municipality, the household-like waste from industry constitutes about 50% of the municipal waste collected.

2.1 Government organisational structure and policies on waste

2.1.1 Organisational structure

The governments in Italy are organised hierarchally, all the way from national, regional, provincial to municipal. Provincial government governs all municipalities in the province.

Provincial government has the responsibility to 1) develop a provincial waste policy, 2) draw a Provincial Waste Management Plan and 3) authorise landfill sites and recycling plants. They also are in charge of providing industries with permits to operate. Municipalities implement the provincial waste management plan, but the mayor of each municipality can decide what waste streams should be collected separately, how to collect and when.

With regard to type of waste, provincial governments are in charge of municipal solid waste, which also includes household-like waste generated from industry, such as those from shops, restaurants and the like. It also includes waste from SMEs with less than approximately 50 employees. Regional authorities, on the other hand, are in charge of industrial waste.[9]

Technological issues are dealt with both by the province and the regional authorities. Concerning the economic and judicial issue, it is taken care of by three entities: 1) provinces, 2) regional authorities, and 3) National Environmental Agency. This creates a big mess: streamlining of responsibility is deemed necessary. It was felt by the interviewees in the Province that they need more people to take care of the issues they are responsible for.

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[7] Information presented in this section is based on the interviews to 11 stakeholders in Italy as presented in the Appendix as well as supplementary information provided by the project partner in Italy (SAPM) in conjunction with the interviews, unless mentioned otherwise.

[8] According to the latest official data of 2005 by the National Statistic Institute of Italy (Istituto nazionale di statistica) (2007), the population of Torino Municipality is 900 608 (429 669 men, 470 939 women), constituting 433 494 families. The information from the Torino Statistical Office (2007) indicates that as of 31 January 2007, the population is 900 271, with 431 315 men and 468 956 women.

[9] The amount of industrial waste generated in Torino Province is 2.5 million tonne, while MSW consists of 1.7 million tonne. Neither provincial nor municipal government have authorities to have some public control over industrial waste: it is by law in the hands of regional authority. As Torino is highly industrial area, the Province wishes to have more control over industrial waste.

Compare to other provinces, Torino Province has technical competence. The technical competence comes from technically skilled staff inside of the organisation, as well as the collaboration with the technical/ engineering universities in the region. Experts in universities can be called upon within the working group set up in the Province, or may work as an independent consultant. The challenge is how to utilise those people with technical competence in the area of controlling and monitoring.

2.1.2 Waste policies

Italy enforced the National Waste Decree in 1997, which is translated into regional waste management plan and provincial waste management plan respectively.

With regard to the provincial waste management plan, they set general targets for *waste reduction*, *recycling* (*separate collection rates*) and *disposal*. The provincial waste management plan can last up five years, but should be updated within the five years, taking into account the current situation. In the case of Torino Province, last revision was made in 2005, and another revision will be made in 2006.

Measures related to *waste reduction* are mostly discussed in national or regional policy. The provincial representatives find that most of reduction measures concern production and distribution process and feel that they have limited capacity to take effective measures.

Concerning waste management, the overall policy of Torino Province can be summarised as 1) achievement of 50% separate collection targets, 2) building of more biological treatment plants thus increase the overall capacity, and 3) building of a waste incineration with energy recovery for the unsorted waste.

With regard to *separate collection* of recyclables, Torino Province has set the goal of 50% (by weight) source separation of the total amount of municipal waste by 2009. The target is based on the national waste management plan, which requires that all the provinces must achieve at minimum 35% source separation by 2003.[10] Most of the provinces did not manage to achieve this target, and nor did Torino. However, Torino Province managed to reach 36.6% source separation by 2005, and it aims to achieve 50% by 2009.

For Torino Province, the motivation behind going for 50% target includes minimisation of residual waste generation and needs for its disposal. It has been difficult to build any new waste management facilities, be it landfill, composting plant or incineration plant, due to the difficulties of gaining social acceptance. While there is a plan of building an incineration plant by 2011, the residual waste should be reduced as much as possible in order to continue to dispose the residual waste at the existing landfill which is reaching its limit.

As a way of achieving the 50% source separation target, Torino Province aims to change the waste collection method from road container system to *door-to-door (D-to-D) system*. The Province encourages D-to-D system as it is more user friendly and will achieve better waste quality and quantities. The main policy instrument introduced by the Province to achieve the target includes the provision of *financial support* to municipal D-to-D system. In 2005, it provided 3.6 million Euro to 60 project presented by single municipalities or waste management districts. The financial resource for the subsidies comes from landfill tax.

[10] Provinces are allowed to put higher targets than what is required by the national plan.

In Torino Municipality, introduction of a mandatory D-to-D system was decided in February 2004.[11] The Municipality aims to introduce D-to-D system to the entire city by 2010. The motivations for Torino Municipality to introduce D-to-D collection systems are:

- Financial support provided by the Province;
- Achievement of 50% source separation target in the waste management plan; and
- Scarce landfill capacity.[12]

Among the sorted waste, as of April 2006 40% of the biological waste separately collected lacks market. Meanwhile, the total capacity of biological treatment plants in Torino Province is not sufficient to treat all the biological waste currently collected separately, thus requiring treatment in neighbouring communities. Torino Province therefore created a working group together with the Italian Composting Association CIC. The two key points discussed there include 1) the treatment costs (currently requires financial contribution from the regional government to run the facility), and lack of the market (there should be a need to push the market demand) and 2) construction of new recycling facilities.

In order to motivate farmers to use compost material, the Provincial government is working on 1) the improvement of the quality of the compost, 2) provision of technical solution for transport and spreading on the field and 3) green public procurement (e.g. use in the maintenance of green park). Moreover, the Regional Authority provide financial incentive of 220 Euro per hector for farmers that apply compost on soils in order to enhance the market for compost and restore carbon content in (depleted) soils.

Due to the difficulties of finding new landfill sites while the remaining capacity of the existing landfill is already close to its limit, Torino Province has the plan to build an incineration plant with energy recovery by 2011.

Concerning landfill, municipalities have to pay 15 Euro per every tonne of municipal waste as landfill tax. Approximately 5% of the tax goes to the Province, 2.5 Euro per tonne goes to the municipality hosting the landfill-sites as a reward to their environmental contribution, and the rest goes to the regional government.

There is also some taxation on incineration. However, it is lower than landfill as it is regarded as pre-treatment. No tax is charged on recycling and composting.

2.2 Waste management system

In Italy, municipal waste management is organised by the municipal government, who implement the Waste Management Plan developed by the Provincial government.

In Torino Municipality, MSW is managed by a public company called AMIAT.[13] AMIAT is owned 99% by Torino Municipality and 1% by a small waste management district located in

[11] A separate collection system was introduced on a voluntary basis through an EU-funded "urban project" in 2001, but it failed.

[12] The landfill currently used was supposed to be closed in 2003, and is extended until 2007. In order to keep the landfill run as long as possible, it is obvious that more source separation should be done.

[13] AMIAT deals with the following waste: 1) MSW from the owners (Torino Municipality and the small waste management district north of Torino Municipality) and two more small waste management district, 2) small amount of hazardous waste, and 3) construction and demolition waste. Hazardous waste they handle include both industrial and non-industrial

the north of Torino within Torino Province. AMIAT is responsible for all the activities related to MSW management: collection, transport, disposal and delivery to recycling plants. These activities are funded by municipal waste fee and the revenues from recyclable materials.

2.2.3 Collection

2.2.3.1 Physical management

Waste collection system in Torino Municipality as well as Torino Province is undergoing the shift from road container system to D-to-D (door-to-door) system. Figure 2-1 shows the status of the introduction as of 2004. The waste management districts/ municipalities highlighted in green already have D-to-D system, while those in grey still have road container system (Turin Province & Waste Provincial Observatory, 2005).

In Torino Municipality, the decision to introduce D-to-D system was made in February 2004. The city was divided into many small districts, and the system was introduced in selected districts which gradually expanded. In the beginning it covered approximately 25 000 people in the urban area, and expanded to 150 000 people (70-80 000 households) by December 2005. After a part of the urban area, the system was introduced in the districts in the hill areas which consist of many private households, lower in density and relatively rich people, as well as areas with high-rises. The edge areas of the Municipality were first covered, and the coverage gradually extended towards the centre. This is to prevent transboundary shipment of waste (the neighbouring community started door-to-door collection system earlier). The idea is to have the whole city served with the D-to-D collection system by 2010.

(batteries, un-used pharmaceuticals, mineral oils, etc.) waste. Concerning 3) it is daily recovered and put in the landfill owns by the AMIAT (It is the first public plant in Italy that recovers the construction and demolition waste).

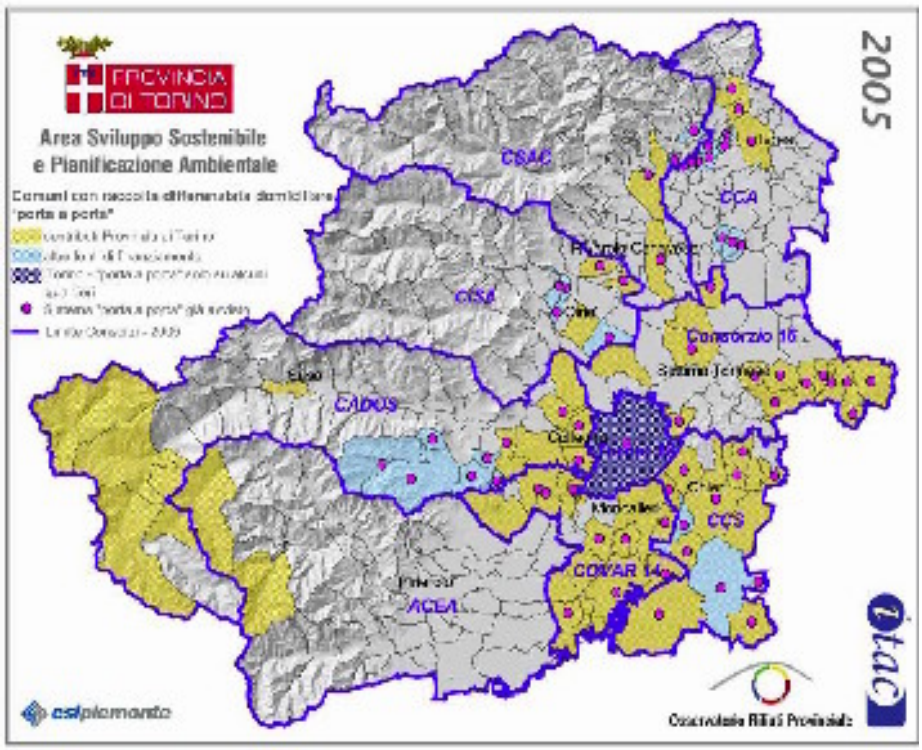

Figure 2-1: Spread of door-to-door system in Torino Province, Italy, 2005 (source: Turin Province & Waste Provincial Observatory, 2005)

Details of D-to-D (door-to-door) system in Torino Municipality

In D-to-D system in Torino Municipality, waste is divided into five fractions: 1) residual, 2) food, 3) paper and composite, 4) glass and metal and 5) plastics. Bags, bins and containers of different size are provided to suit the amount of waste generated from different types of houses (i.e. individual houses, high-rise buildings).

They use containers equipped with wheels with the size up to 360-litre – higher volumes would be too heavy for the workers to move, as bins are emptied mechanically. 1000 litre containers (4-wheels) are used only for the buildings with more than 100 families. To these big bins waste in plastic bags can be thrown in. The idea is to hand-load the waste as much as possible, at least for private households although vehicles that were built before for machine load still exists. The new vehicles for door-to-door collection are much smaller and some of them are easy to go into the narrow streets, especially in the hill sides.

Food waste is collected twice a week, while the rest of the waste is collected once a week. When there are problems with space, they collect twice a week. In rural areas, packaging materials are collected every other week. The idea is to collect food and other recyclables as much as possible and make the rest less convenient.

Containers forgotten on the roadside attract so-called “fly-tipping”: various types of waste are put aside as if they are road containers. This may happen also in the neighbourhood where waste containers are put out on the busy streets (even when the containers are put on the road on the appropriate days and taken back). Despite the free-of-charge collection system at the

door, there are still problems with the uncontrolled bulky waste.[14] They are left next to the road containers or some D-to-D collection points.

Experiences in Torino Municipality indicate that it is very important to have a good exchange of information, and that implementation is based on solid and detailed planning. D-to-D system requires more complex logistic management than road container system. Internal working team was created to enable the flexible and detailed planning. The team tried to accommodate the local situations and change the technical solution (e.g. the size of the containers, the location of the containers) as much as possible. For instance, when a household do not have the space for different waste bins, the system allow placing the containers outside of the property, if such space exists outside of the property. When the containers are put outside of the property all the time, they put a lock on the lid in order to at least avoid the contamination of sorted fractions. Nonetheless these "all the time" containers attract fly-tipping.

Concerning the quality of respective waste streams, paper has more than 5% contaminants. Glass is the smallest volume and has not had many problems. The content of the food waste is currently rather good. Plastic is a problematic field: especially in the case of 1000 litre bins in the high rises, mixed waste are often thrown in. Solutions proposed include modifying the lid of the containers for paper waste.

Activities concerning specific waste stream

With regard to packaging waste from households, they are collected by the municipalities and are brought to the system organised by CONAI (the national packaging association). The packaging waste from business (i.e. tertiary packaging) is taken care of by the business themselves and the municipalities do not involve in this.

Regarding WEEE, with the introduction of national WEEE legislation, the producers should be in charge of the collection and disposal. However, it is not happening in reality. Without the proper implementation of WEEE, WEEE are mixed in the residual waste.

In Torino Province, some of the WEEE, such as TV sets, computers and white goods, have been collected at community collection centres, while products such as drilling machines have not been brought in there.

Concerning municipal hazardous waste, there is a national producer consortium for used oil and mineral oil. They set up collection points in places such as oil stations and recycle the oil. They also started the collection of vegetable oils. For batteries, there is a national requirement which mandates take-back and recycling of used batteries. A problem related to batteries as well as oil is the involvement of big supermarkets, which sell mineral oil and car batteries. They do not provide collection points. There are many court cases in different parts of Italy on this issue. The verdicts vary: in some cases supermarkets were found guilty and needed to pay fine, but in others they won the cases.

With regard to used/ old pharmaceuticals, there are collection points in each pharmacy. Municipalities provide collection containers as it is their responsibility to collect.

[14] With regard to bulky waste, in Torino Municipality there is a long tradition of collection-on-demand, free of charge from household. This has been financed by municipal waste fee. Non-household entities must pay for the collection.

In the case of Torino Municipality, there are three community collection centres, to which citizens bring in sorted waste streams such as EEE, solvents, bulky waste, batteries, etc. on their own. There is a person at the gate, and guide people to place waste in the appropriate containers. The centres open between 6:30-11:30 and 15:30-18:30, from Monday to Saturday. According to a gate keeper, there are visitors approximately every 15 minutes. The centre does not have much problems, though occasionally people leave waste during the closing hours and produce litters in front of the gate. Sometimes attempts are made to steal valuables, such as WEEE. Adding more centres face challenges due to difficulties in securing proper locations.

Concerning the plastics, there is a social work group that is active in collecting plastics. Each household should bring the containers with plastics on specific days for collection. The group is also active in collecting paper waste and supply vehicles for paper collection. They are involved in the rehabilitation of drug addicts and former prisoners, and try to have them involved in social activities such as waste collection. As of April 2006, 150 people are working for D-to-D collection of paper and 25 people for bulky waste.

2.2.3.2 Financial mechanism

Municipal waste management is run by the municipal government and is mainly financed by the municipal waste fee. However, often some part of the activity is financed by other incomes of the municipality. Currently on average 85% is covered by the waste fee, while the rest of the 15% is covered by other revenues in Torino Province.

The current waste management fee in Torino Province is on average ca 100 Euro per inhabitant per year. The size of the waste management fee is decided by each municipality. The size (square meters) of the house has been used as a basis for determining the fee. The square based system was introduced at national level in the 1980s as that was the only data they have about the household. Since 1997 the polluter pays principle is gradually introduced, and now (in Italy) the waste fee is partly based on the size of the property, but partly based on the number of people in the household (which is translated in the size of the bins) or the quantity of waste produced.

Meanwhile, the total waste management cost – including the cost for collection, transport, treatment and disposal – on average is 95.4 Euro per inhabitant per year (See Figure 2-2). The cost of Torino Municipality is found under BACINO 18. Due to the high disposal costs, the municipal government decided to raise the size of the fee so that the fee covers all the waste management activities. Namely, it would add 80 Euro to the current fee.

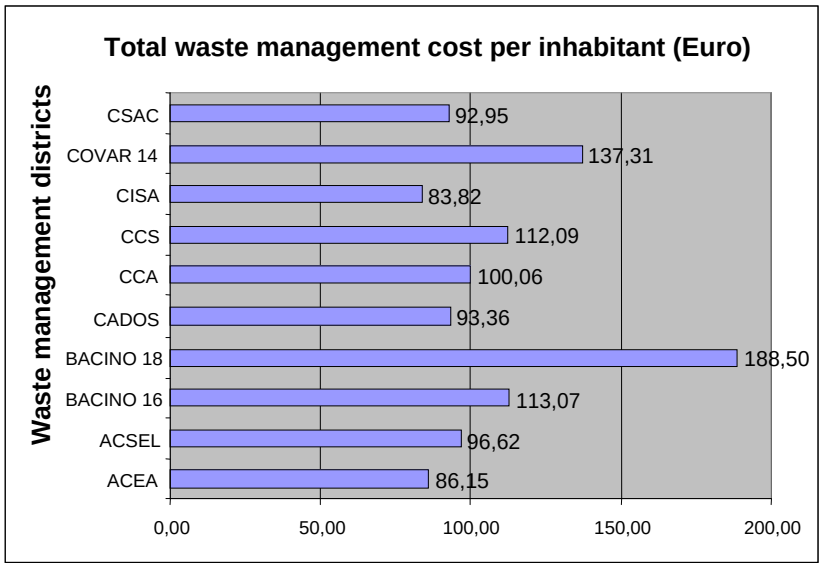

Figure 2-2: Total municipal waste management cost of each waste management district in Torino Province

In raising the size of the waste management fee, the municipal government considers moving from the fee system based on the size of a property to those that reflect the actual amount of waste disposed more. AMIAT also try to support the estimation of waste generation from non-households, such as hotels, shops and the like. In a survey to explore alternative solutions conducted in July 2005 involving 1250 people, 58% of the population in Torino Province they agreed on the waste fee based on the actual measurement of waste generated, while 42% of the population disagreed to it (ASTAREA, 2005).

Regarding packaging, when the waste is brought to the system organised by CONAI (the national packaging association), some money is paid back to the municipalities for their collection activities. This is financed by the fees that the packaging producers must provide to the association. The size of the money given to the municipalities depends on the quality of the packaging materials separately collected. The money given from the PRO does not cover the full cost of collection. The cost is partly borne by the municipality (co-financing).

2.2.3.3 Information provision and management

Major information and communication campaign was held when moving to D-to-D system in various parts of Torino Province. In Torino Municipality, AMIAT made a large investment in the information campaign (500 000 Euro for 25 000 people, which translates into 20 Euro per person).[15]

The information campaign started with direct contact with waste producers (i.e. citizens). The information was provided door-to-door, face to face. It is followed by the provision of a starter kit, which includes a) information kits and b) tools that are needed for the implementation. Item b) consists of small kitchen-basket and 7-10 litre bags for food waste, a bin for plastics, bags for paper, glass and cans. In case citizens miss the door-to-door information, they can go to one of the information and distribution points in the municipality.

[15] According to Scuola Agraria del Parco di Monza (Ricci 2006, personal communication), the average cost spent by local authorities for information and communication campaign in introducing the D-to-D collection system is about 1.5 Euro per person in Italy. It is mainly AMIAT that financed the campaign, although there was some support from both the Province and from the Municipality.

They can either get their starter kits from these information and distribution points, or take the information and have the starter kits delivered to their houses.

When information was provided door-to-door, 30-35% are not reachable (not willing to listen), while the rest of the people are easy to talk to. AMIAT also put advertisement on the street to raise the awareness concerning the system. Before starting the new system, direct communications took place with the building managers of the buildings with more than four families.

Fears existed among the citizens if their waste would be collected. In order to facilitate the transition, a tool free number was introduced to which citizens can bring forward their complaints and concerns. Most of the complaints were on the 1) non-distribution of containers, and 2) removal of the road containers. This is because the implementation took the step of provision of the starter kit → manufacturing of the bins → distribution of the bins and → removal of the road containers 2-3 weeks after the distribution of the bins. In the introductory phase, there were occasions where the bins were not distributed as planned, or that people get upset not to find the road containers.

The information campaign works in a team of three people (two communication people and one technical supervisor who modifies the location of the bins and adjust technicalities) and a vehicle. There were 16 teams in total with the total number of 48 people working.

Personnel in charge of information campaign at AMIAT summarised lessons learned from the experience as follows:

- The procedure that took place (door-to-door information campaign followed by the provision of starter kits) is better than the public meeting.[16]
- Door-to-door information campaign allows direct communication with waste producers, which facilitate provision of new bags, additional information, etc. in the starting and implementation phase.
- It was good not to rely on the classical information provision, such as advertisement on the TVs.
- It should be noted that environmental argument is not enough to convince the users to move to the new system. One should make it convenient and user-friendly.

After gaining the experience from the initial 25 000 people in the urban area, the information campaign and management of the information was outsourced. The outsourcing was necessary due to the necessity of many labour forces.

In addition to AMIAT, a social work group that has been active in collecting plastics facilitate the better acceptance of the new system among the citizens. AMIAT also gains new information from these people. They act as intermediate actors.

Out of 315 municipalities in Torino Province, 4-5 municipalities had problems in introducing D-to-D system due to some miss communication. However, these problems are perceived to be local. In July 2005, the Province conducted a customers' satisfaction survey involving 1250

[16] The interviewee shared the experience of introducing a new system through public meetings. It took only a few opponents talking loud that prevented the rest of the audience from going for the new plan, even when the rest of the population would not have such strong opposition/would have been glad to go for the new plan.

interviewees. More than 50% of people prefer the D-to-D collection compared to the previous collection scheme (ASTAREA, 2005).

Concerning collection of old pharmaceuticals, Torino Province obtains the achievement from each municipality once a year. There has been some public awareness campaign on this.

2.2.3.4 Authorisation, monitoring and enforcement

According to the Italian National Decree on Waste Management,[17] MSW management companies such as AMIAT can obtain licence to collect waste by registering themselves in the National Board. Municipality then authorises MSW management companies to collect waste in its jurisdiction.

In the case of Torino Municipality and AMIAT, they have a contract that has AMIAT as the entity to manage MSW generated in Torino Municipality. This type of contract normally lasts 10 to 20 years. The details of the contract are negotiated every year between the two entities.

The actual operation of D-to-D system has been closely monitored by AMIAT staff with the aim of improving the system. Concerning the information campaign, AMIAT has been supervising the outsourced teams.

2.2.4 Recovery and disposal

2.2.4.1 Physical management

In Torino Province, there are 250 industrial plants which are authorised to treat waste, and additional 500 are authorised to recover waste. Some of those authorised to recover waste are also utilising the facilities as intermediate storage place. Some those recovering waste also take care of end-of-life vehicles. There are seven composting plants: two are authorised to compost food and garden waste while the other five could be used only for garden waste, as the technologies used in these facilities are simplified ones.

In the case of Torino Municipality, AMIAT has its own composting plant, as well as a plant for WEEE, for construction and demolition waste, a sorting plant for mixed waste and a sorting plant for wood (bulky waste). WEEE is also taken care of by another plant based in Torino.

As of April 2006, there is not enough capacity to compost all the biological waste separately collected in Torino Province. Good results have been achieved in municipalities in the Province, while the largest composting facility is in the revamping phase. Thus some biological waste should be sent outside to the neighbouring communities.

Compost obtained from separate collected materials is sold as fertiliser (in Torino Municipality, 7-15 Euro per tonne). However, concerning the market for compost, although there are some agricultural activities in the Province (5-10%), there are cultural problems for farmers to accept compost as fertiliser. This leads to lack of market for 40 000 tonne of compost materials generated from 100 000 tonne of separately collected biological waste. The

[17] National Decree on Waste Management no. 22 date 5/ 02/ 97, "Fulfillment of European Directive 91/ 156/ CEE on waste, 91/ 689/ CEE on hazardous waste and 94/ 62/ CE on packaging and packaging waste", in Italian Official Journal n. 38 of 15/02/97 (available in Italian).

Provincial Government is working on 1) the improvement of the quality of the compost, 2) provision of technical solution for transport and spreading on the field and 3) green public procurement (e.g. use in the maintenance of green park).

A critical issue concerning biological waste is how to take care of the odour emission coming from the biological treatment plants. The same problem has been experienced at industrial manufacturing facilities. Generally speaking odour emission from biological treatment plants (i.e. composting plant) posed very strong implementation problem in the 1980s. However, solution for the odour problem does exist. At the moment the specific problem in Torino is in the process of being solved, while trying to gain acceptance from the public. The problem is not so much to do with the technical solution, although it exists. What is more challenging is to gain acceptance from the public.

In order to deal with the remaining residual waste and pre-treat the waste before landfilling, incineration becomes necessary in Torino Province. The Province has the plan to build an incineration plant with energy recovery by 2011. The main reason for introducing incineration plant is the difficulties of finding new landfill sites, while the remaining capacity of the existing landfill is already close to its limit.

The response of the public to the building of new incineration plant is relatively positive. The public are more or less convinced about the necessity of the new plant. Preliminary project idea has been presented to the public, and EIA has been conducted. The overall view of the public is that incineration is better than landfill but it is better to do source separation than incineration.[18]

Concerning final disposal, there are 11 active landfill sites in Torino Province. Eight are for municipal waste and three are for industrial waste.[19] In addition, there are 14 closed landfill sites, which are still under care as they are under "after closure" care period.

In the case of Torino Municipality, AMIAT is responsible for managing the landfill in Torino Municipality including the after closure phase. Despite the pressing situation (see Footnote 12) so far AMIAT has managed to dispose waste from the city without having to transport it outside of the city boundary. However, in an emergency situation they collaborate with neighbouring communities.

2.2.4.2 Financial mechanism

As mentioned in details in Section 2.2.3.2, the cost for municipal waste management is covered by municipal waste fee, complemented by other revenues. In Torino Municipality, the raise of the size of municipal waste fee has been discussed in order to cover the full cost of municipal waste management with the fee alone.

The cost for landfill disposal in Torino Municipality is 250 Euro/ tonne for industries, 113 Euro/ tonne for the municipalities, and 19 Euro/ tonne for oversieves from composting

[18] It should be noted, however, that local NGO's are pushing the Province in order to complete the extension of DtD collection schemes in order to minimise the quantities to be disposed off, before building the incinerator.

[19] Among the three landfills for industrial waste, one is for hazardous industrial waste. This site is co-owned by a private company and the regional government (33%). The partial ownership is a strategic choice for the public authority to have some control over the industrial landfill site. In addition to the ownership, government could also control via permit provision and inspection. They can also provide instruction for the infrastructure for the disposal site.

plants. In addition to the landfill cost, municipalities have to pay 15 Euro per every tonne of MSW sent to landfill as landfill tax (for the destination of the tax, see Section 2.1.2).

2.2.4.3 Information provision and management

Concerning recovery, as long as the waste is stocked in an intermediate storage plant, there is no requirement to communicate to the authorities as to how it is stored, how much is stored, etc, which is a loophole in the system.

At the landfill in Torino Municipality, the number of trucks, the number of workers and the like are recorded for each collection area. AMIAT needs to keep track of the amount of waste produced, how it is transported and its destination.

2.2.4.4 Authorisation, monitoring and enforcement

Waste recovery and disposal facilities as well as industrial plants need to obtain permits from the Provincial government in accordance with the EU IPPC Directive.[20] In Torino Province, 23 people from the Province work for authorization, and 3-4 people for control. In addition to MSW management sector, they authorise and control various other sectors.

According to the Italian National Decree on Waste Management,[21] Regional governments are in charge of keeping the records of the number and capacity of landfill sites per each province. The Provincial governments are in charge of licensing the actual operation. Except for wastewater, the Provincial government provide permits related to all environmental parameters. A special government body in charge of wastewater provides the permit for wastewater related to landfill sites. The Province also authorises the operation of recycling plants, and in this case all the permits should be provided by the Province.

Monitoring and inspection of waste facilities take place regularly.[22] There is a public body, called ARPA (Regional Environmental Agency) who is in charge of inspecting technical requirements and environmental parameters. Inspections related to administrative requirements – booking keeping and data recording concerning generation, transport, destination, landfill of waste – are conducted by the Province. In the case of composting plant, generally compost plants owed by AMIAT (more than 40 000 tonne per year) in Italy have 1-2 inspections per year regarding odour emission and 4 sample per year for compost stability and composition.

When inspection indicates irregularity, the facility needs to pay fines. For the composting plant in Torino Municipality, the Province sent a technical group in order to define the modification needed to modernise and ameliorate environmental and operational performance of the plant.

There is no limit value set for the waste generation from industrial plants. Thus the IPPC Directive and its permit do not work as a mechanism to reduce waste generation from the industrial plants.

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[20] Council Directive 96/ 61/ EC of 24 September 1996 concerning integrated pollution prevention and control. OJ L 257, 10/10/1996 P. 0026 – 0040.

[21] Supra note 17.

[22] According to Provincial government, control takes place only when there are problems with the facilities. Some people in charge of authorisation also work for the control in case of necessity.

2.3 Results so far

According to the Provincial Government, the following changes are observed in the area where D-to-D system is introduced. The source separation rate, including among others glass, paper, plastics and food, improved to 50-60%.[23] The quantity of food separately collected improved from 60g per day per capita (during the container system) to 200 g (as of 2005), which is translated into approximately 70 kg per person per year.

Table 2-1 summarises the overall improvement of Torino Municipality in terms of the MSW generation and source separation of waste streams addressed in D-to-D collection system from 2003 to 2005.

Table 2-1: Municipal solid waste generation and source separation of waste streams addressed in Door-to-door collection system: Torino Municipality, 2003-2005

Year		**2003**	**2004**	**2005**
MSW generation per capita per day (g) (a)		1 556.47	1 566.05	1 628.58
Source separation per capita per day (g)	total (b)	403.93	500.95	573.74
	Food waste	55.25	70.08	79.74
	Paper and cardboard	207.58	239.81	259.93
	Glass	0	0.04	0.01
	Metals	9.68	6.63	7.13
	Plastics	12.23	21.46	20.70
	Dry recyclables*	60.13	62.48	62.66
Percentage of source separation (%) (b/a x 100)		26.1	32.0	35.3

(Source: based on Regione Piemonte (2007a), Regione Piemonte (2007b), Regione Piemonte (2007c))
* Dry recyclables may contain paper, cardboard, glass, metals and plastics that are collected together.

As the D-to-D system currently covers roughly one sixth of the population (See Section 2.2.3.1), the overall improvement for source separation is from 26% in 2003 to 35% in 2005, and for food waste separation, from 55 g per day per capita (2003) to 80g per day per capita (2005) (See Table 2-1). Concerning the rest of the steams separated at source, increase has been observed for plastics and papers. Regarding glass, an explanation for the very low source separation rate could be the inclusion of glass in the dry recyclables. Concerning paper, relatively small change occurred as the quantitative and qualitative results of the fraction collected by the social work group are outstanding. Regarding the quality of sorted fractions, certain level of contamination was found in plastics.

About 5% of the inhabitants do not adjust themselves to the new system. 5% of the household do not have the space for source separation. In the latter, solutions sought include placing the waste bins outside of the house (See Section 2.2.3.1).

Overall, it can be said that the introduction of D-to-D collection system has contributed to the increase in source separation. Whether it will reach the 50% source separation targets by 2009 remains to be seen.

[23] The Province and the national observatory did a study as to how much source separation could be achieved by road container system. The result was that road container system cannot go beyond 35%. The Italian Guidelines on Separate Collection issued in 1999 by the Ministry of Environment and Italian EPA suggest that road container system could achieve less than 30% of source separation, while D-to-D system could achieve 50-70% source separation (Ricci, 2006, personal communication).

2.4 Role of policy instruments

As mentioned earlier, the interviewees at the Provincial government find that the measures related to waste prevention is to do with production and distribution process. During the interviews, no specific measures have been discussed. The provincial government may have a role in including waste generation when providing IPPC permits to industry. However, as mentioned, the amount of waste generated has not been considered as criteria for permits. The role of IPPC Directive in reducing waste thus remains hypothetical and will not be discussed further.

Interviews with people in charge of waste in Torino made it clear that the policy instrument they currently most vigorously strive to implement is D-to-D collection system. The positive outcome discussed in the previous section seems to support the studies in other areas that suggest the effectiveness of D-to-D system in improving source separation. As described, the introduction of the operational and physical infrastructure is accompanied by intensive information campaign and convenience for the consumers. The importance of the information campaign has been stressed by a number of interviewees. The fact that the reason for a few cases to fail was considered to be miscommunication also supports the importance of information campaign.

The experiences in Torino Province indicate the role of D-to-D system, information campaign and provision of convenience as a package, although it is difficult to isolate one of them and see the relative importance of these three components. As mentioned, the amount of resources put on the information campaign in Torino is significantly higher than the experiences in other Italian communities (See Footnote 15), although the results achieved so far is similar to other areas where D-to-D system has been introduced (See Footnote 23). One could question the necessity of resources spent on information campaign – could Torino Municipality not achieve the same result with less information campaign? Further studies would be necessary to determine that. For instance, if one could identify a city that has similar characteristics as Torino Municipality, which also introduces D-to-D system with similar degree of convenience but with less intensive information campaign, the comparison of the result of the two cities could be analysed together with the intensity of the information campaign. Not only the resources used, but various aspects of information campaign – the usage of the resource – should also be compared. Similar comparison can be made regarding the type of convenience provided to facilitate introduction of D-to-D system in other areas (check the Italian study).

The case study indicates that subsidies from the Province to municipalities were an important factor that motivated the municipal governments within the Province to introduce D-to-D system. Another instrument mentioned by an interviewee that encouraged Torino Municipality to go for D-to-D system was to meet with the numerical target. The case seems to support the effectiveness of the numerical targets as identified in the first study of this WP. However, as discussed in the first study, it is difficult to isolate the effectiveness of the numerical targets or the subsidies alone in introducing D-to-D systems.

Finally, the diversion targets set forth in the EU Landfill Directive[24] evidently urged policy makers to take measures to improve source separation of biodegradable municipal waste.

[24] Council Directive 1999/ 31/ EC of 26 April 1999 on the landfill of waste. OJ L 182, 16/ 07/ 1999 P. 0091 – 0019. More description of the Directive can be found in the first report of WP1 (Tojo, Alexander & Bräuer, 2006).

3 Case Study 2: Katowice, Poland[25]

Poland is divided into 16 administrative regions called voivodship, which are further divided into administrative regions called poviat. Poviat consists of local communities referred to as gmina, the smallest administrative unit in Poland.

Katowice has been developed as a centre of heavy industry, with seven coal mines and iron foundaries. It gained its municipal status in 1865 and now the capital of Sileisia, one of the 16 voivodships. Katowice, with its area of 164.5 square km, consists of 22 city districts with 323 400 inhabitants constituting 135 600 households. Data in 2003 suggests that 24.5% of the population engaged in mining industry, while 19.9% engaged in building industry. As of 2003, the predominant source of waste is the coal mines (3.4 million tonnes), while annual generation of municipal waste is 133 800 tonnes (GIG, 2006).

3.1 Government organisational structure and policies on waste

3.1.5 Organisational structure

Similar to Italy, the Polish government has a hierarchal structure – central government, voivodship (regional government), poviat (county government) and gmina (local government). Voivodship has two administrations: one is Voivod, who is sent from the central government, and the other is Local Parliament — a self-government selected locally via election. Council-people from the local parliament select from themselves a Marshall. Concerning poviat and gmina, Some of the large cities are "gmina with poviat entitlements", meaning that such a poviat consists of one gmina.

Different levels of government provide permits depending on the degree of environmental impacts of the industrial plants. Permits for plants that have a substantial impact on environment are currently provided by the Voivod of the regional government. On the other hand, the head of poviats called starosta are in charge of issuing permits for plants that are deemed to have less impact on the environment. When issuing permits, both starosta and voivod have to publish the information about the plant and everyone has the right to provide his/her opinion. In 2008, Marshall will take the task of issuing permits for the sites covered by the EU IPPC Directive, which at the moment are issued in part by voivod and in part by starosta.

Permits for building waste disposal facilities involve various levels of governments as well. Gmina (local government) provides permits concerning their location, while starosta (country government) and voivod (regional government) are in charge of their construction and management. Permits related to transportation, collection and recycling of waste are issued by starosta (country government).

The Marshall at the regional government collects and provides data for all the waste. They collect environmental fee, develop various policy and strategic documents,[26] and are responsible for planning and building the treatment plants for hazardous waste. They also

[25] Information presented in this section is based on the interviews to 9 stakeholders in Poland as presented in the Appendix as well as supplementary information provided by the project partner in Poland (GIG) in conjunction with the interviews, unless mentioned otherwise.

[26] Examples of the documents given by the interviewee at the Marshall Office include the Program for Environmental Protection and Program for Water Retention.

supervise county and local governments, although the recommendation from the Marshall office does not have to be followed by these governments.

Inspections are governed nationally by an independent organisation called Central Inspectorate for Environmental Protection, which has regional and local offices. For environmental crime, there are special prosecutors that have very strong authorities for investigation.

Municipal governments (gmina) are responsible for municipal waste. Each municipal government should finalise waste management plan by 2006, develop local waste management legislation and has the responsibility to maintain the cleanliness and tidiness of their community.

3.1.6 Waste policies

The 1981 Act of Environmental Protection is the first national law in Poland that addressed environmental protection in general, although it was considered to be imperfect in many ways. The new Environmental Protection Law came into force 1 October 2001 partially and fully on 1 January 2002. General environmental principles introduced in the Law relating to waste management include the principle of prevention, precautionary principle, polluter-pays principle and citizens' access to environmental information (Council of Ministers, Poland, 2003, p.393-394).

The first Polish law concerning waste management was enacted in 1997 and it came into force 1 January 1998. On 1 January 2002 a new Act on Waste of 27 April 2001 came into force, which introduces waste hierarchy, proximity principle and principle of extended producer responsibility as its basis (Council of Ministers, Poland, 2003, p.394). The 2001 Act on Waste also specifies requirements for waste generators and actors involved in waste management activities. It contains chapters on issues such as waste treatment process, landfills, transboundary movement of waste, some of which are supplemented by specific legislation (Council of Ministers, Poland, 2003, p.394-397).

The Act on Waste of 2001 was followed by a number of other laws governing specific waste streams, such as the law on end of life vehicles (2004), the law on the waste from electrical and electronic equipment (2005) and the like. The law on packaging waste was also enforced in 2001. In line with the corresponding EU Directives and the principle introduced in the Act of Waste, these legislation mandate producers to take care of the end-of-life management of their own products.

The Act on Waste was further revised substantially in 2005. The revision in 2005 includes, among others, the inclusion of parts related to waste management in the Act on Tidiness and Cleanliness.

These laws adopted by the national Parliament are supplemented by more detailed requirements described in subordinate laws and other policy documents. These subordinate documents include ministerial regulations, Voivod regulations and resolutions and permits set up by the local law representatives such as resolution of council of the community).

The Act on Waste also stipulates that the waste management plan should be developed at the respective level of government – national, voivodships, poviats and municipal. Among the national short-term goals (covering the period 2003-2006) determined in the 2002 National

Waste Management Plan, those that are of particular relevance to this project are as follows (Council of Ministers, Poland, 2003, p.405):

- Provide all the inhabitants with proper waste collection schemes and avoid waste dumping outside public control
- Raise the effectiveness of separate collection, in particular that of biodegradable waste
- Develop methods of separate collection of hazardous waste within MSW
- Intensify the activities concerning closing, reclaiming or modernising existing municipal waste landfills, building regional landfills in accordance with the EU standards.[27]

This is to cope with the situation where approximately 10% of MSW had been dumped in the environment without any treatment, and that approximately 97% of MSW collected by actors considered suitable by the authority is landfilled (as of 2000), and that (Council of Ministers, Poland, 2003, p.400-401).

Concerning biodegradable waste, based on the diversion requirement given in the EU Landfill Directive,[28] they set the national recovery rate target of biodegradable municipal waste to be 12%. Among biodegradable municipal waste, 35% of garden waste, deemed easy to collect in comparison to food waste, should be collected separately in 2006 and 50% in 2010 (Council of Ministers, Poland, 2003, p.413).

In addition, the 2002 Plan suggested that the capacity of composting plants across the nation be enhanced (Council of Ministers, Poland, 2003, p.413). Meanwhile, the Ministry of Agriculture in joining the EU introduced a new standard for compost to be used as fertiliser. The latter has implication to the existing "compost" plants and is further discussed in Section 3.2.8.1.

The 2002 National Waste Management Plan also sets the recovery target of 50% and recycling target of 25% for packaging waste by 2007. Specifically, the following recycling targets are set for the respective packaging materials: paper and cardboard, 45%; aluminium, 35%; glass, 35%; plastics: 22%, wood, 13% (Council of Ministers, Poland, 2003, p.427).

The 2002 National Waste Management Plan further sets the long-term goals (2007-2014) under four categories: 1) waste prevention and minimisation, 2) waste collection and transport, 3) recovery and disposal and 4) market for recovered materials (Council of Ministers, Poland, 2003 p.405-406).

Concerning waste prevention and minimisation, educational schemes, individual composting of biodegradable waste and application of economic instruments to manufacturers are mentioned as methods that may be applied (Council of Ministers, Poland, 2003, p.405-406). The interviewees commented on the difficulties of taking effective measures in the area of municipal waste management, as it touches upon the behaviour of consumers.

The 2002 Plan suggests that waste collection and transport should be decided at the local level (Council of Ministers, Poland, 2003, p.406). This is among the areas affected by privatisation policy, introduced in various arenas of the Polish society since it moved away from

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[27] As set forth in the Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste. OJ L 182, 16/07/1999 P. 0091 – 0019. See Footnote 24.

[28] Ibid. supra note.

Communism. The municipality has on one hand legal obligation to maintain the tidiness and cleanliness of their communities, organise separate collection, recovery and disposal of MSW and hazardous waste and monitor the handling of waste. In Katowice, a new law that obliges collectors of MSW to provide facilities for source separation for paper, plastics, metal and glass will be enacted soon. Meanwhile, they also need to allow waste collection companies to operate so long as these companies meet the conditions stipulated by law. Furthermore, they do not have possibilities to collect waste management fee from their citizens unless accepted by local referendum with which 30% of the population must agree.[29] Exception is the subsidies provided by the Marshall office for the disposal of hazardous waste. Lack of financial means as well as lack of ownership of waste limits the possibility for municipalities to organise MSW management system as they wish.[30] This issue is considered as a major challenge in developing an efficient separate collection system in Katowice Municipality, and will be further discussed in Section 3.2.7.2.

Concerning the long-term goals related to recovery and disposal and market for recovered materials, the 2002 Plan does not specify specific methods to be taken, but suggests various issues to be considered when selecting the method (Council of Ministers, Poland, 2003, p.406). Upgrading of landfills is among the concrete actions taken in this area (also in line with the short-term goals mentioned above). [31] In early 2006, a new regulation came into place concerning the type of waste that can be put in the landfills. Laboratory tests are required for specific types of waste to be landfilled. The tests can be conducted by only those laboratories certified by the government.

Considering the predominant MSW landfilled and lack of sufficient market for compost, incineration has been considered as an alternative waste recovery/ disposal option. It reduces the volume of waste and energy can be recovered. The introduction of an incinerator has been also considered in the Katowice Waste Management Plan between 2007-2015. However, the introduction of incineration plants in Poland has been hindered due to the negative perception among the public[32] and relative high cost compared to other disposal alternatives.[33] Concerning the perception, the Minister of the Environment is considering of having an

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[29] As of April 2006, only a few communities have introduced waste tax in Poland.

[30] During the discussion that took place on 27 April 2006 on the National Waste Management Plan, changes related to municipal waste management was suggested. The suggested changes included shifting the ownership of MSW to municipalities instead of merely making them responsible for organising collection and treatment of MSW. The system should be changes so that inhabitants should pay the waste fee/ tax to the municipalities instead of paying it to the waste collection companies. The latter had been proposed to the Parliament several times, but the Parliament who is the final actor to decide the adoption of the Act changed the proposal and took the waste tax part away. It was due to the heavy lobby by the collection companies, whose slogan is "Free market is good for waste management." Also included in the former proposal was to enable the municipalities to establish some zoning system in order to facilitate efficient connection, but it was also taken out by the Parliament.

[31] Based on the environmental audit submitted by each municipal waste landfill operator to voivods or starosta. Between 2004 and 2012, 361 municipal waste landfills will be closed, 118 need to make large adjustment and 545 needs little adjustment. As of December 31 2003, the fate of 130 municipal waste landfills was yet to be decided (Ministry of the Environment, 2004).

[32] In Poland, there was one incineration plant built in Poznan in 1927 under the German occupation, but no incinerator was used for municipal waste since then for a long time until recently when one incinerator was finally introduced near Warsaw. According to some interviewees, people in general are afraid of dioxin, furan and accidents due to negative experiences with chimneys with black smoke. 99% has been landfilled.

[33] There is an environmental fee for landfill differentiated among waste streams (see Table 3-1). However, the fee is not high enough to serve as an incentive for decreasing the waste directed to landfills. In fact the total cost for landfill (environmental fee plus payment to the operator of landfills) is 30-60 PLN (ca 8-16 Euro), which is lower than that for recycling and incineration – 200 PLN (ca 54 Euro) per tonne of waste. Finally one incineration was built close to Warsaw recently, but the city must subsidise substantially to continue its operation.

information campaign to improve the public image by providing good examples of state-of-the-art incinerators.

An alternative idea to the building of waste incinerator is to use waste as alternative fuels. In order to encourage energy companies to utilise waste as source of energy, the Ministry of the Environment considers development of a standard for green energy.[34] Fraction of waste can be used as green energy. As energy companies need to utilise green energy, this may appeal to them as a good solution. Katowice also considers introduction of a facility to produce alternative fuel from waste as an alternative to introducing an incineration plant.

Several interviewees commented that waste management, although increasing its importance, has not been a priority area in the environmental policy as compared to, for example, the completion of sewage system in the rural area.

3.2 Waste management system

Municipal waste management in Poland is in transition and is much affected by a rather radical shift towards privatisation since the society moved from Communistic to market-based economy. It is open to competition and is organised by a number of private companies, who finance their activities with the money collected directly from their customers (i.e. citizens).

In Katowice, the majority of MSW is managed by MPGK, a company established in 1990, privatised in 1994 and owned 100% by Katowice Municipality. However, it has been facing competition with ten other private companies who also receive permits from the municipality to collect waste from citizens.

3.2.7 Collection

3.2.7.1 Physical management

According to the data the Municipality has, as of 2003, 18 private companies collect mix waste from households in Katowice. Of 18, 10 companies are involved in separate collection of recyclables. It is the owner of properties – individual houses as well as apartments – that select a collection company.[35] This creates situations where different collection companies collect waste from households on the same street, making the collection system inefficient. In the case of apartments, cooperative, the organisation taking care of the settlements to which an apartment belongs, organises a tendering process, and all the residents of the apartment have contract with one company. MPGK, a private company owned 100% by Katowice

[34] The Ministry of Environment tried to encourage energy companies to co-incinerate some wastes. However, according to 2000 EU Directive on incineration, the standard for co-incineration is identical to incineration, and various administrative burden makes it costly to operate. According to the interviewee at the Ministry, energy companies have been of the opinion that it is not commercially efficient to include waste as source of energy. The interviewee also pointed to the fact that coal is cheap in Poland, and waste, especially considering transportation, is not competitive concerning the price.

[35] The number of collection companies in Katowice is still relatively small compared to, for instance, cities such as Krakow and Wroclaw. In Wroclaw, 90 companies are found in the list of companies which got the permission to collect MSW.

Municipality, covers 85% of the population.[36] As of April 2006, MPGK has approximately 22 000 contracts with private households, schools and corporations (factories as well as offices).[37]

Emerging separate collection of some recyclables

As of April 2006, separate collection of specific waste streams started to be introduced. MPGK when making contract with individuals started to provide bags in four different colours to collect paper, plastic, metal and glass separately. For apartments, they provide containers with different openings. MPGK ask their customers to put recyclables in the bags provided by MPGK in front of their house on days specified on the information leaflet which is also provided when making a contract. A new bag is provided whenever one containing recyclables is collected.

Meanwhile, the source separation has not been mandatory and not all the citizens are provided with the facility yet. For instance, an interviewee living in an apartment with about 500 inhabitants located in the urban area of Katowice mentioned that there has been no sorting of waste in her settlement. Inhabitants can throw mixed waste in six containers placed outside of the apartment anytime they want to. The waste is collected from these containers twice a week. According to the interviewee, source separation would face problems with space. However, there is also a recognition that recycling would be perceived well especially among the older generation who used to bring glass, paper and metal to collection points. It should be noted that in the past there were modest incentives, such as toilet papers, when bringing sorted recyclables.

The introduction of obliging all the collection companies to install containers for recyclables (paper, glass, plastics and metals) for every 400-500 citizens has been discussed. The concrete form of installation, such as the location of the containers, has not been decided. An interviewee mentioned that if the distance between the containers for mixed waste and those for recyclables becomes more than 50-70 meters, the likelihood for people to sort waste would be reduced.

It should be noted that the current financial mechanisms, as accompanied by the activities of informal sector, does not encourage waste collection companies to promote source separation. This will be discussed further in the following section (3.2.7.2).

The implementation of the aforementioned collection system is all in the hands of private collection companies. As of April 2006, the Municipality has no possibility to determine who should be in charge of collecting waste from which part of the city, how the collection should be done and the like.

Concerning specific waste streams, in line with the 2002 Act of Waste, the laws subsequently introduced and the National Waste Management Plan (see Section 3.1.6), manufacturers and importers of packaging materials became responsible for meeting collection and recovery targets. Producers who are responsible for collection make contract with recovery

[36] 85% of the population corresponds to 300 000 inhabitants out of 323 000 inhabitants of Katowice and is equivalent to 76% of the amount of MSW. In addition to Katowice Municipality, MPGK also has customers in neighbouring communities, such as Chorzow.

[37] The 2001 Act on Waste defines municipal waste as ”the waste generated in the households, as well as the waste not containing hazardous waste, which, with regard to its quality or composition, resembles waste generated in the households, and” originated ”from other waste producers.” Similar to other countries, the sources of municipal waste are therefore households as well as entities engaged in commerce, trade, education, tourism and the like (Council of Ministers, Poland, 2003).

organisations, which in turn make contract with collection companies. As of April 2006 40 recovery organisations emerged who face intense price competition. Consequently, the collection companies are currently underpaid (see Section 3.2.7.2). Moreover, the system experienced a number of illegal procedures, such as fraud in reporting.[38]

Regarding batteries, in addition to collection initiatives at school and retailers discussed below, the Municipality is considering to organise battery collection system in collaboration with administrators of apartment blocks in Katowice.

There are some voluntary initiatives as well. For instance, one of the supermarket chains provides soil for gardening when people bring in paper for recycling. Gas stations that have small kiosks also installed small containers for paper, cans and plastics. Some large retailers also collect batteries.

There was also an initiative several years ago by a kiosk where there are people at the collection containers. People in the neighbourhood bring the recyclables and hand them to the man, who put the respective fractions in different bins. The collected fractions are usually clean, as people feel embarrassed to hand dirty fractions in person. However, it is not clear whether this initiative took place in Katowice.

Another collection channel observed in some parts of Poland has been schools. Some recovery organisations for batteries and aluminium cans encourage children to bring spent batteries/ used aluminium cans to school. The school that has the highest collection rate is awarded with commodities such as computers. The children educated are in turn talk about their activities to their parents, thus the raising the awareness of the whole community. The initiative for batteries also exists in Katowice, referred to as initiative BATEROWIEC. The Initiative, organised by the Katowice Municipality for 12 years, enjoy the participation of 32 schools and kindergartens as of 2002-03.

Involvement of informal sectors

In addition to the aforementioned systems organised by waste companies, the involvement of so-called informal sectors have been noticed after joining the EU.[39] They come to the waste bins provided by the private waste companies and try to take out valuables such as cans, metals, glass, cartons and the like. They typically come and scavenge the waste once or twice a day.

The view of citizens towards the informal sectors has been negative, especially due to the litter they leave around the waste containers after scavenging. Citizens generally would not like to interact with the informal sectors, and the idea of involving the informal sectors in the door-to-door collection of sorted fraction is not perceived to be acceptable. As it is the obligation of each settlement in the community to keep the neighbourhood tidy and keep waste containers in good conditions, some caretakers started to lock the areas around the waste containers in order to prevent the informal sectors from coming in. An interviewee mentioned that in some settlements, some sorted fractions are put aside next to the waste bins for mixed waste, which would ease the work of informal sectors. However, the litter still occurs as the informal sectors look into the mixed waste anyway.

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[38] For instance, a document that stated that certain recycling rate was achieved turned out to be fraud. In reality the stated fraction was put into landfill without being sorted and treated.

[39] According to some interviewees, the emergence of informal sectors may be due to the enlarged diversification of the Polish society since joining the EU.

As of April 2006, no attempt has been made to understand/ estimate how much has been collected through the informal sectors. This is despite much of the "clean" fraction collected in sorted bins as well as in mixed waste are taken by the informal sectors, leaving the contaminated ones in the hands of waste collection companies.

There seems to be no will for MPGK to integrate these informal sectors formally in the collection activities. In order to avoid the loss of valuable and cleaner fractions collected in the recyclables, they will change the types of waste bins so that once cans, plastics, etc., are thrown into the bins, people cannot open the bins and pick up the content.

3.2.7.2 Financial mechanism

Similar to the majority of communities in Poland, there is no waste tax collected from citizens in Katowice. Waste collectors receive money from their customers (i.e. citizens) for their service directly, and no money goes to the municipality. The operation of MPGK is 100% financed by the income of the company. In the last 10 years, no money has been provided from the Municipality to MPGK.

An interviewee at the MPGK mentioned that the fee is based on the amount of mixed waste which is determined by the size of the containers and the frequency of collection. In the case of residents in apartments the fee can be included in rent, which makes the fee less visible to the residents. MPGK does not charge for recyclables, as they fear that they will lose their customers by doing so. Charging for recyclables is not encouraged by policy makers either, as they aim to improve the source separation of recyclables and do not wish to give disincentives to consumers.

Since the separation collection for the recyclables started, the volume of mixed waste delivered by the individuals decreased. This puts companies like MPGK in a difficult situation. The more the sorted fractions become, the less the revenue from mixed waste becomes. In addition, the sorted fraction typically contains some mixed waste and is not readily sold. As of 2005, MPGK made a loss of 1.5 million PLN (ca. 404 460 Euro)[40] by sorting between clean fraction and non-clean fraction. Furthermore, as discussed, the valuable and clean fractions of recyclables are often taken by informal sectors. In the case of paper, lack of market made the value of collected paper rather low, making it impossible to cover the cost for collection, transport and sorting. In the past there was a big demand by the Germans, but it is no longer the case.

The fact that there is no waste tax – or any public money available for waste management operations – poses challenges to the improvement of waste management system in several ways. It takes away financial means from municipalities to introduce and enforce instruments to fulfil requirements set forth in national legislation and to influence the behaviour of the citizens and collectors. For waste collection companies such as MPGK, it is not economically beneficial to sort waste. This together with the financial limitation would make it difficult to provide services for sorted collection for more citizens.

However, Katowice Municipality so far decided not to change the situation through the referendum. A reason given was that there are too many people who currently do not pay for waste management the difficulty associate with collecting tax from those people. However,

[40] With the conversion rate of 1 PLN = 0.270 Euro as of 18 April 2007 (Forex, n.d.). This conversion rate is used throughout this document.

this argument can be questioned given that 85% of the population have contract with MPGK, which means that they pay for waste management.

Concerning packaging waste, due to the competition between various recovery companies, the payment proposed from the company that has contract with MPGK moved from 4500 PLN (ca 1213 Euro) per tonne of packaging materials to 75 PLN (ca 20 Euro) per tonne for all the activities related to sorted collection. As the situation is still not stable, as of April 2006 MPGK was still waiting to see whether there may be new development.

With regard to the market for recyclables, glass will go to glass mill, and metal to steel mill. There has been a problem for paper. In the past there was a big demand by the Germans, but it is no longer the case. There are 5-6 large paper companies, but it does not help. The cost for collection, transport and sorting cannot be covered by the value of paper. People are rather fine with using recycled paper (e.g. as toilet paper).

3.2.7.3 Information provision and management

As for information provision to citizens MPGK provides a leaflet that very clearly and easily explains the waste fractions. The leaflet is provided together with bags in four different colours when they make contract with individuals. For apartments, a leaflet explaining the containers with different openings has been provided. The leaflets also indicate which week dates of the months the respective recyclables are collected.

The municipality is not directly involved in providing information to citizens. However, the municipal environmental fund can support educational activities, such as battery collection campaign at school as discussed in Section 3.2.7.1. In 2006, Katowice Municipality provided 33 000 PLN (ca 8898 Euro) to support the activities (Katowice City Hall, 2006).

3.2.7.4 Authorisation, monitoring and enforcement

As mentioned earlier, municipalities must provide a permit to collection companies so long as they meet the requirements set forth by law.

The revised 2002 Act of Waste requires waste companies to report to the president of the city the weight of different types of waste they collect for the previous year (by the end of the first quarter of the year.

Inspection for collection activity is considered insufficient, especially for small collection and transport companies. There are cases where waste collected by some of the small companies disappears somewhere. In contrast, some of the large companies, such as MPGK, even have monitoring systems connected to satellite to keep track of the collected waste.

3.2.8 Recovery and disposal

Part of the mixed waste collected by MPGK are treated in the compost plant, while the residue from the compost plant as well as the rest of the mixed waste goes directly to the landfills. As of April 2006 no waste is incinerated. The very small clean fractions of the recyclable materials are sold.

3.2.8.1 Physical management

As of 2003, approximately 38% of all the mixed waste collected by MPGK (119 thousands tonne) is treated at a compost plant. The plant was built in 1988, owned by MPGK and used in the technology called DANO. The current content of the incoming materials into the plant is mixed municipal waste (including metal, glass, plastics and paper that are not sorted) and green waste. The output materials have been sold for reclamation, soil for public space, slopes for highways and the like, but not for agriculture. The rejected residues are disposed of in the landfill together with the remaining mixed waste.

There has been a struggle regarding the understanding of the word "compost" used for the materials that come out of the plant, the changes in standards and its implication to the market of the materials. According to the Ministry of the Environment, the type of technologies was developed 20-30 years ago for the treatment of mixed waste to be used for waste heap. They regard the term "compost" to be inappropriate for the output materials.[41] When Poland joined EU, the domestic standard for "compost" was abolished. Instead, the Ministry of Agriculture introduced a new standard for fertiliser in accordance with the EU requirement.

The difficulty facing MPGK is that with the introduction of the new standard, the output materials are considered as waste. This means additional administrative burden for handling the output materials. According to an interviewee at MGPK, the output materials from the existing plant at MPGK would not be qualified as fertiliser due to the incoming materials.[42,43]

The stream separately collected – paper, plastic, metal and glass – are sorted between cleans and non-clean fractions, and clean fractions are sold. However, recycling rate achieved so far through the channel managed by MPGK has been very low (approximately 2% of the total MSW). It is partly due to the fact that the fractions remained in the collection bins for recyclables have higher level of contamination. This is particularly the case for glass and metal where there is a good market for recycled materials, making it attractive for informal sectors to take away the clean fraction.

In line with the plan of Katowice Municipality between 2007 and 2015 (see Section 3.1.6), MPGK is considering the introduction of an incineration plant or production of alternative fuels from the compost plant. Materials currently sent to landfills after the treatment in the "compost" plant can be regarded as alternative fuel when incinerated. MPGK, in expecting the future regulation on alternative fuel (biomass), in the screening process of DANO, seeks to see if the mixed waste that went through DANO technology could be considered as biomass. However, as mentioned earlier, incineration would face oppositions of citizens.

As there is no incineration, mixed waste not taken to compost plant and the residue from the compost plant is sent to landfills. Consequently, more than half of the waste collected by MPGK is disposed of in landfills. The Municipality does not own any landfill, nor does

[41] The Ministry of the Environment is considering of including a clause in the new regulation that prohibit the use of the term "compost" for the materials coming out of these obsolete technologies.

[42] Currently, even when they take only the green fraction (leaves from the parks, gathering from street sweeping) as incoming materials, the output materials will not meet the new standards, due to heavy metals deposited on the ground (street dust) from industrial activities. According to the interviewee at MPGK, the situation concerns not only Katowice but many other places.

[43] Another interviewee commented that the technology used in Katowice is obsolete and should be replaced, but it was a very expensive and is difficult to replace for the company.

MPGK. So the landfills currently used are located in the neighbouring cities and are owned by private companies.[44]

In Poland, the informal sectors have been rather active in the landfill sites as well, and it has been a major concern especially 2-3 years ago where there were accidents in the landfills. In one case, a person died as the operator of the compactor did not see a man collecting something in the landfill.

In some landfills, they issue procedures for picking valuables and informal sectors organise a small association. In these cases, informal sectors and the landfill managers are cooperating with each other. There was also a case where the labour force of informal sector was used to check the valuables inside of the waste stream. In one cave in Sileisia, a small recovery place was established next to the landfill. This was possible due to the rather big area the landfill had. However, some landfills are completely shutting these informal sectors out. It is up to the landfill managers to decide to allow them to come in or not. The landfill that the author visited has not let the informal sector enter their site.

3.2.8.2 Financial mechanism

The operation of compost plant, which costs approximately 2.5 million PLN (ca 674 100 Euro) a year, is financed by the fees charged to the customers of MPGK.

Concerning landfills, there are two types of fees: one is an environmental fee determined by the government, and the other is the fee paid to the landfill owners. The size of the environmental fee is differentiated between different waste streams, as found in Table 3-1. The size of the fee paid to the landfill owners differs and depending on the negotiation between the generator and the landfill owner. In general, the more waste received, the cheaper per tonne of waste delivered. Between different categories of waste, the fee for those that can be used for construction of landfills, such as demolition waste and soil, are lower – for instance 15-20 PLN (ca 4-5.4 Euro) per tonne – compared to mixed waste – for instance 14 - 15 USD (ca 10.3-11.1 Euro)[45] per tonne. There is no environmental fee for residues from composting, but MPGK still needs to pay 45 PLN (ca 12 Euro) to the landfill owner.

[44] In Katowice there is one closed and reclaimed landfill administrated by MPGK on the Leopolda Street, but it is no longer used.

[45] With the conversion rate of 1 USD = 0.74 Euro as of 18 April 2007 (Forex, n.d.). This conversion rate is used throughout this document.

Table 3-1: the Size of Environmental Fee put on the Landfilling of Different Categories of Waste in Poland

Categories of waste	Fee [PLN (Euro) per tonne]	
	2003	2006
Mixed waste	13.80 (3.72)	15.39 (4.15)
Market waste	13.80 (3.72)	15.39 (4.15)
Cleaning roads	13.80 (3.72)	15.39 (4.15)
Bulky waste	13.80 (3.72)	15.39 (4.15)
MW not otherwise specified	13.80 (3.72)	15.39 (4.15)
Biodegradable	22.80 (6.15)	25.43 (6.86)
Other non-biodegradable	8.90 (2.40)	9.93 (2.68)
Paper	22.80 (6.15)	25.43 (6.86)
Glass	18.30 (4.93)	20.41 (5.50)
Metals	13.80 (3.72)	15.39 (4.15)
Plastics	13.80 (3.72)	15.39 (4.15)
Wood	22.80 (6.15)	25.43 (6.86)
Batteries	158.00 (42.60)	176.00 (47.46)
WEEE containing hazardous substances(HS)	110.00 (29.93)	129.71 (34.98)
WEEE (non-containing HS)	13.80 (3.72)	15.39 (4.15)

(Source: Regulation of Council of Ministers, Dz.U. nr 161, poz. 1335; Regulation of Council of Ministers, Dz.U. nr 260, poz. 2176, translated by GIG)

Although development of landfill is not favoured by the national and regional government (voivodship), the hosting municipalities may not necessarily be against landfill. They could obtain 50% of the environmental fee collected by hosting landfills. The rest are divided into the environmental fund at the national, regional (voivod) and poviat (county) level. Except for the ecological fee gained by hosting landfills, the only revenues related to waste management for municipalities is fine from companies.

3.2.8.3 Information provision and management

The operation of landfill follows procedures that help keep track of the content and volume of incoming waste. The trucks are weighed at the gate of landfills. The content of the incoming waste is registered through the declaration by the truck, as well as the cards that specify the characteristics of the waste stream. People at the gate also check the type of waste visually. They also keep the records of the location within the landfill where the respective waste streams delivered on certain dates are landfilled.

3.2.8.4 Authorisation, monitoring and enforcement

The revised 2002 Act of Waste requires waste companies to report to the president of the city 1) the details methods in which different waste streams are treated and 2) the weight of the biodegradable waste directed to the landfills and not taken to landfills.

The entity giving permits to operate waste facilities changed as the relevant legislation changes. After the accession to the EU, it is the voivodship providing the integrated permit in accordance with the IPPC Directive.

With regard to municipal waste coming into landfills, there is no legal obligation to check the quality of the waste. For others, sample should be checked in a laboratory. For instance, the sample of sewage sludge should be taken and for months kept and be analysed.[46]

3.3 Results so far

As found in the sections above, MSW management and related legislation in Poland is in the process of being developed. In this section the situation in Katowice is compared to the short-term (2003-2006) goals stated in the 2002 National Waste Management Plan.

1. Provision of proper waste collection schemes to all the inhabitants and avoidance of waste dumping outside public control

There is no concrete information that clearly suggests that no collection companies in Katowice collect waste generated by certain individuals. Limited interview opportunities to collection companies other than MPGK and to citizens also makes it difficult for the author to see what type of services is provided to the 15% of the population not covered by MPGK. However, the impression gained from the interviewee from the Municipality indicates that although the Municipality grasps the operation of MPGK well, they do not have a good grip of the operation of the remaining collection companies. This seems to suggest that as of April 2006 some inhabitants are most likely still not provided with proper waste collection schemes and that some illegal dumping continues to occur.

2. Raising the effectiveness of separate collection, in particular that of biodegradable waste – achievement of the following collection and recovery rate: 35% collection of garden waste which leads to the 12% recovery of biodegradable municipal waste by 2006, 50% recovery and 25% recycling of packaging waste by 2007.

As of April 2006, there appeared to be no scheme for separate collection of biodegradable waste.

Separate collection of paper, plastics, metal and glass has been initiated, but the total recycling rate achieved has been 2%. Current financial mechanisms, except for legal mandate, do not encourage collection companies to divert these recyclables from mixed waste. However, collection companies may be motivated to improve the collection of clean fractions which would help them gain revenues from selling recyclable materials.

3. Development of methods of separate collection of hazardous waste within MSW

As of April 2006, activities identified in this area concern batteries. Initiative to collect batteries at school has been going on for more than 10 years, and the Municipality provides financial support to it.[47] As of 2006, the amount of batteries collected from school amounted to 2780 kg. The collection figure from other collection points such as retailers is not available.

4. Intensification of the activities concerning closing, reclaiming or modernising existing municipal waste landfills, building of regional landfills in accordance with the EU standards.

Actions in this area seems to be most prominent nationwide.

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[46] According to the interviewee at the Marshall office, lack of sufficient number of laboratories that are certified to conduct the test poses difficulties for landfills to operate. However, this constraint was not mentioned by the interviewee at the landfill

[47] See, for example, szkola51.neostrada.pl/aktualnosci2004/ekologia.htm.

In summary, although considerable improvement of the condition of landfills has been observed – the least preferred option in the waste hierarchy – measures to promote the upper part of waste hierarchy has not lead to any tangible results.

3.4 Role of policy instruments

The goals set forth in the 2002 National Waste Management Plan managed to make progress in the management of landfill in line with the Landfill Directive. Given the current situation where vast majority of the waste stream ends up in the landfill, it I not difficult to see why policy makers put efforts in this area. It is indeed of great importance to enhance the management of landfills as certain waste stream inevitably ends up in landfills despite various efforts of waste diversion.

However, not much progress seems to have been made in the rest of the areas of waste management system – proper collection of waste, source separation of recyclables, biodegradable waste and hazardous substances. With regard to proper collection of waste and source separation of recyclables and biodegradable waste, a cause most frequently mentioned was the current financial mechanisms and over-preference on free market. The interviews revealed that the problem has been clearly recognised by all levels of government. What is required now is a strong political will at various levels of government – especially national and municipal – to remedy the situation, so that municipalities will obtain the possibility to have control over the waste stream not covered by EPR programs.

The challenge facing the financing of source separation of the recyclables has been experienced in various other countries. An example of remedy is the introduction of advance disposal fee system, often introduced as a component of an EPR program (Tojo, 2006, 3-30). Interviews indicated that the introduction of EPR program for packaging in Poland has not provided sufficient funding to remedy the situation. Effective monitoring and enforcement of the implementation of the program and transparent financial management may help improve the situation.

The necessity of municipalities to provide permits to collection companies so long as they meet the criteria set forth in law in itself is fair. In order to improve the efficiency of collection, municipalities should introduce a zoning system simultaneously. Moreover, the actual activity of the collection companies should be monitored and proper sanction - including the removal of licence – should be enforced in order to improve the quality of collection activities as well as disposal of collected waste.

The 2002 National Waste Management Plan indicated the prioritisation of garden waste in striving to achieve diversion of biological waste from landfills. Meanwhile the existing compost plant faces difficulties in meeting the new standards, asserting that regardless of the change in technologies it is impossible to meet the new standards when having garden waste as incoming materials. The author did not have possibility to verify the correctness of the assertion. However, if the assertion holds true, and recognising the necessity of further diverting biological waste from landfills, it would be good to include food waste in the separate collection scheme.

4 Case Study 3: Tølløse, Denmark[48]

Tølløse is a rural community in Denmark located in the western part of Sealand (some 50 km west of Copenhagen) with approximately 10 000 inhabitants. As of 2004, 50% of the inhabitants are in working age (26-59 years old), 24% are children (up to the age 15) and 18% elderly people (60 years and above) (Tølløse Kommune, 2006).

As of 2004, construction and demolition waste constitutes roughly 63% of the waste generated in Tølløse, while the remaining 37% are household-like waste.[49]

In line with the overall structural changes of government in Denmark (see Section 4.1.1), Tølløse will be merged with five other neighbouring municipalities (Holbæk, Svinninge, Tornved, Bjergsted and Jernløse), which together will constitute a new municipality of Ny Holbæk from 1 January 2007.

4.1 Government organisational structure and policies on waste

4.1.1 Organisational structure

As of 2006, government structure in Denmark is in the process of being reorganised. The current three-layered structure (national, county and municipality) will be reduced to two layers (national and municipalities). Meanwhile, small municipalities will merge into bigger one and the total number of the municipalities will be reduced from 271 to 98.

The Danish waste management system has been unique in Europe in that municipalities are in principle responsible for the entire waste stream generated from their jurisdiction regardless of the source. The specific responsibilities of each municipality, as prescribed in the Danish Environmental Protection Act and the Statutory Order on Waste and are relevant to MSW management, includes:

- Preparation of a waste management plan every four years;
- Preparation of regulations detailing the waste management schemes established within its boundaries;
- Making sure that waste management is carried out in line with the waste hierarchy;
- Establishment of schemes for environmentally acceptable handling of waste generated within its jurisdiction;
- Establishment of collection schemes for domestic waste, including glass and paper from households; and
- Collection and registration of information on waste amounts and waste treatment plants (The Danish Government, 2004, p.63-64).

However, they are not responsible for certain waste streams covered by specific regulations, such as end-of-life vehicles, construction and demolition waste, biomass waste, EEE and

[48] Information presented in this section is based on the interviews to 11 stakeholders in Poland as presented in the Appendix as well as supplementary information provided by the project partner in Poland (GIG) in conjunction with the interviews, unless mentioned otherwise.

[49] Calculation based on Tølløse Kommune – Affaldsstatistik 2000-2004. (Noveren, n.d.).

containers for beer and soft drinks managed by a mandatory deposit-refund system (The Danish Government, 2004, p.65).

Concerning authorisations and inspection, county governments currently provide licenses for incineration plants, while registration necessary for transport companies is handled by municipalities. From 2007, in conjunction with the structural change of the government, decentralised EPA-centres will take over the responsibility for larger incinerators while municipality offices provide for smaller incinerators. The change also envisages having a national registration system for transport companies to reduce administrative burden of the companies. The Danish government is expected to publish a proposal for a reorganisation of waste management in Denmark early 2007; this is not included in this report.

In addition to license and permits related to environmental parameter, incinerators need to get the permit from the Ministry of Economy and Business Affairs, which is in charge of energy supply management. The second permit concerns the possibility to sell the heat generated from the incineration. Furthermore, incineration plants also need to be in line with the spatial planning. Spatial planning concerning landfills and incineration plants are determined at the national or county level.

4.1.2 Waste policies

The overall legal framework for waste is provided for in the part six of the Danish Environmental Protection Act, while more specific provisions are found in the Statutory Order on Waste no. 619 of 27 June 2000. Furthermore, a handful of Statutory Orders govern the handling of specific waste streams such as construction and demolition waste, biomass waste, EEE and containers for beer and soft drinks managed by a mandatory deposit-refund system. There are also tax posed upon incinerations and landfills, as well as specific source of waste such as packaging, PVC and phthalates, nickel cadmium batteries, vehicles and the like (The Danish Government, 2004, p.63-70). Moreover, hazardous waste management has been standardised nationwide since the early 1970s.

The Danish Waste Management Plan 2005-08, which aims to outline guidelines for the Government's waste policy, is based upon the following three elements (The Danish Government, 2004, p.7):

1. Reduction of the loss of resources and environmental impacts from waste
2. Decoupling of waste generation from economic growth
3. Improvement of cost-effectiveness of environmental policies and the quality of waste management

The first and the second point mainly address waste prevention both in terms of quantity and quality, while the third point primarily concerns the management of waste generated.

Regarding the means of recovery and disposal, the 2005-08 Plan sets the goal for the volume of waste to be recycled, incinerated or landfilled. Table 4-1 summarises the targets for the entire waste as well as waste stream within the scope of this project, as compared to the results in 2001.

Concerning collection, reuse and recycling of household waste, the 2005-08 National Waste Management Plan sets numerical targets for specific waste streams. The targets for 2008 and the figure compared in the 2005-08 Plan are summarised in Table 4-2.

Municipality must plan their waste management activities so as to fulfil these targets. They can set higher targets than the national ones, and some municipalities actually do so. Of particular relevance is the new requirement to collect metal and plastic packaging not only from industry, trade and services but also from households.

Table 4-1: Waste recovery and disposal of household waste and entire waste stream in Denmark (percentage by weight): results in 2001 and targets for 2008

	Results of 2001			Targets for 2008		
	Recycling	Incineration	Landfill	Recycling	Incineration	Landfill
Household waste*	29	61	8	33	60	7
Domestic waste*	16	81	3	20	80	0
Garden Waste	99	0	1	95	5	0
Entire waste stream	63	25	10	65	26	9

* Household waste consists of domestic waste, garden waste and bulky waste.
(Source: The Danish Government, 2004, p.39).

Table 4-2: Targets for collection, reuse & recycling of specific waste streams among household waste for 2008 and existing results, Denmark

Waste streams	Targets for 2008	Results so far
Cardboard/paper packaging	60% recycling	55% target met in 2001
Plastic packaging	22.5% recycling	14% in 2001
Metal packaging	50% recycling	15% target met in 2001
Glass packaging	80% recycling	65% target met in 2001
Wood packaging	15% recycling	No figure available
Packaging waste total	55% recycling	56% for cardboard/paper, plastic, metal & glass packaging in 2000
Disposable containers for beer and soft drinks	95% return	No figure available
Refillable containers for beer and soft drinks	98% return	No figure available
Recyclable paper and cardboard waste from households	60% recycling	59% in 2001
Discarded refrigeration equipment	95% collection	89% in 2001
Total collected amount of used oil	90% regeneration	75% (no reference year)

* This corresponds to 48% of total cardboard/paper waste from households.
(Source: data gathered from The Danish Government, 2004, p. 226-228, 236, 246, 254, 276, 305)

Concrete measures for source separation is also left to the respective municipalities.[50] However, regarding paper, unless the recycling target (55% for 2001, 60% for 2008) is achieved, it is mandatory to introduce kerbside collection for paper. Once introducing kerbside collection, the municipality is exempt from achieving the target. The system introduced in Tølløse Municipality is the sorting of organic and residual waste to be collected from each household (door-to-door). Concerning paper and glass, it is a "bring" system (further described in Section 4.2.3.1).

[50] There has been a discussion to standardise the activities of transporters. However, waste management is subject to the self-governance of municipalities, and both social democrats and the right wing government support local solution on this issue. The diversified solutions requested by municipalities have been mentioned as a challenge for a transport company which provides collection and transport service not only within the case community but also in neighbouring municipalities.

The prioritisation of prevention and recycling over incineration, with the ultimate avoidance of landfilling (The Danish Government, 2004, p.9) is clearly reflected in the high tax put on landfilling and incineration. Originally introduced in 1987, the size of the tax on landfilling raised from 40 DKK (ca 5.35 Euro)[51] per tonne of waste to 375 DKK (ca 50.16 Euro) in 2001 (Waste Centre Denmark, 2006). Similarly, the size of the tax on incineration per tonne of waste gradually moved from 40 DKK (ca 5.35 Euro) in 1987 to 330 DKK (ca. 44.14 Euro) in 2001 (Waste Centre Denmark, 2006).

In order to finance the activities related to waste management, the municipalities can collect waste fees from their citizens. Different from the landfill and incineration tax paid to the national government, the fees should be earmarked and be used solely in relation to waste management. Tølløse Municipality introduced the weight-based waste fee system in 1993 together with the source separation between organic and residual waste.

As found in Table 4-1, a substantial portion of household waste (61% by weight as of 2001) has been incinerated. According to some interviewees, incinerations have been rather well accepted in Denmark. It can be attributed to the long history of the use of incineration,[52] as well as the improvement accompanying the building of a new incinerator. Another important factor for public acceptance as well as successful use of incinerators is the integration of planning between incineration building and district heating. Rigid estimation as to how much waste is generated, how much waste is treated and how much heat generated would be used in district heating, is made. As of January 2003 32 incinerators are in use (The Danish Government, 2004, p.137).

The Danish waste policy clearly aims at reducing the amount of waste deposited in landfills (9% of the total waste stream by 2008, see Table 4-1). Perceived reasons include limited land available in the country as well as the dependency on groundwater resources (Tojo, 2006, p.3-22). Another incentive is the EU Landfill Directive, which puts limitation on the landfilling of biodegradable waste into landfill sites.

An issue characterising the current development of waste policy in Denmark is the government strong preference of privatisation. An interviewee pointed out an irony that privatisation paradoxically means more rules in reality. In order to have private entities carry out the task on competitive basis while assuring the quality of the performance, responsibility assigned to the private entities should be pre-determined in details. It is perceived to reduce flexibility of waste management solutions suitable for each municipality. The privatisation would also mean the in-flow of cheap labour from other countries. For instance, when the waste transport is liberalised, there should be an open tender at the EU level. It would be difficult for the Danish local waste managers (such as local waste haulers) to win the price competition. Moreover, in the eyes of the public the ownership of water management and waste management belongs to citizens and not to municipalities. It is not easy to get approval from the public to sell something that belongs to them to a private actor.

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[51] With the conversion rate of 1 DKK = 0.134 Euro as of 18 April 2007 (Forex, n.d.). This conversion rate is used throughout this document.

[52] See, for example, Kleis, Heron and Dalager, Søren. (2004). *100 Years of Waste Incineration in Denmark. From Refuse Destruction Plants to High-technology Energy Works.* [Online]. Available: www.ramboll.dk/docs/eng/Press_Releases/Publications/Waste/100YearsofWasteIncinerationinDenmark.pdf [30 August 2006].

4.2 Waste management system

The waste management system in Tølløse can be characterised by 1) door-to-door collection of waste sorted between organic and residual fractions and 2) weight based pricing system for residual waste.

The system was introduced in 1993. Politicians at that time wished to introduce a system in which individual citizens could contribute to the reduction of environmental impacts from waste. Such system meanwhile should be reasonably inexpensive. In 1992 various solutions experienced in various parts of the world were collected, considered and compared. As a result the solution currently used was introduced. The introduction was inspired by the initiative in Tinglev, which is the first municipality in Denmark that introduced weight-based pricing system. Tølløse is the only community in the surrounding area that introduces the weight-based system.

Although the municipalities are responsible for the overall organisation of waste management in their jurisdictions, the operations are often outsourced to transport and sorting companies. So is the case in Tølløse.

With the merger of the Municipality of five other neighbouring municipalities, the system will most likely change. Interviewees, though regrettably, showed doubts on the continuation of the system in Tølløse, as it has not been perceived very well among the policy makers in neighbouring municipalities.

4.2.3 Collection

In 2004, roughly 22% of municipal solid waste (MSW) in Tølløse is directly collected from institutions, trade and offices, while the rest are collected at the households, collection points at the neighbourhood and the community container stations.[53] In the following sections the handling of the latter – waste collected at households, collection points in the neighbourhood or community container stations is described.

4.2.3.1 Physical management

Door-to-door collection of organic waste and residual waste

Since 1993, door-to-door collection of domestic waste sorted between organic and residual fractions have been taking place. Each household is equipped with two waste bins: one in green for organic waste constituting 40% of the volume, and the other in red for residual waste constituting 60% of the volume. Recently transparent bags have been provided for residual waste in order to facilitate the examination of the content.

Each container is equipped with a micro-chip/ bar code based ID. When the waste bin is weighed, the ID as well as the weight is registered in the computer. The bar code includes the address of the citizens to whom the respective waste bin belongs. This system based on electronic devices, although in general working well, has faced some technical difficulties during winter. An interviewee commented that despite the perception that the system requires heavy administration, it is not more than other systems. Registration of the containers requires more work in the beginning, but it is manageable.

[53] MSW accounted for here does not include some of the waste collected at the container stations, such as waste containing asbestos, asphalts, concrete and bricks, soil, car tyres and gypsums as they are outside of the scope of the HOLIWAST project. Roughly 20% of the waste brought in to the container stations is from institutions.

Every second week the waste is collected by a local transport company who won the tender. The company currently operating the system is called Axel Hansen, who won the tender in November 2003. The tender takes place every seven years.

Each household must bring the bins to the kerbside on the collection days. Alternatively, they could pay extra fee and have Axel Hansen roll out the bins for them. Challenges experienced in this area include the collection on the snowy days. Citizens have the obligation to clear the snow so that the collectors can have access to the garbage bins. Otherwise the waste in the bins is left uncollected. The obligation was introduced 10-15 years ago. However, old people have difficulties in clearing the snow.

Axel Hansen uses a waste truck that has two compartments at the back, to which the two fractions are loaded separately. The collection operation in the beginning required four people. Now the collection can be operated by a single person. Currently one truck and two drivers are working on collection in the Tølløse Municipality. One driver works 4 days a week (04:00-14:00) and the other, one day a week (04:00-16:00).

Tølløse Municipality also provides call-in services for bulky waste, upon which bulky waste is picked up from households with the payment of extra fees. Citizens also have possibilities to bring in bulky waste as well as other waste to container stations, as described further below.

Bring-system: collection points at neighbourhoods and container stations

In addition to the D-to-D collection of organic waste and residue waste, Tølløse offers their citizens collection facilities where households can bring separate fractions. There are collection points for glass and paper in the neighbourhood. Moreover, there are two container stations.

Among the two container stations, the main container station was open in 1996 and is owned by the Tølløse municipality. The station opens four days a week, with the following opening hours: Wednesday 0800 – 1800, Thursday 1200 – 1600, Friday 0800 – 1600 and Saturday 0900 – 1500. During these opening hours three people work at the station and guide people to the right containers. The other, smaller station is located about 10 km away and opens once a week.[54]

As of July 2006, waste can be sorted in to more than 20 fractions at the main container station. These fractions are newsprint, cardboard, glass and bottles, textile, concretes, soil, iron and metal, white goods, other WEEE, tyres with and without metal, raw trees, gypsum, window glasses, fluorescent lamps, cables, ceramics, PVC, chemicals, combustible bulky waste such as furniture, non-combustible waste such as large plastics and foams, small garden waste, roots and garden waste for wood chips. Spent batteries collected at schools, institutions, city halls, shops and the like are also brought to the station. Personnel at the station subsequently divide the batteries between hazardous and non-hazardous waste.

These fractions are gradually introduced: when the container station opened in 1996, there were only eight fractions. A recent change introduced in August 2005 is the collection of plastics. The intention is to increase collection of plastics from households in order to meet

[54] As the small container station opened earlier than the big one and the residents around the area wish to keep it open, it has kept its operation. When Tølløse is merged with other municipalities most likely the small container station will be closed. Another foreseeable change in conjunction with the merger of Tølløse with other municipalities includes the standardisation of the operation with other municipalities. This includes, among others, the daily opening of the station, which means that instead of having one team with three people working, they most likely would need two teams.

with the increased targets set forth in the revised EU Packaging Directive.[55] As of July 2006, it is limited to hard plastics for large quantity of liquids. Mixing the newly introduced fraction into other waste stream is often observed in the beginning, but most people start to be able to sort after half to one year.

Residents are provided with an identification card to enter the container station. In addition, small industries are also supplied with an identification card for special price. Industries are allowed to come on Wednesday, Thursday and Friday. Only those with the card (i.e. the resident/ industry of Tølløse) can utilise the container station. Approximately 80% of the incoming waste is from household, while 20 % is from business.

According to the interviewee at the container station, 1500-2000 people visit the station per week.[56] There are typically more activities on Wednesday afternoon. (During our visit there are constantly people coming in and out. 30-40 people came, either with cars or with wagons. Some interviewees mentioned that the container station serves as a venue for citizens to meet each other.

According to the interviewee at the container station, 90% of the people are good at observing the rules and sort the waste accordingly. The staff at the container stations is responsible for taking care of the source separation, although it is not them who would be financially responsible for the contamination.

It is up to the staff at the container station to decide the destination of the respective fractions. They check regularly the prices of different recyclers, waste treatment plants and the like and give an order the transportation companies to take the respective fractions to the respective destinations. There are no fixed contractors for some fractions, such as bricks and stones. There are contracts for others: some of them, such as cardboards, newspapers, irons, carbons, are 30 years long.

One of the biggest challenges facing the station is the use of black bags. Two years ago they introduced a system where all the waste fractions brought to the container station must be put in transparent bags. This would make it easy for the staff to check what is inside of the bags. However, the uptake of the citizens, especially of those new to the Municipality, has not been very good. Plausible reasons for the struggle are 1) black bags are cheaper than transparent ones, and 2) not all the municipalities in Denmark have the same requirement, thus making it confusing for the people.

Axel Hansen, the transport company that collect two fractions of waste, also empties the containers for glass, papers, bulky waste, plastic waste, iron/ metal, construction and demolition waste and household hazardous waste at the container stations as well as from business and transport the content to the treatment facilities. Approximately 100 containers are transported per week.

In addition, youth organisations have been organising some collection activities and sell the collected fractions to the industries. For instance, collection of bottles takes place on 1 May.

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[55] Directive 2004/12/EC of the European Parliament and of the Council of 11 February 2004 amending Directive 94/62/EC on packaging and packaging waste. OJ L 47, 18.2.2004, p. 0026–0032. More description of the Directive can be found in the first report of WP1 (Tojo, Alexander & Bräuer, 2006).

[56] During the visit by the author, people constantly came in and out the station despite that it was during the summer holiday. Within the visit of 45 minutes, 30-40 people came with their cars or wagons.

4.2.3.2 Financial mechanism

As mentioned earlier, municipalities in Denmark can currently collect waste fees from their citizens, which can be used only for waste related activities. The financing of waste management in Tølløse is a weight-based fee collected from individual households.

Table 4-3 summarises the size of the fees for households for the period between 1 October 2005 and 30 September 2006.[57] Households pay the annual fix fee per container and per households. If one wishes to have additional container, additional fee should be paid. When waste is collected fortnightly they weigh the container and record the weight via microchips installed on the container. When the total weight for residual waste exceeds 5 kg, households pay additional fees based on weight. Households would pay extra for additional services such as having waste collected at the timing different from the planning of the community or would like to have their containers rolled out to the street. Finally, households need to pay for the installation and registration of the containers when they first start using the containers. The fee, with some support of fees collected from other areas, finances both the collection and treatment and related administrative works. When incomes from recyclables are more than what was expected, the base fee for the next year is reduced.

When source separation and weight-based system was introduced in Tølløse, citizens were somehow reluctant, as they thought that it would mean additional cost for them. At that time very few municipalities introduced the weight-based systems and not much experiences have been obtained. However, the cost turns out to be not considerably higher than other Danish municipalities.[58] However, the cost is still perceived to be high by some citizens and constitutes one of the main complaints brought forward to the Municipality.

Table 4-3: Price for collection of municipal solid waste from households, Tølløse Municipality (1 October 2005-30 September 2006)

	Price without tax, in DKK (Euro)	Price with tax, in DKK (Euro)
Fix fee per container	857.40 (114.68)	1071.74 (143.26)
Fix fee for additional container	371.88 (49.74)	468.85 (62.71)
Weight-based fee (no charge for the first 5 kg)	3.62 (0.48)	4.52 (0.60)
Extra service: timing of the collection	54.38 (7.27)	67.97 (9.09)
Roll out of containers – less than 20 meters	396.67 (53.05)	495.84 (66.32)
Roll out of containers – more than 20 meters	481.38 (64.38)	601.72 (80.48)
Installation and registration of the container	681.78 (91.19)	852.23 (113.99)

(Source: Tølløse Municipality, 2006, translated by the author)

4.2.3.3 Information provision and management

[57] There are different price structure for business and institutions. For instance, the price for the identification for industries to enter the container station is differentiated based on the amount of waste generated from the respective industries. As this report focuses primarily on the waste stream from households, it will not be described further here.

[58] As of 2006, the size of the municipal waste fee varies from 800 to 3500 DKK (ca 107 to 468 Euro) per household. The size increases when, for instance, a new incineration is built. The difference in the size of the fee does not necessarily suggest the difference in the level of service citizens receive.

When a new resident moves into Tølløse, he/ she is supplied with the containers as well as the information package explaining the waste management system in the municipality. The new comers to the community are supplied with the information about the community waste management system and it seems that they are by and large adapted to the system rather well.

Information about the current system has been provided in printed materials some years ago, although most of the people already know about the system. The interviewee at the container station mentioned that everyone in Tølløse knows about the station, and that the information is provided through the newspaper or by neighbours. Information is available also on the Internet and there are paper versions available in the City Hall.

A number of interviewees mentioned that people in general are happy and proud of the system. The initial scepticism in 1993 disappeared as they realised that the system actually works. There is a general feeling among citizens that recycling is good. In most cases the new comers have also adapted the system well. However, recent years experienced a growing number of new comers who are not totally satisfied with the system.

Meanwhile, some of the information seems difficult to penetrate. For instance, the necessity of using transparent bags for waste brought into container stations has been announced via various media such as newspaper, pamphlets to the households, Internet and the like. There is also a big sign at the gate. However, as mentioned, there seems to be a problem for citizens to change to transparent bags.

Concerning information management, the information concerning the weight of the two fractions collected from households are accumulated via microchips installed in each container. This not only enables the Municipality to charge households in accordance with the weight of waste generated, but also helps them keep track of the overall waste generation in the community.

It is the responsibility of the container station to keep track of the amount of each fraction collected by weight. They weigh the tracks that pick up the respective fractions.

The transport company has to report to the municipality concerning their activities. Moreover, the transport company and the person in charge of waste in the Municipality meet four times a year. Among the topics they talk about include complaints from the citizens such as collection on the snowy days (See Section 4.2.3.1). Other complaints to the system include the perceived high cost and the frequency of the waste collection service.

4.2.3.4 Authorisation, monitoring and enforcement

As of 2006, transporters need to be registered at each municipality. However, the situation may change in the near future in which a national registration system for transport companies is established to reduce administrative burden of the companies (see Section 4.1.1).[59]

The container station needs a licence from the city hall to operate. The duration of the current permit is 8 years. The city hall is also the entity that supervises the operation. They send people every year for inspection. Similar to transporters, discussions is going on in which a

[59] According to an interviewee, in the beginning of the 1990s the truck companies had to get approval from the local governments in order to operate as waste collector. However, the government stopped this procedure, for fear of being misused to keep some truck companies out of the waste management arena.

standardised licence will be developed for container stations, with a view to reduce administrative burden.

Concerning waste separation practices, in the past waste was taken in from the side of the truck, and the driver did not have to get out of the truck to collect waste. There was no inspection and approximately 5-6 households a week may have mixed residual waste in the green bin. However, under the current system, people collecting the waste – the drivers of the waste track – check the quality of the waste, and in case where separation is not well done, they leave a note. When this happens for the second time, they leave the waste uncollected. This may have contributed to better source separation, the results of which have been observed by the waste treatment company. An interviewee pointed out that when there is not enough space in the bin for residual waste, people start to put residual waste into the bin for organic waste. There is no financial penalty for households when putting waste in a wrong place.

Personnel at the container station not only guide people, but also constantly patrol the content of the containers and sort the portions that do not belong to the respective containers. When the staff see someone bringing in his/ her waste in coloured bags they refuse to accept the content.

4.2.4 Recovery and disposal

As of 2004, 53% of the MSW collected at the households, collection points and container stations in Tølløse is sent to the recycling plants, while 41% is incinerated and 6% is landfilled.[60]

4.2.4.1 Physical management

The two fractions collected from the households as well as glass and newsprint collected at collection points are sent to NOVEREN, a waste management company jointly owned by 9 municipalities in North Sealand (Bjurgsteg, Nykøbing-Rørvig, Tornved, Dragsholm, Kalundborg, Trundholm, Holbæk, Svinninge and Tølløse). Many of the fractions collected at the container stations are also brought to NOVEREN, while others such as glass and batteries are sent to other plants.

NOVEREN does not have an incineration plant. They need to reload the waste for incineration and bring them mainly to three incinerators: 1. Fynsværket in Odense, 70%, 2. REFA in Nykøbing Falster, 18%, and 3. Svendborg Varmeværk, 12%. Among the fractions covered in this project, those sent for incineration from NOVEREN include residual waste from households and mixed combustible waste gathered at the container station.

Concerning the organic waste, NOVEREN has a composting plant and normally treat the incoming waste, although now there is another company that takes care of it as well. NOVEREN is a shareholder in this company. In the plant, 25-30% of the organic waste must be incinerated due to the inclusion of other waste such as plastics. These fractions are taken away during the pre-sorting process (drum rotating). There is also an after-sorting process from which only a very small part is taken away. The remaining material is used by the farmers.

[60] Concerning what is included in MSW here, see Footnote 53.

The rest of the recyclables that come to NOVEREN are treated and sent to specialised private recyclers. Fractions such as paper, cardboard, glass and iron is sent to DANFIBER. Iron and metal are reloaded and are sent to Stena at Roskilde.[61]

There has been a discussion among the three neighbouring companies similar to NOVEREN concerning whether they should merge into one. The re-organisation of their owners – municipalities – may also have some implication to the structural change of these companies.

4.2.4.2 Financial mechanism

NOVEREN sets differentiated price for waste streams depending on the types of waste and their treatment method. On top of the prices set up by the company, national tax should be paid for incineration and treatment (see Section 4.1.2). The total price the customers of NOVEREN have to pay for compost, incineration and landfill is summarised in Table 4-4. As found, as of January 2006, compost of organic waste is more expensive than incineration of residual waste, despite there is no tax for recycling of waste.

Table 4-4: Cost for recovery and disposal of waste generated in Tølløse, (per tonne of waste, as of January 2006)

Type of waste	National tax, in DKK (Euro)	Price paid to NOVEREN, in DKK (Euro)	Total, in DKK (Euro)
Organic waste for Compost	-	615 (82.26)	615 (82.26)
Residual waste for incineration	330 (44.14)	260 (34.78)	590 (78.91)
Sorted fraction for landfill	375 (50.16)	313 (41.86)	688 (92.02)
Mixed fraction for landfill	375 (50.16)	571 (76.37)	946 (126.53)

(Source: Mr. Ebbe Mondrup, NOVEREN, personal interview, 30 January 2006)

Concerning the rest of the recyclables, if the price of the recyclables increases, NOVEREN pays back the surplus to their customers. Meanwhile, if the price of the recyclables decreases, the customers must pay the difference.

Waste incinerators cannot make profit in Denmark. They can charge to the extent that would be even out the surplus and deficit in a couple of years, but if the surplus continues to grow they have to pay back to their customers (i.e. municipalities). Recyclers on the other hand can make money on normal market conditions

4.2.4.3 Information provision and management

In Denmark, information on various waste streams has been managed via a waste registration system called ISAG (Information system for waste and recycling) based on registration on treatment plants since 1993. Information on 1) the origin of waste, 2) types of waste, 3) how the waste is treated and 4) weighed amounts are collected from all treatment plants. This

[61] There used to be many local private recycling companies in Denmark. However, it is now dominated by a dozen of large companies. In remote islands, such as the Faroe Islands, local government is involved in the recycling operations of streams such as end-of-life vehicles and tyres. Regarding the ownership of the disposal facilities, 75% of all incinerated waste is treated at publicly owned plants and 100% of all landfilled waste is landfilled on publicly owned landfills, as mandated in the Danish legislation.

provides an overall picture of the waste flow (waste generation from different sources, recycling, incineration and landfilling) within Denmark (Tojo, 2006, p.3-32).

In accordance with this system, NOVEREN has to register the origin, types, amounts and fate of the incoming waste. They are also obliged to report to Tølløse concerning their operations.

4.2.4.4 Authorisation, monitoring and enforcement

All the actors involved in the recovery and disposal needs to acquire a licence to operate. Similar to the situation to container stations and transporters, standardisation of the requirements with a view to reducing the administrative burden of these facilities has been discussed.

Under the current systems, all the incineration plants need site specific licenses. Entities responsible for providing these licenses are counties and municipalities. They shall follow very specific regulations in accordance with the EU Waste Incineration Directive[62] and all their decisions could be subject to complaints to at least one more administrative level.

As of 2006, the change has been proposed to have a standardised license for small incinerators and make it necessary for only large incinerators to have site-specific licenses. As there will be no counties after the reorganisation, it will be the municipalities which provide individual (site specific) licenses to large incinerators (list 1), while smaller ones (list 2) will be subject to standardised licenses.

As discussed in Section 4.1.1, incineration plants also needs to receive a permit from the Ministry of Economics and Business Affairs concerning the use of heat generated at the plants. Incineration plants receive preferential treatment over other sources of energy in the regional district heating, so this requirement usually does not create a problem.[63] Another decision made by the government related to incineration plants is their location. The location should be in line with the spatial planning of the county office.

Recyclers will be subject to standardised licenses as well.

Concerning inspection, county governments are currently inspecting the operation of treatment facilities, such as NOVEREN. With the disappearance of county, however, most likely it will become the task of the national government. The interviewee from NOVEREN mentioned that it would be good to have national government regulate and inspect them. Otherwise the municipalities are making regulations for their own operation and doing self-inspection, as NOVEREN is owned by the municipalities.

Up until now the operation of the majority of the recyclers has been perceived sound. According to some interviewees, it is due partly to the tight regulation and its enforcement. The fact that recyclers used to be more local and work closely with municipalities may also enable the municipalities to keep an eye over their operation. According to some interviewees, only 15-20% of the recyclables are in the grey zone – the destination and the fate of these "recyclables" are unknown.

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[62] Directive 2000/ 76/ EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste. OJ L 332, 28/12/2000 P. 0091 – 0111.

[63] However, it is only recently that the section in charge of energy issues split from the Ministry of Environment and moved to the Ministry of Economics and Business Affairs. Thus the implication of the split to the licensing is yet unknown.

4.3 Results so far

When the source separation and weight-based pricing system was introduced in 1993, the amount of residual waste was halved. According to the interviewee at the Municipality, the situation has been stabilised.

However, when examining the situation of these two fractions from 2000 to 2004, as summarised in Table 4-5, some clear changes can be observed. First, the amount of residual waste collected at households is constantly increasing. Second, the proportion of organic waste between the two fractions of waste subject to door-to-door collection has been decreasing (15% from 2000 to 2004).

Table 4-5: The amount of organic fractions and residual fractions collected at households and proportion of organic fraction in Tølløse (2000-2004)

Year	2000	2001	2002	2003	2004
Amount of organic waste collected (tonnes): A	542.0	510.2	510.5	493.6	448.6
Amount of residual waste collected (tonnes): B	604.4	662.7	715.5	800.4	921.0
Sum of the two fractions (tonnes): A+B	1146.4	1172.9	1226.0	1294.0	1369.6
Proportion of organic waste (%): A/A+B x 100	47.3	43.5	41.7	38.1	32.8

(Source: calculated by the author based on NOVEREN, n.d.)

According to the interviewee from the municipality, the substantial increase of the residual waste in the latest years and the change in proportion can be explained by the behaviour of young families moved into the community, who are not used to waste separation.

Despite the fact that weight-based pricing system is introduced only in Tølløse and not in the surrounding communities, according to the interviewee at the Municipality, exportation of waste to the neighbouring communities have not been observed.[64]

Meanwhile, Table 4-6 summarises the changes in the proportion of the fractions of municipal solid waste[65] that are sent to recycling, incinerated or landfilled, as compared to the national target for domestic waste for 2008. There is a gradual decline of the proportion recycled (2% between 2000 and 2004, while the fractions incinerated have increased by 3% between 2000 and 2004. However, it is still far beyond the national recycling target to be achieved by 2008.

Table 4-6: Changes in the proportion of municipal solid waste sent to recyding, incinerated or landfilled in Tølløse, 2000-2004, in percentage, as compared to the national target for 2008

Year	2000	2001	2002	2003	2004	National target 2008
Fractions sent to recycling	55.3	55.5	54.3	54.2	53.2	33
Fractions incinerated	37.7	37.8	40.1	39.7	40.8	60
Fractions landfilled	7.0	6.7	5.6	6.1	6.0	7

(Source: calculated by the author based on NOVEREN, n.d.)

[64] The author did not have the opportunity to countercheck this with people in the neighbouring communities.

[65] For the boundary of MSW used here, see Footnote 53.

The achievement of recycling rates for other fractions cannot be analysed due to the lack of information on figures that can be used as denominator.[66]

4.4 Role of policy instruments

The overall impression of the interviews in Tølløse was that in general people are content about the current system and the achievement they are making. The source separation between organic and residual waste, accompanied by weight-based pricing system, have been working well and is perceived to encourage source separation of recyclables. Indeed, an interviewee mentioned that for several collections per year he does not have to pay any extra as the weight of the residual waste stays below 5kg after 2 weeks due to the intensive separation. And despite the increasing portion of residual waste and slight reduction of fractions going to recyclables over the last five years, the results – at least compared to the national target – has been very good.

It is difficult to assess how much the improvement of source separation could be attributed to the weight-based pricing system. The system came together with provision of convenience for consumers. The level of environmental awareness of the citizens may influence the achievements.[67]

A few interviewees commented on the role of landfill tax in promoting recycling. In the case of landfill tax for municipal solid waste, the actor who receives direct incentives is the municipality. It would be interesting to further investigate if the municipality got incentives to promote measures to encourage their citizens to separate waste.

EU policies on waste, most notably the revision of Packaging Directive, promote policy makers to take additional measures in the arena of MSW.

[66] The available statistics indicates the weight of respective recyclables sent to recycling facilities, but it does not provide figures on how much recycling rate is actually achieved at the plant. Neither does it suggest the estimation of the total recyclables to be generated.

[67] Indeed people involved in the interviews all seem to be very conscious of environmental issues. However, it is difficult to say how representative these people are in terms of level of environmental awareness.

5 Conclusions

Analysis of the environmental effectiveness of waste policies in the three case communities, based on a close look at how the system has been actually implemented by various actors, highlight some of the common issues to consider.

An issue that seems to occupy the mind of many who involved in waste management in Poland and Denmark is *privatisation*. In both countries, the current political climate tends to favour privatisation in waste management arena as well as others. In Denmark, the municipality has had solid governance over the waste management within each jurisdiction. The question in this case seems to be how far the privatisation should be pushed in order to maintain/ further improve the quality of waste management, while seeking for the improvement in efficiency. The challenge facing Poland is privatisation has been pushed in all directions without the government securing the possibility of providing basic services for citizens. The possibility for municipalities to obtain financial resources for planning and implementing an efficient collection system seems to be the first step to be taken.

The door-to-door source separation and collection system implemented over a decade in Tølløse and started to spread in Torino indicates that *convenience* for people matters for effective source separation. The provision of convenience is the essential element especially in Torino where no monetary incentives for households exist. Tølløse Municipality also seem to make it easier for people to implement source separation through, for example, installation of waste bins. Meanwhile, the extensive logistics and planning stressed in the case of Torino Municipality may not be necessary in the rural community such as Tølløse, where relatively small number of people live without much limitation of space.

The policies in the three communities are clearly steered by the *EU waste policy and legislation*. Most notable examples include the Landfill Directive and the revision of Packaging Directive. Concrete measures have been taken to increase the diversion of biological waste from landfills in Italy, to upgrade the quality of landfills in Poland and to include source separation measures for plastics and metals from households in Denmark. The magnitude of the influence indicates the importance of the EU to select a path that indeed leads to long-term improvements.

Concerning *incineration*, there appears to be a large difference between Denmark and the other two countries with regard to the perception of the public towards the incinerators. The combined assessment of energy use in the region and other environmental parameters may help make a sensible decision concerning the building of incinerators. However, it should be remembered that incinerators, regardless of its potential to recover energy and reduction of waste, would compete with potential for furthering material reuse and recycling.

In all three cases, measures related to *waste prevention*, despite its appearance in the overall policy direction, have not been taken much at the local level. Further investigation would be necessary to see how prevention of waste, both in terms of quantity and quality, can be promoted at the local level.

Regarding the effectiveness of interventions, as stated in the introduction, the study presented in this report is limited to the evaluation of the attainment of the immediate goal. An answer to whether the pursued goals set forth under the respective intervention indeed contribute to the achievement of the overall goal of an environmental intervention – reduction of environmental impacts from society – can be obtained from the outcome of other work

packages of the HOLIWAST project. This hopefully will give insights to the respective communities when considering their future waste strategy.

As discussed under each case, the assessment of the magnitude of the role of policy instruments identified in the respective case poses challenges due to other influences. Comparison of these cases with communities in similar context - demography, level and type of industrial activities, economic situation, among others – may help strengthen the attributability assessment. This can be explored further in the third part of this Work Package.

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Abbreviations

D-to-D	Door-to-door
EEE	Electrical and electronic equipment
ELV	End-of-life vehicles
EPR	Extended producer responsibility
IPPC	Integrated pollution prevention and control
MSW	Municipal solid waste
PRO	Producer responsibility organisation
RoHS	Restriction of hazardous substances
WEEE	Waste electrical and electronic equipment
WP	Work Package

Appendix

Interviewees related to the three cases except for the project partners are listed below. All the interviews are conducted by the author in person unless otherwise mentioned. In addition to various help related to the interviews, the author receive various inputs from the respective partners throughout the interview processes. These inputs are reflected in the content of this report.

Interviews in Italy

The interviews in Italy were arranged and accompanied by Marco Ricci and Valentina Caimi of Scuola Agraria del Parco di Monza (SAPM), the Italian partner of the HOLIWAST project. All the interviews are conducted in English via translation by the partners. Except for the morning of 3 April 2006, Yannick Menard of BRGM, the French partner of the HOLIWAST project, also participated in the interviews. In addition to the occasions listed below, partners at SAPM made some supplementary interviews to these interviewees based on the interview notes and additional questions arisen from the initial meetings.

Organisations	Time and place	Name and position of the interviewees
Torino Provincial Government	10:00-13:00 3 April 2006, Torino Provincial Government	Assessor Massaglia, Responsible for Environment Management and Policies P. Foietta, Director of the Sector for Environmental Planning and Sustainable Environment
AMIAT: the waste management company 99% owned by Torino Municipality	14:00 – 17:00 3 April 2006 and 15:00-16:00 4 April 2006, AMIAT	Diego Commetto, Direttore Centrale, Pianificazione Starategica Comin Giuseppe, in charge of information campaign Luca Rabino and Andrea Galparoli, in charge of Waste Management Program and environmental management system Corrado Campione, in charge of landfill, AMIAT
AMIAT	09:00 – 15:00 4 April 2006, study visit of D-to-D collection system, various parts of Torino Municipality	Mr. xx & Mr. xx, in charge of planning A person in charge of collecting waste A personnel at the Municipal collection centre

Interviews in Poland

The interviews in Poland were arranged and accompanied by Alina Rejman-Burzynska Eugeniusz Jedrysik and/ or Marta Machnicka-Hławiczka of Główny Instytut Górnictwa

(Central Mining Institute: GIG), the Polish partner of the HOLIWAST project. Interviews are conducted in English and unless otherwise mentioned translated by the partners. In addition to the occasions listed below, the partners made supplementary interviews based on the interview notes and additional questions arisen from the initial meetings.

Organisations	Time and place	Name and position of the interviewees
MPGK, waste management company owned 100% by Katowice Municipality	11:00-13:30 20 April 2006, MPGK, Katowice*	Andrzej Malara, President Helena Ulanowska, Vice President, Management Tadeusz Duda, Director of Composting facility
Katowice Municipality	11:00-13:30 20 April 2006, MPGK, Katowice*	Mirosław Herman, Director of Waste Management Division
Marshall Office of Sileisia	10:00-11:00 21 April 2006, Katowice	Ewa Owczarek-Nowak, Department of Environmental Protection, Katowice
A representative of citizens	10:45-12:00 27 April 2006, GIG, Katowice	Marta Machnicka-Hławiczka, GIG
MPGK	10:30-12:00 27 April 2006, Composting Pant, MPGK	Tadeusz Duda, Director, Composting Plant
Landfill in Siemianowice (Landeco)	12:45-13:00 27 April 2006, landfill site Siemianovice	Dariusz Prenzel, Director
Ministry of the Environment, Warsaw	10:45-12:00 28 April 2006, Ministry of the Environment, Warsaw	Beata Klopotek, Deputy Director, Waste Management Department,
Municipality of Katowice	Telephone interview by Alina Rejman-Burzynska, GIG	Katarzyna Kucmierz, Waste Managemnet Division

* The representatives of MPGK and of Municipality of Katowice were interviewed jointly, as suggested by the respective stakeholders.

Interviews in Denmark

The interviews in Denmark were arranged and accompanied by Kim Christiansen of LCA 2.-0, the Danish partner of the HOLIWAST project. Interviews are conducted in English and unless otherwise mentioned translated by the partner.

Organisations	Time and setting	Name and position of the

		interviewees
Tølløse Municipality	10:30-11:00 January 2006 and 15:00-15:30 31 January 2006, Tølløse Municipality	Anne-Sophie Olsen, in charge of waste management
Axel Hansen (MSW transport company)	11:30-12:00 30 January 2006, Axel Hansen	Connie Damgaard, in charge of coordination
NOVEREN (MSW management company of the region)	13:15-14:15 30 January 2006, NOVEREN	Ebbe Mondrup Torben Støyer Jensen
Tølløse Municipality	15:30-16:30 30 January 2006, residence of John Harphøth	John Harphøth, elected official
Representatives of the citizens	12:30-13:30 31 January 2006, the residence of Gudrun Mørch	Gudrun Mørch, Mr. Mørch and a friend of Gudrun
DAKOFA (Danish Committee for waste)	10:15-12:15 21 July 2006, DAKOFA, Copenhagen. interview conducted in English	Henrik Wejdling, Technical Manager Nana Winkler, Adviser, Waste Denmark
Container Station, Tølløse	14:00-14:45 21 July 2006, Container Station	Jim Jørgensen, manager