

Waste Management Policies in Central and Eastern European Countries: Current Policies and Trends

Final Report



THE REGIONAL ENVIRONMENTAL CENTER
for Central and Eastern Europe

Waste Management Policies in Central and Eastern European Countries: Current Policies and Trends

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Edited by
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THE REGIONAL ENVIRONMENTAL CENTER
for Central and Eastern Europe

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Executive Summary

This final report on the project, **Waste Management Policies in Central and Eastern European Countries: Current Policies and Trends** (henceforth the Project), focuses on:

- The role of economic instruments in waste policies and the analysis of waste tariffs for various fractions of non-hazardous and hazardous waste;
- The analysis of financial strategies for a self-financing waste sector in the context of the implementation of “full cost recovery” and the “polluter pays principle” by taking into account environmental investment needs;
- The assessment of waste management priorities and strategies in the context of the waste hierarchy implemented in the EU; and
- The analysis of the development of recycling policies at the national level on a case study basis.

The study therefore focuses on important issues to be considered in the context of implementing EU waste directives into national waste management policies.

The aim of the Project, carried out from October 2000 to July 2001 by DHV CR and a team of selected experts from 10 Central and Eastern European Countries (CEECs), was to collect data and information using national correspondents and, at a later stage, to submit working papers and overviews. The Project team communicated mostly via the Internet at the Web site: <www.euowaste.org>. A substantial share of data and information is accessible on the Web site together with the full text of three case studies (their abstracts are attached to this report) and working papers.

Over the past decades the quantities of waste generated have been increasing world-wide. The situation in CEECs resembles to a high degree the situation in Organisation for Economic Co-operation and Development (OECD) countries in the 1980s, when landfilling was the main disposal technique. Only negligible parts of waste streams were recycled or used as an energy resource.

Waste management is viewed in all CEECs as an important environmental policy issue. The transposition of EU directives is the driving force behind these changes. As some CEECs are relatively close to EU accession, it is obvious that current EU waste legislation is of foremost importance. It is stressed, however, that a detailed analysis of waste management policies, which is the objective of this study, was hampered by a lack of available information.

Since some waste management data is either unavailable or unmonitored, it is difficult to ascertain whether strategic targets and obligations are reached or how effectively.

It is recommended that the CEECs improve data collection and either establish accessible databases or issue statistical publications, as such data are necessary for performance assessment of their waste management sectors. Lack of reliable data and information may cause serious problems with respect to planning, monitoring and enforcement, e.g. traceability of hazardous waste from primary generators to final disposal or reprocessing sites must be improved to prevent illegal practices. Inspection authorities should have instant access to the databases of waste generators and disposal facilities.

The use of data of unknown quality increases the probability and magnitude of decision-making errors if the data is used for such purposes as strategic planning, investment decisions, compliance assessment, enforcement and penalisation.

Before the data is used, data quality assessment (DQA) should be carried out as a quantitative process that employs statistical methods to determine whether a set of data will support a particular decision with an acceptable level of confidence. The Project team has not received any information from individual CEECs concerning the problem of how data quality will be improved in coming years.

Despite the far from ideal situation in waste statistics, it is evident that the amount and character of the waste generated in CEECs differs from the situation in average OECD countries. Analysis of the data and information collected indicates that:

- About five tonnes of total waste per capita are generated in CEECs, which is markedly more than the OECD average (about 2.2 tonnes).
- Production waste comprises the major share of all waste, as the production to consumption waste ratio is 11 for CEECs, while the OECD average is 3.1. This is due to the structural and technological situation of national industries.
- Wastes from mining, metallurgy, quarrying, coal-fired power and heat generation, fertilisers, glass and cement manufacture comprise the major share of production waste.
- The generation of production waste (about 90 percent of the total waste generated) decreased significantly during the 1990s. This was caused by economic transformation, the phasing out of the most obsolete installations, and the modernisation and substitution of technologies. Because of the economic convergence and the pre-accession process to the EU, the volume of production waste is expected to decrease to a level comparable with OECD and EU member countries (about two tonnes per inhabitant).
- Hazardous waste represents about four percent of production waste. Because of the variations in the definition and industrial production (including raw materials), the share of hazardous waste varies from 0.02 percent reported by Bulgaria to 53 percent in Estonia.
- Special waste streams like waste oils, batteries and accumulators, end-of-life vehicles, tyres, etc. are rarely monitored separately, and data is fragmented or, in some cases, non-existent.
- Generation of solid municipal waste on an annual average amounts to 370 kilograms per inhabitant, which is less than the OECD average (about 500 kilograms per inhabitant). The annual amounts, as well as the relative shares (percentage of total), vary significantly among CEECs. Latvia generated 244 kilograms per inhabitant (1998), while Slovenia, with 600 kilograms per inhabitant, represented the largest generator among the CEECs.
- As family incomes increased in CEECs and life styles imitated EU members', the amount of solid municipal waste was increasing slightly by the end of the 1990s.

The existing disposal structure cannot solve the above-mentioned problems characterised by the enormous generation of production waste. First, the structure of national economies must be transformed to become less energy and material demanding. Creating expensive end-of-pipe solutions for obsolete and inefficient production technologies is an unattractive option. In such cases, it is inevitably necessary to invest in best available production technologies, attract foreign investors and develop less polluting economic activities. Since the main contributor to waste is production, the IPPC regulation should be used in combination with disposal charges, especially in the case of hazardous waste.

Landfilling is the major disposal route for all categories of waste, as about 84 percent of the total waste was landfilled in 1999. By 1999 there were only seven large municipal incinerators (with a capacity of more than three tonnes per hour) in operation in the Czech Republic, Hungary, Poland and Slovakia and three smaller ones in Poland. In total, 97 incinerators are reportedly in operation for hazardous waste treatment, 22 of them with a capacity exceeding 10 tonnes per day. The main reason for this large disparity between landfilling and incineration can be largely explained by the fact that landfills are cheaper to construct and operate than incinerators. There is also a lack of investment to build incinerators that would fully comply with EU emission limits. The existing incinerators (mainly in the Czech Republic) will have to be either phased out or modernised.

The recycling industry has considerable potential, not only on a national but also on a regional scale, though small economies like the majority of the CEECs (Poland and Romania are exceptions) cannot improve their waste management practices independently. Waste management strategies should be integrated into the policies of other sectors. According to the EU Directive on Waste, national plans should be used for the development of a disposal and recycling regional structure, which would allow more efficient transport of waste and raw materials.

Hazardous waste management plans should be viewed as the most important issue at this stage. In many CEECs there is no safe infrastructure for hazardous waste disposal. Unsafe dumps of hazardous waste are time bombs which will present a risk to future generations. Management of hazardous waste requires efficient monitoring and enforcement.

The CEECs should utilize their favourable position in comparison to the OECD, given the relatively low volume of solid municipal waste generated compared to the OECD average. Selected collection of paper and cardboard, scrap metals, waste electric and electronic equipment (WEEE), and biodegradable and hazardous components of solid municipal waste, which contains a share of small business waste, should start as soon as possible with simultaneous support to the private sector.

Private initiatives are being founded without government subsidies or redistribution of centrally collected taxes and charges. More accountable responsibility of producers could lead to more efficient results than in the case of public sector involvement. Areas such as the separate collection of packaging, tyres, batteries or end-of-life vehicle (ELV) disposal, composting and other such activities could lead to countless new employment opportunities.

Besides the above-mentioned common problems, the individual CEECs will have to identify their own specific issues for strategic planning. New problems emerging at the EU level (sewage sludge, mining waste, WEEE, etc.) must be taken into account even before the key problems are confronted, as there are potential synergies between individual solutions.

To examine societal response to those key problems, an analysis of waste management strategies was carried out in the form of a comparative analysis. The most important general findings drawn from the comparative analysis are:

- All countries have at least parts of their waste management strategy incorporated into official documents.
- Some CEECs have already prepared local or sub-national waste management plans dealing with specific types of waste or, regionally, with a waste management strategy as a whole. Accessibility of these documents is limited.
- CEECs closer to EU accession have already prepared concrete implementation plans together with cost estimates, necessary or anticipated, to meet EU standards. Investment information (planned or implemented) and strategy make up an important part of a waste management strategy because they define concrete objectives (though often in a relatively general form) and estimate the financial needs for fulfilment. Unfortunately, in some cases this information was either unavailable or incomplete.

A waste management strategy should start with a clear definition of its main terms in legislation together with defining responsibilities for each key player, from the central government to the final consumer. Distribution of responsibilities should follow the principle of subsidiarity — problem-solving at the level of administration where the solution is the most practical and cost-effective.

A waste management strategy should have clear short-, medium- and long-term objectives together with proposed solutions on how to reach these objectives. These solutions should be clearly defined but also allow flexibility, especially in the medium and long term. The proposed solutions should be followed by proper political support with sufficient resources to make their fulfilment possible. Work towards these objectives, possibly in the form of implementation plans, should be controlled, monitored and adjusted to current conditions with a focus on enforcement.

Many CEECs employ economic instruments, but information is often insufficient to allow comparison. Generally, the CEECs use command and control instruments, especially for hazardous waste treatment. These regulations set up “boundaries” in the waste sector. Though

important, they do not represent significant instruments from a financial point of view. The mix of instruments used in waste management varies across CEECs, and it is difficult to compare the countries in detail. This holds for both the EU and accession countries.

One of the levies imposed in all reviewed countries is the municipal waste charge. This charge (as in a number of EU countries) represents a user charge applied to recover costs connected with the collection of waste and its treatment. Only a few countries use a tax as an instrument in the waste management sector. The application of taxes is practiced in different forms ranging from tax allowances in direct taxes to the use of excise-taxes to burden some products. As the taxes usually represent income to the state budgets (which is the main difference between taxes and charges), they do not have any direct relation to environmental protection in terms of the use of revenue.

The system of instruments often includes enforcement procedures for when the waste generator fails to fulfil requirements stipulated by relevant legislation. Unfortunately, there is usually a lack of information about enforcement efficiency.

In CEECs, charges are usually set as a volume charge, but in some cases they are set as an average payment per household or capita (monthly or annually, as, for example in Hungary or Lithuania respectively). A mechanism in Bulgaria taxes municipal waste based on the value of the property; the revenue again goes to municipal budgets and is also used for cost recovery. The question is to what degree these payments also reflect how negative externalities — other payments or charges on final waste treatment (in this case influenced by the government) — are included in the total “price.”

The second relatively common economic instrument is the waste disposal charge. As landfilling represents the most common option to the final waste treatment, these charges are probably the most significant instruments used in the waste sector. The rates usually reflect the type of waste, imposing higher rates on hazardous or toxic waste (in some cases even more detailed categorisation based on toxicity, such as in Latvia). The revenue of the charge is usually used for various purposes, including the recovery of the costs connected with landfilling, the earmarking of some revenue for environmental purposes, or the transfer of funds to central or municipal budgets. Non-compliance penalties or fees supplement charges in some CEECs (e.g. Estonia and Hungary).

The level of disposal charges ranges approximately from EUR 0.04 per tonne to EUR 1 per tonne in the case of municipal waste, and it is significantly higher in the case of hazardous or toxic wastes (ranging from EUR 1 per tonne to EUR 80 per tonne). Generally, the charges are the lowest for mining waste, medium in the case of municipal waste and industrial waste and the highest, as already mentioned, for hazardous or toxic waste. When compared to rates applied in EU countries, rates in CEECs are generally lower, but in consideration of the purchasing power in CEECs the rates are relatively comparable.

Economic instruments and insufficient investment together do not generate enough finances to promote waste disposal techniques other than landfilling, such as incineration, recycling, reuse, etc. As the reduction of landfilled waste is one of the main targets it should be considered whether the application of disposal charges is adequate. One of the most important factors related to the use of economic instruments is social acceptability and impact on low-income households. Charges that are too high may promote home incineration of waste, illegal dumping, etc.

On the basis of this study it can be concluded that economic instruments are extensively used in the EU accession countries. Their use, however, should be related to a more sound planning process and their effectiveness should be regularly evaluated. As the process of the transposition of the *acquis communautaire* into national legislation increases throughout 2000-2002, it is difficult to evaluate the effect of the newly introduced economic instruments. It must be kept in mind that their further adjustment will depend on economic growth and the increasing purchasing power of the population.

Generally, the main characteristics of the currently used economic instruments in CEECs relate to:

- The lack of financial incentives for preferred disposal options (landfilling vs. incineration vs. recycling);
- The relatively low rates of disposal and user charges; and
- The early development of efficient product-based schemes (often an initiative by the private sector).

CEEC's seeking EU-compatible waste management strategies should therefore:

- Implement the polluter pays principle. Especially in the case of user charges, it should be combined with increased producer responsibility.
- Reverse the ratio between landfilling and energy reuse of waste in power and heat generation. Landfilling taxes must be raised substantially; tax rates should be differentiated according to the means of disposal. Nevertheless, this is not enough for the construction of new incinerators and/or the reconstruction of existing ones, since this requires large investments.
- Support composting and recycling. Increasing separate waste collection and separated treatment of biodegradable waste, and increasing recycling of other waste types in order to reduce the total amount of waste disposed in landfills, are viable options for economic disposal of part of the waste. Suitable proportions for disposal charges (landfilling, incineration, energy recovery, composting, etc.) must be established.
- Enhance the incentive function of economic instruments that are essential for full harmonisation with EU waste management policies (e.g. tax reform, product charges for individual products, etc.).

Some efforts, such as the introduction of the polluter pays principle, decentralisation or privatisation of some waste management activities, have already taken place, but a clearly defined strategy, including instruments for its realisation or enforcement, is largely missing.

The role of central government in waste management (and generally in environmental protection) is relatively significant in all CEECs, mainly due to the centralised governmental systems established in the past, the incomplete transformation towards a full market economy and the lack of strategic approaches in environmental policy (now improving due to EU approximation).

Financial strategies are the weakest points in CEEC waste management plans. The survey made by national correspondents indicates that there are no sound financial strategies prepared as a part of waste management plans/strategies, in contrast to the recent recommendations made by the Commission or the World Bank. By making the existing systems of environmental financing more efficient and capable of providing adequate financial resources for important projects, the CEECs would not only decrease the total EU accession costs but also relax financial pressures on producers and consumers.

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List of Abbreviations

APOREKO	Association for metal waste recycling in the Czech Republic
ARA	Austrian system of packaging waste collection
ARN	Auto Recycling Nederland
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Costs
CBA	Cost Benefit Analysis
CEA	Cost Effectiveness Analysis
CEE	Central and Eastern Europe
CEEC	Central and Eastern European Country
CEI	Czech Environment Institute
CEPIK	Central record of vehicles and drivers (in Poland)
CICPE	Czech Industrial Coalition for Packaging and the Environment
Coll.	Collection of laws
CR	Czech Republic
CSOZP	Czech association for environmental protection
CZK	Czech Crowns
DEM	German Marks
DQA	Data Quality Assessment
DQO	Data Quality Objective
DSD	German system of packaging waste collection
EAP	Environmental Action Programme
EC	European Community
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
E EK	Estonian Kroons
ELV	End-of-life vehicle
EPR	Extended Producer Responsibility
ERRA	European Recovery and Recycling Association
EU	European Union
EUR	European Union Euros
EWC	European Waste Catalogue
FORS	Polish forum for car recycling
GATT	General Agreement on Tariffs and Trade
GBP	British Pounds
GDP	Gross Domestic Product
GUS	Central statistical office (in Poland)

LIST OF ABBREVIATIONS

IDIS	International Dismantling Information System (in Poland)
IFIs	International Financial Institutions
IGO	Institute of waste management (in Poland)
ISO	Information system on waste (in the Czech Republic)
IT	Information Technology
KBN	State committee for scientific research (in Poland)
LME	London Metal Exchange
LPG	Liquefied Petroleum Gas
MHW	Municipal Hazardous Waste
MoE	Ministry of Environment
MSR	Small dismantling stations (in Poland)
MWC	Municipal Waste Companies
NGO	Non-Governmental Organisation
Ni-Cd	Nickel-Cadmium
NiMH	Nickel-Metal-Hydride
NLG	Dutch Guilders
OECD	Organisation for Economic Co-operation and Development
OJ	Official Journal
PE	Polyethylene
PET	Polyethylene Terephthalate
PIAP	Industrial research institute for automation and measurement (in Poland)
PLN	Polish Zlotys
PP	Polypropylene
PPS	Purchasing Power Standard
PS	Polystyrene
PVC	Polyvinyl Chloride
REC	The Regional Environmental Center for Central and Eastern Europe
RS	Republic of Slovenia
SEA	Strategic Environmental Assessment
SIEI	Sofia Initiative on Economic Instruments
SIT	Slovenian Tolars
SMEs	Small and Medium Enterprises
SPDS	Union of secondary materials industry (in the Czech Republic)
SR	Medium-sized dismantling stations (in Poland)
UK	United Kingdom
USD	United States Dollars
VAT	Value Added Tax
WEEE	Waste Electric and Electronic Equipment
WTO	World Trade Organisation
ZR	Large dismantling stations (in Poland)

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2. Project Objectives

This final report on the project, **Waste Management Policies in Central and Eastern European Countries: Current Policies and Trends** (the Project), was prepared by DHV CR, Ltd., Prague (Consultant), 10 months upon signing the contract as required by the REC (Contractor).¹

The final report was completed after discussion between Contractor and Consultant and upon the inclusion of comments on the final report draft submitted by the Contractor, the Project team, stakeholders and beneficiaries. Comments were requested before June 30, 2001 to enable the Project team to integrate them into the final report.

According to the Terms of Reference (ToR), the overall objective of the Project was to make a synthesis of waste management policies of Central and Eastern European countries (CEECs) by:

- Focusing on the role of economic instruments in waste policies and analysing waste tariffs for various fractions of non-hazardous and hazardous waste;
- Analysing financial strategies for a self-financing waste sector in the context of the implementation of “full cost recovery” and the “polluter pays principle,” taking into account the environmental investment schemes;
- Analysing waste management priorities and strategies in the context of the waste hierarchy implemented in the EU (waste minimisation/waste prevention, reuse and recycling — composting, incineration with energy recovery, incineration without energy recovery, landfilling); and
- Analysing the development of recycling policies at the national level on a case study basis.

The Project aims to identify and compare possible alternative funding mechanisms that may be used by municipalities and governments to optimise existing instruments. The study focuses on important issues to be considered in the context of the implementation of EU waste directives into national waste management policies.

3. Introduction

Over the past decades the quantities of wastes produced have been increasing worldwide. The situation in CEECs closely resembles the situation in the OECD countries in the 1980s, when landfilling was the main disposal technique. Only minor parts of waste streams were recycled or used as an energy resource. At that time, 60 percent of household waste was dumped, 33 percent incinerated and seven percent composted.²

Since then the share of incinerated and recycled waste has increased substantially. This study shows that in CEECs more than 80 percent of solid municipal waste is dumped and that the scope of recycling is insufficient. A more recent analysis of waste management in the EU member states³ showed that the following problems appeared in the 1990s:

- Waste generation within the EU and European Free Trading Association (EFTA) increased by nearly 10 percent between 1990 and 1995.
- Limited availability and quality of data hinder projections of future trends.
- Increasing amounts of waste create new problems, such as rising levels of sewage sludge, end-of-life vehicles and residues from the cleaning of flue gases.
- Waste transport represents up to 15 percent of freight in some EU member countries.
- Recycling and reuse schemes are only partially successful.

In 1992 West Europeans generated around 390 kilograms of domestic waste per person. Around 80 percent of the waste produced in Europe is classed as “industrial,” the remaining 20 percent as “domestic.”⁴ The trend is still upward and waste management has become a key issue in Europe.

A large amount of biodegradable waste put into landfills is another problem of EU members. A report⁵ from the European Topic Centre on Waste, Copenhagen, shows the scale of the problem. Against a baseline of 1995, the EU countries must landfill less than 75 percent of this amount by July 2006, 50 percent by July 2009 and 35 percent by July 2016. At present Denmark, Austria, Luxembourg and the Netherlands are complying with the 2016 target, France and Sweden with the 2009 target and Belgium, Finland, Germany and Italy with the 2006 target. UK, Ireland, Greece and Portugal are landfilling 90 percent or more of their biodegradable waste at present; the EU average is 65.8 percent (year 2000).

As in the EU member countries two decades ago, in CEECs it is extremely difficult to estimate the quantity of waste generated given the lack of common definitions and waste categorisation. Such information is essential for waste management strategic planning, and would enable the gap to be bridged between EU and CEEC averages in all waste management areas. There is a great deal of knowledge accumulated in the EU that can be used to the benefit of candidate countries exerting great efforts to transpose and implement environmental *acquis*.

Despite limited data availability, the Project team compared the situation in CEECs with the situation in EU and OECD member countries as much as possible using waste management indicators (e.g. activities expressed per capita or per GDP unit). The primary purpose of the Project was to study applicability of economic instruments in waste management. The use of those instruments proved to be an effective approach alongside a strict legal framework that detailed obligations to the private sector and state administrations. The utilisation of economic instruments is still limited in CEECs due to the extensive use of the command-and-control approach from previous decades, but the situation has changed rapidly with the EU pre-accession activities.

Waste needs to be prevented and minimised for two major reasons. First, waste is a potential source of pollution and health risks. Second, waste consists of a high volume of recyclable and reusable materials. The main objective of strategic waste planning should be to minimise the risks and maximise the waste utilisation as expressed in the EU waste hierarchy:⁶

1. Waste prevention;
2. Waste recycling and reuse; and
3. Safe disposal of non-recoverable residues.

In its 1996 Communication on the Review of the Community Strategy for Waste Management, the commission stressed that prevention of waste and the minimisation of hazardous substances in waste must stand as the overall targets of a strategy for community waste management.

According to the 5th Environmental Action Programme (EAP) for the year 2000, management of waste generated within the community was a key task of the 1990s. The community strategy strives for waste minimisation in terms of both volumes and environmental hazards/damages. The programme set the EC waste minimisation target for the year 2000 — quantities of waste generated at an EC average of 300 kilograms per capita on a country-by-country basis should be stabilised. Since then the EU waste policies have been further developed.

Strategic planning in the EU candidate countries related to waste management must take into account current discussions on further development of the EU waste policies.⁷ The 6th EAP is the most important document in this respect, laying down priorities and objectives for the decade (2001-2010). The emphasis was put on the strategic planning via preparation of “thematic strategies” with the aim to ensure sustainable management of resources and waste. The Thematic Strategy on Waste Recycling was also mentioned in this context. The strategy would identify which waste would get priority in recycling according to an appropriate set of criteria.

Five strategic directions are proposed by DG Environment while stress is put on the EU hierarchy of waste management (prevention is followed by reuse, material recycling, energy extraction and final disposal). The directions are:

- To improve implementation of existing community environmental legislation;
- To integrate the environmental dimension into other policy areas;
- To facilitate an active role of the general public in the environmental decision-making process;
- To enhance the use of market instruments through involving businesses and consumers; and
- To plan and manage land-use in a better way.

As the 6th EAP indicates, the EC focuses not only on how to modify existing legislation but also on how to implement and enforce it, e.g. by means of civil liability for environmental damage and environmental taxation. DG Environment prepares papers on taxation of virgin raw materials and new eco-taxes on resource- and waste-intensive products and processes. The substitution principle is attracting increasing attention — whereby hazardous substances would be replaced where it is economically and technically feasible.

Resource and waste management is one of several targets in the 6th EAP. Integrating waste and resource management into the Integrated Product Policy is to be supported by taxation shifts that should burden the use of virgin raw materials and, in turn, enhance reuse and recycling. In the area of waste management, DG Environment stresses the need to implement waste directives in an efficient and coherent way. The main goal is to reduce the amounts of waste generated; the proposed quantitative target is to reduce the quantity of waste going to final disposal by 20 percent by 2010 and by 50 percent by 2050 (2000 as a reference level).

This reduction would require substituting hazardous substances that cause serious problems with less hazardous ones by means of better product designs. The latest draft of rules on eco-design waste electric and electronic equipment (WEEE) can serve as an example of this new approach.

If substitution or eco-design is not possible, the member states must ensure that such hazardous substances are dealt with in closed-loop systems. In such cases, the producer should be made responsible for their collection, treatment and recycling to minimise their

impact on the environment. Economic instruments such as taxes on raw materials and specific products should be used as effective tools. Last but not least, changing consumption patterns (e.g. via green procurement policies, eco-labels, information campaigns and similar instruments) should be promoted to a greater extent.

As for the supposed modification and amendments to the existing *acquis*, Directive 86/278/EEC on sewage sludge use in agriculture will be replaced by new legislation. A review of packaging regulations (Directive 94/62/EC) and the drafting of new recommendations on construction and demolition waste is expected.

In the following chapters we tried to compare the present situation in CEECs with the developing objectives of the EU waste management policy. Even though the pre-accession negotiations focus on individual directives and EU candidates are preparing their implementation plans for the individual directives,⁸ we tried to demonstrate that it is necessary to have integrated waste management planning exploring linkages to other sectoral policies, integrated prevention and pollution control, integrated product policy and similar comprehensive approaches.

The 6th Environmental Action Programme, which was approved by the EU environment ministers in June 2001, was therefore used in this study as a benchmark for the waste management policies of CEECs. We also commented on those areas where the EU legislation is being revised or developed, e.g. mining waste, waste-to-energy processes, sewage sludge, PVC waste, electrical and electronic waste, waste definition and statistics, etc.⁹

4. Project Methodology

With respect to the expected Project outcomes, as well as the budgetary and time framework, the following project methodology was developed. The terms of reference proposed (from the “Methodology” paragraph):

- To **discuss with experts/stakeholders from the different member states** (researchers, staff from local/national departments, waste disposal companies, statistical offices, consumer associations, etc.) on waste pricing issues and waste management policies and future trends, and to validate each country-specific section of the final report.
- In countries where the literature is scarce and not easily accessible, the involvement of local sub-contractors or **missions to these countries** may be required.

It is obvious that as information is scarce and not easily accessible, our work required a working environment that allowed open communication and elimination of geographical constraints. The creation of a virtual working structure (all communication took place in the virtual space of the Internet) was the only solution to the above requirement.

Two main cornerstones of our approach were:

- A competent team of “national correspondents” was established.
- The Project Web site <www.eurowaste.org> was designed and implemented as a working environment not only for the Project team and Contractor, but also for all interested experts/stakeholders.

Describing the methodology applied in the Project, special attention was paid to the following parts:

- Project team formation;
- Communication strategy;
- Data collection and verification;
- Data analysis; and
- Case studies.

4.1 THE PROJECT TEAM

The Project team was formed in October and November 2000 and strengthened after the validation meeting. The Project covers the whole region of the CEECs, paying particular attention to 10 candidate countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Project team members are listed in Table 1.

National correspondents

The formation of a functional, communicative and competent team of national correspondents was viewed as a critical part of the Project. National correspondents were chosen from approximately 25 individuals during the preparation of the bid. Those selected were contacted, and a major share of them responded positively and got involved in the preparation of the draft questionnaires and the inception report. Once the draft questionnaires were approved, the national correspondents were provided with sub-contracts.

TABLE 1

List of Project Team Members

<i>Position</i>	<i>Name of Expert</i>	<i>Company/Institution</i>	<i>Nationality</i>
Project Management Team			
Team Leader, Technical Editor	L. Nondek	DHV CR	Czech
Deputy Leader — QA/QC	B. Sulek	DHV CR	Czech
Case Study Leader	M. Rosendorfova	DHV CR	Czech
Web Master, Secretary	L. Kocmanova	DHV CR	Czech
Senior Analysts			
	V. Bizek	DHV CR	Czech
	T. Kluvankova	Oravska Institute for Forecasting SAS, Bratislava	Slovak
	E. Geuss	Freelance consultant	Czech
	T. Chmelik	Economic University, Prague	Czech
	A. Randmer	Board of the Centre for Development Programs, Tallinn	Estonian
	L. Stefanescu	National R&D Institute for Environmental Protection (ICIM), Bucharest	Romanian
National Correspondents			
Bulgaria	D. Brankov	Clean Industry Center at Bulgarian Industrial Association, Sofia	Bulgarian
Czech Republic	B. Cernik	ENZO — consultancy and publishing in waste management, Prague	Czech
Estonia	A. Randmer	Board of the Centre for Development Programs, Tallinn	Estonian
Hungary	G. Botond	VITUKI Innosystem Ltd., Budapest	Hungarian
Latvia	J. Plavinskis	Latvian Pollution Prevention Centre, Riga	Latvian
Lithuania	L. Galaziene	Environmental Centre for Administration and Technology, Kaunas	Lithuanian
Poland	B. Kuzio	Waste Information Centre, Institute of Waste Management Katowice	Polish
Romania	L. Stefanescu	National R&D Institute for Environmental Protection (ICIM), Bucharest	Romanian
Slovakia	I. Vybochova	Freelance expert	Slovak
Slovenia	V. Grilc	National Institute of Chemistry, Ljubljana	Slovenian

Analytical Team

Besides the Project management and IT support, a group of senior analysts engaged in data analysis and synthesis. The senior analysts presented their views on the data/information collected at the validation meeting (January, 2001).

4.2 COMMUNICATION

The Project was based on electronic communication between the “virtual Project team” members spread geographically over Central and Eastern Europe (CEE). The main body of communication between individual members took place in a virtual space formed by the Internet and a Project web site. The only personal contact the Project team members made was at the validation meeting at the half-way point of the Project (January, 2001).

A Web site was established to facilitate communication between the large number of project participants and beneficiaries in all studied countries.¹⁰ All working documents were immediately available on the server. This efficient and open communication system was based on a special Web site designed for the Project. This enabled national correspondents to use HTML or Word forms to create a database on economic/demographic and waste generation/management data and to make the working papers available for senior analysts at an FTP server either in PDF or Word document format. Passwords protected individual forms so that only national correspondents were able to change the content of their own forms.

The Web site was made operational (URL, basic structure of web site, discussion forum, registration form, virtual library) at the beginning of October 2000. MS Access database and HTML electronic forms (for filling in) were added in October and tested by the beginning of November. The database contents were fully available to registered visitors by December 20, 2000. The Web site will be in use till the end of 2002.

A new domain <www.eurowaste.org> has been registered by DHV CR to serve the Project exclusively.

4.3 METHODOLOGY OF DATA COLLECTION

Accessing environmental information is sometimes still difficult in CEE, where principles of open, democratic society are not yet fully rooted in state administration. The EU candidates are, however, obliged to transpose Council Directive 90/313/EC on Free Access to Information on the Environment and, moreover, all of them signed the Aarhus Convention in 1998.

The collection of information on the waste management sector in individual CEECs served therefore, *inter alia*, as a test for their state administration’s ability and/or willingness to ensure unhindered, free public access to information on the waste sector. Besides basic statistics, this information should include information on national waste strategies under preparation, action plans, legislation and instruments, or on the effectiveness of legislation adopted during the past decade.

For the purpose of the Project a questionnaire in electronic form was designed that enabled the Project team to collect relevant information and compare it on the basis of suitable indicators. An electronic framework for information collection on waste management practices proposed by EEA¹¹ and EU reporting requirements related to the selected waste directives and regulations were used as a benchmark.

The questionnaires therefore required information on:

1. **National statistics for waste generation** (waste categories identical to EU legislation);
2. **Indicators** on waste generation and management¹² — per capita, per GDP unit, relative shares (%), suitable waste indicators, use of the OECD “state-pressure-response” model to define and analyse key indicators;
3. **Data on waste management practices** (including expert judgments on statistical uncertainties);
4. **Institutional and legal aspects** (institutional responsibilities derived from legal obligations), forms based upon EU Reporting;¹³ and
5. **Costs and economic instruments.**

Draft questionnaires were designed during the inception phase. National correspondents were invited to express their opinions on data collection feasibility.

To enable standardised comparison of the individual national waste management and financial strategies, a set of assessment criteria (and sub-criteria) was proposed to national correspondents for discussion. The method of Analytical Hierarchy Process (AHP) was modified for this purpose. The principle of this method is described in a working paper.¹⁴

Data collection was considered to be the critical element of the whole Project. The questionnaire for data collection was prepared in Word and HTML format (electronic forms on the Web site). Data gathered by national correspondents in the preferred MS Word format of the questionnaire was later transferred to electronic HTML forms by the web master. Because of limited space some information had to be condensed or modified in the electronic form.

The questionnaire was divided into three parts with deadlines given to the national correspondents. This enabled control of the data collection phase and the continuous transfer of questionnaire content onto the Web site. Most of the national correspondents collected the requested data in time or with short delays caused by limited data availability. The Consultant received all questionnaires by the end of the year 2000. This study therefore reflects the situation at the end of 2000, which may have changed considerably during the following months.¹⁵

The national correspondents were asked to correct and complete all data by April 30, 2001. The Consultant was not informed of any principal problems caused by national authorities refusing access to the data requested. After each section deadline, that section of the questionnaire was placed on the "Working Papers" page of the Web site to give Project team and registered stakeholders an opportunity to revise them and comment on the data to be published.

Data completeness

The role of the national correspondents was to collect publicly available data and information from the waste management sector. The abbreviation "n.a." (not available) was used where data did not exist or was not available. An overview of data completeness is given in Chapter 5. Some data was modified/added during the data validation phase (February-March 2001). The collected data was made available at the Project Web site for registered participants/stakeholders (registration form, username and password).

Restructuring data into subsets

In the first phase national correspondents collected standardized data and information. The contractor has thoroughly studied the EEA report on the information system on waste management practices.¹⁶ Due to time and budgetary limits of the Project, it was decided to adopt a simplified approach proposed by the EEA.

The data collected is therefore restructured into four Web subsets:

- A) Meta-information on national waste management authorities**, including institutions and statistic systems.
- B) Information about national contexts**, a database containing basic economic and demographic data that is necessary when transforming the absolute values obtained for waste generation and disposal into a comparable set of indicators (based upon the OECD "pressure-state-response" model). The data takes the form of simplified, basic national statistics providing reference values necessary for the calculation of indicators.
- C) Aggregated national indicators** based upon data on waste generation and waste management options (technologies and practices) that is structured pursuant to the waste classification used in the *acquis* and/or in waste statistics of OECD members.
- D) Catalogue of waste management policies and instruments.** The purpose of this "knowledge base" was to give a description of existing policies, measures and their legal framework at the national level of each CEEC. Upon verification the data was restructured into tables of instruments. Brief information on the waste management plan/strategy is given in the last part of the subset.

The subsets are available on the Project Web site.

4.4 DATA ANALYSIS

Despite all efforts exerted by the Project team, the data and information collected was fragmentary for many CEECs (see Table 2), due to the low level of development of waste monitoring and reporting abilities in CEECs. Large amounts of data were either missing or appeared inconsistent. This was the case in the majority of CEECs.

Moreover, there are still many inconsistencies in the definition of waste, its classification, and terminology. There are also differences in data coverage in the CEECs compared to the EU standards, and indeed between the particular CEECs. Additionally, economic transformation has caused substantial changes that have unpredictable impact on the generation of industrial waste, hazardous waste and special waste streams in particular.

The organisation of data and knowledge in several interrelated subsets described above allowed the team to carry out analysis of various topics. The topics were defined with respect to the EU waste hierarchy and pending problems of the waste sector in CEECs.

In this way policies and measures were linked with waste management data using the **“pressure-state-response”** model. The word “pressure” stands for the waste generation (visualized as indicators and trends), “state” is the existing waste management practices and the “response” is presented by national strategies — new incentives not only to comply with the EU/OECD waste management framework but also to remedy undesirable development of waste generation and waste disposal.

The EU policies and measures, including economic instruments, were therefore used in the following text as a benchmark, since the majority of CEECs are EU candidates presently harmonising their waste policies and measures with the EU.

Taking into account the waste hierarchy (prevention, recovery (including reuse and recycling), utilisation as an energy resource, landfilling), the “pressure” and “state” indicators were linked with the “response” presented by national strategies (policies, plans, instruments and measures). Target values and indicators proposed at the national level were compared. Finally, the impact of economic instruments such as taxes, disposal or user charges, product charges, etc. were analysed.

4.5 METHODOLOGY OF SYNTHESIS

To meet the objectives mentioned above, the Project team dealt with general, legal, technical and economic aspects of national waste strategies, which meant that the information and data collected allowed for the clear description and subsequent assessment of national waste strategies from the points of view described above. The Project team used the following methodologies to discuss the analyses’ results in a broader context:

- Comparison of CEECs’ approaches with those applied by the EU members, especially in the areas of:
 1. Waste management priorities and strategies;
 2. Use of policy instruments to achieve given objectives;
 3. Financial strategies for a self-financing waste sector.
- Comparison of the spectrum of economic instruments used at the individual national level with the EU member states;
- Concise description of reuse and recycling policies of CEECs and identification of three case studies that may serve as an example of efficient development and application of general waste strategy in a national context.

4.6 CASE STUDIES

A special part of the Project aimed at analysing recycling policies at the national level on a case study basis. The case studies therefore focussed on the **recycling and reuse programmes in selected CEECs**, while in accordance with the ToR, attention was paid to the following points:

- To identify changes in waste management policies in the context of recycling/reuse following transition to market economy; to discuss the problems that the operators of recycling capacities face because of the withdrawal of subsidies;
- To compare past recycling/reuse schemes and the current situation. For example, to analyse deposit-refund schemes (where applicable), to analyse recycling rates of different materials (glass, paper, etc.) in 1990 and today and compare these figures against past figures (for example 1980, 1985, 1990, 1995 and most recent), e.g. material reuse rate was about 50 percent in the CEECs in 1990, and to evaluate strengths and weaknesses of current reuse and recycling schemes;
- To evaluate the need to adapt these schemes on the basis of the national and EU targets following the example of packaging and packaging waste and the likely costs and possible financing instruments;
- To identify policy options for improving and building up waste reuse and recycling schemes in the countries under consideration, and to discuss advantages and disadvantages of various options, keeping in mind the conditions in the region as well as in EU member states.

During the inception phase, national correspondents were encouraged to provide the Consultant with case study proposals. Finally, eight case study proposals were submitted to the Contractor. Due to the time and financial resources allocated to this part of the Project, national correspondents were advised to search for already existing studies that were likely to meet ToR requirements and that would be used as background materials.

The contractor finally selected three case studies:

- Packaging waste (Czech Republic);
- Waste batteries and accumulators (Slovenia); and
- End-of-life vehicles (Poland).

The full texts of the case studies are available on the Project Web site. Their summaries are attached to this report in Annex III.

5. Data Availability and Quality

Before the collected data and information were used to describe waste management in CEECs and to evaluate the use of economic and other instruments in order to achieve strategic objectives, the problem of data availability and quality had to be discussed in detail. Reliable data and information are essential for a sound and realistic formulation of national waste management plans, their periodic assessment and the possibility for modifications.

5.1 DATA COMPLETENESS AND COMPARABILITY

Data and information collected by the Project team varied with respect to completeness and quality, which limited applicability (see Table 2). Therefore, comparability with EU member states could not be fully guaranteed. Even though the Project team contacted the institutions responsible for data collection and database maintenance in all CEECs involved in the study, we only succeeded in getting more detailed information on data collection schemes in a few countries.

Information on the statistical system provided by all national correspondents showed that all CEECs have national databases on waste.

There are some differences related to:

- **The authority in charge of data collection:** the MoE or the national statistical office collects data and maintains the databases. Some countries have parallel systems (Slovenia, Slovakia, Bulgaria), while others divided responsibilities between two or more authorities (for example, in Hungary the MoE collects data on hazardous waste and the statistical office collects data on municipal waste); for an overview see Table 3.
- **Data reliability:** Some reports indicate that data on hazardous waste and non-hazardous waste collected by the MoE are more reliable than those collected by the statistical office and vice versa.

These variances generated difficulties in establishing evolution trends, especially for different industrial waste streams. In the years 1997-2000, CEECs modified their national waste lists or catalogues, adopting the European Waste Catalogue (EWC). As a result, the data collected in previous years was incompatible and therefore time series were not available for the purposes of forecasting (outlooks, projections) and trend analysis.

The change of national waste classifications when the EWC was introduced is a common problem faced by almost all countries involved. The limited compatibility has also been identified among EU members. The variations in hazardous waste generation between Austria, Denmark, Ireland, Germany (North Rhine-Westphalia) and Spain (the Basque Provinces and Catalonia) could first of all be explained by the fact that even though the Hazardous Waste List and the EWC were introduced, they did not sufficiently describe what was regarded and reported as hazardous waste in each country or region. The amount of hazardous waste that may be related directly to the Hazardous Waste List varied between 27 percent and 71 percent.¹⁷

Data on waste generation and disposal was collected by the ministries of environment (or their authorized agencies) in the majority of CEECs; in some cases national statistical offices were involved (see Table 3). In some CEECs, the MoE and the national statistical office generate different data because of different methodologies.¹⁸ National correspondents reported no detailed information on validation¹⁹ and verification methodologies used in their countries. On the other hand, discussion at the validation meeting revealed many common problems in this area.

TABLE 2

Overview of Questionnaire Completion

<i>Issue surveyed in questionnaire</i>	<i>Survey Results</i>	<i>Remarks</i>
Central information (statistical) system on waste management	Exists in all 10 countries	In five CEECs there are special waste information centres or agencies.
National reports	Periodical reports on the state of the environment are issued in all surveyed countries	In some cases there are special reports on waste management.
Public access to environmental information	In six countries there are specific regulations transposing the Aarhus convention and Directive 90/313/EEC, others are either drafting such regulations or have transposed the directive via other regulations.	No local authorities refused to provide the requested information.
Strategy/plan on waste management	In five countries specific documents exist, in remaining cases strategies/plans are a part of overall pre-accession strategy or are being drafted.	National correspondents were asked to bring available strategies/plans to the validation meeting.
Investment strategies	Investment assessments are reported in six countries. Two other countries have investment expected to meet EU standards.	The information on financial strategy is largely fragmentary or missing.
Legal instruments	Transposition of waste <i>acquis</i> is at an advanced stage, mostly via waste acts and related regulations (acts, decrees etc.).	
Economic instruments	User charges are applied in all countries; specific charges, taxation, etc. related to special waste categories differ substantially.	Additional information collected in March 2001
Statistical data availability	On an overall average, the statistical part of the questionnaires was completed with about 50 percent of the information; specific waste streams are the least addressed.	There are substantial variations between individual countries.
Projections, forecasts (e.g. 2005)	Available in two countries only.	

An example of the difficulty in obtaining reliable time series as a base for waste projections was presented by Slovakia, where waste information and data were collected independently by two government agencies, the Statistical Office of Slovakia (SUSR) and the Regional Waste Information System (RISO). Data from these two sources differed partially; a similar situation exists in the Czech Republic. Additionally, specific waste streams are often monitored by the private sector, e.g. waste oil statistics (see Annex 1) prepared by the Czech Association of the Petroleum Industry. Major waste oil collection companies are members together with producers (refineries) and importers.

TABLE 3

Authorities Responsible for Data Collection

<i>Country</i>	<i>MoE</i>	<i>Statistical Office</i>
Bulgaria	•	•
Estonia	•	
Czech Rep.	•	•
Hungary	•	•
Latvia		•
Lithuania	•	
Poland		•
Romania	•	
Slovakia	•	•
Slovenia	•	•

Until 1995-7, various national classifications and waste definitions were used, which made earlier data not fully comparable with the past two or three years. Time series were therefore too short to indicate even short-term trends with an acceptable certainty. In some countries, the basic data was not even gathered annually, e.g. in Slovenia. Continuous improvement is undoubtedly needed in systematic and consistent data collection to make possible the development of projections for waste generation. In many cases the private sector is more efficient in data collection, especially if it is necessary for decision-making or financial management. For example, EKO-KOM (see the Czech Republic case study) is able to produce quarterly statistics on separated collection of packaging waste.

Similarly, the EEA²⁰ recognized recently that at the EU level the comparability of data is limited due to differences in:

- Waste classification;
- Reporting obligations for waste generators;
- Organisation of data collection;
- Structures of national industrial sectors; and
- Differences in proactive approaches to waste prevention, e.g. application of the best available technologies (BATs), cleaner technologies, etc.

5.2 DATA AVAILABILITY

The comparison of data availability was roughly reviewed for the main waste categories.

Municipal waste

Generation and disposal

Only incomplete data was available to the public in all CEECs. The data most frequently missing was:

- Data for years 1990, 2000, 2005 (outlooks); and
- Collection rates.

Data on waste generation and collection rates were not fully comparable in all cases. The data frequently referred to the amount of collected waste that was not the result of weighing the waste at the disposal facility (e.g. landfill, incinerator) but of recalculating the waste vol-

ume to the waste mass using different density values. The most comprehensive reports were gathered in Slovakia, Estonia, Lithuania and Romania. A special situation occurred in Slovenia, where only data for the years 1990 and 1995 was available.

Separate collection and recycling

The separate collection of municipal waste is still not a widely used practice in CEECs, which is why only limited data was available on this subject. The most comprehensive data was from the Czech Republic (see case study on EKO-KOM, Czech Republic).

Other countries reported data:

- For two years only: Lithuania (1995, 1999), Slovakia (1995, 1999), Slovenia (1990, 1995); or
- For one year only: Bulgaria (1995), Hungary (1999), Poland (1999).

Incineration

Incineration of municipal waste is carried out in only four CEECs. Municipal incinerators are used in the Czech Republic (3), Slovakia (2), Hungary (1) and Poland (1 + 3 under construction). Detailed information on incinerators in the Czech Republic and Slovakia was available.

Landfilling

The obtained information showed that landfilling was the most common method of waste disposal in CEECs. All countries operate a number of active landfills, some of them receiving both municipal and industrial waste, and in some cases even hazardous waste.²¹ This seems to be a relatively common practice in the CEECs. The high total number of landfills may result from the double counting of sites that receive different waste categories.²²

A number of countries have little or no details publicly available on their large landfills. The most complete information on large landfills was found in the Czech Republic, Romania and Slovakia (for lists of large individual landfills see the project Web site).

Hazardous waste

The collected information is also incomplete (Table 4). Similar to the reporting on municipal waste the missing data were usually values for 1999 and the outlooks (projections) for 2000 and 2005. The most complete reports were obtained from the Czech Republic, Romania and Slovakia.

Landfilling

As with incineration, missing information mainly concerned investment/operational costs and disposal charges (Table 5). In some cases only information on the capacity of landfills was available (e.g. Hungary). One possible explanation why data on the user charges related to the incineration and landfilling of hazardous waste was lacking is the fact that these facilities generally belong to the waste generators and such costs are included into the internal production costs.

Incineration

Hazardous industrial waste is incinerated more often than municipal waste. The situation is reflected by the fact that more information was collected (Table 6), although data such as investment/operational costs, disposal charges, and expected phasing out of existing incinerators were frequently missing. The most comprehensive reports on hazardous waste incinerators were forwarded from the Czech Republic, Romania and Slovakia.

Non-hazardous waste

Statistical data was collected from nine countries (except Lithuania), mainly for the years 1995-1998. Data for 1999 and outlooks for 2000 and 2005 were frequently missing. The data was mainly concerned with generated and landfilled quantities and only exceptionally gave information about other methods of disposal.

Incineration of non-hazardous waste (not municipal) was recorded in three countries: Czech Republic, Estonia and Poland. Other methods of disposal were reported in Estonia, where information was very detailed, as well as in Poland and Romania, where information

TABLE 4

Information on Hazardous Waste Generation and Disposal

Country	Type of provided data	Availability of information
Bulgaria	Amount generated and landfilled	1996, 1997, 1998
Czech Republic	Amount of waste generated, landfilled, incinerated and disposed of in other ways	1995, 1996, 1997, 1998, 1999
Estonia	Amount of waste generated, landfilled, incinerated and disposed of in other ways	1995, 1996, 1997, 1998, 1999
Hungary	Generated, landfilled and incinerated amount	1990, 1995, 1996, 1997, 1998
Latvia	Generated amount only	1995, 1996, 1997, 1998, 1999
Lithuania	Generated amount only	1995, 1996, 1997, 1998, 1999
Poland	Amount of waste generated, landfilled, incinerated and disposed of in other ways	1995, 1996, 1997, 1998, 1999
Romania	Amount generated and landfilled	1995, 1996, 1997, 1998, 1999
Slovakia	Amount of waste generated, landfilled, incinerated and disposed of in other ways (Data from two sources)	1995, 1996, 1997, 1998
Slovenia	Generated, landfilled, incinerated and exported amount	1990, 1995

was only available for recycled quantities. Slovenia was the only country with rates of collection and landfilling as a percentage that is publicly available, but only for the years 1993, 1995 and 1999, as their database is periodically updated.

Specific categories of non-hazardous waste

Specific categories of non-hazardous waste (industrial, inert and other waste) were published by seven countries (no data from Hungary, Latvia, Lithuania) and for different years from 1995 to 1999. In general, data for 1990 was missing, while some countries published only generated quantities for the years 1995 and 1996 (Estonia). Slovenia was the only country that published its outlook for the year 2005.

Most data referred to industrial and inert non-hazardous waste. Data on other non-specified categories of non-hazardous waste was found in Poland, Romania (agricultural waste) and Slovakia. Details on disposal of other categories of non-hazardous waste were given for Romania and Slovakia. Slovenia had data available on industrial non-hazardous waste for the years 1995 and 1999.

5.3 CONCLUSIONS

Data availability is far from meeting the *acquis* requirements. It is, however, evident that in the majority of CEECs the data is collected on an annual basis, which is necessary when implementing and assessing policies and measures, effectiveness of economic instruments, monitoring hazardous waste, etc. The most incomplete data is on landfills, incinerators and other disposal installations. The EU accession process is probably the major driving force for the improvement of statistical and monitoring systems.

We would like to stress that a lack of reliable data and information may cause serious problems in the area of "EU reporting" pursuant to Directive 91/692/EEC,²³ which obliges the EU members to report regularly on implementation of major waste directives in three-year periods. Aware of the problem, the MoE of the Czech Republic is preparing quality objectives and a quality management system (QA/QC) that would meet the requirements of the EU reporting system. In some CEECs, Phare or bilateral projects should be launched to strengthen waste statistical and reporting systems.

TABLE 5

Information on Hazardous Waste Landfills

<i>Country</i>	<i>Number of landfills</i>	<i>Landfills more than 10 t/day or more than 25,000 t capacity</i>	<i>Details provided</i>
Bulgaria	0	0	n.a.
Czech Republic	46	23	Capacity, annual intake, permitting year, expected phase out
Estonia	1	1	Permitting year
Hungary	1	n.a.	Capacity
Latvia	0	0	n.a.
Lithuania	1 (under construction)	1	Capacity, investment value
Poland	68	1	Annual intake, permitting year, type of received waste, disposal charge
Romania	83	39	Capacity, annual intake, type of received waste, expected phase out
Slovakia	n.a.	n.a.	n.a.
Slovenia	0	0	n.a.

TABLE 6

Information on Hazardous Waste Incinerators

<i>Country</i>	<i>Number of incinerators</i>	<i>Incinerators more than 10 t/day</i>	<i>Provided details</i>
Bulgaria	11	0	8 for hospital waste, 3 large incinerators for industrial waste
Czech Republic	67	14	Capacity, permitting year
Estonia	1	0	None
Hungary	7		Capacity
Latvia	0	0	
Lithuania	0	0	n.a.
Poland	73 13 industrial waste 60 hospital waste	4	Annual intake, disposal fee, permitting year
Romania	3	3	Capacity, annual intake, permitting year, received waste, cost of investment
Slovakia	69 30 industrial waste 39 hospital waste	8	Capacity, annual intake, permitting year, technology used
Slovenia	1		Capacity, annual intake, permitting year, expected phase out, disposal fee

Permits to operators of industrial and disposal facilities (including IPPC permits²⁴) and their obligatory reports laid down by national legislation should be used in the short-term as a major source of data and information on large waste generators, landfills and disposal installations. This will require uniform electronic formats of permits and reports to make revisions and updates of databases easier. The use of traditional “paper forms” combined with decentralized permitting (e.g. to the tune of 78 districts and municipalities in the Czech Republic) makes the transfer and validation of data laborious.

The same improvement should apply to cross-border movement of hazardous waste (Basel Convention) to make the cooperation between European countries easier. The ability to trace the national transportation of hazardous waste from primary generators to final disposal or reprocessing must also be improved to prevent illegal practices. Such an information system should be based upon a database of permits involving a generator, collector, transporting company and operator of the disposal/reprocessing facility. The inspection authorities should have immediate access to the database.

There is limited information on data validation or verification procedures and/or data quality objectives adopted by CEECs governments or relevant agencies. The US EPA²⁵ defines data verification and validation in the following way:

- **Data Verification** means a consistent, systematic process that determines whether the data has been collected with respect to compliance, correctness, consistency, and completeness as compared to a predefined quality standard.
- **Data Validation** means an evaluation of the technical usability of the verified data with respect to the planned objectives, e.g. use for planning and monitoring purposes. In addition, data validation can provide a level of overall confidence in the reporting of the data.
- **Data Quality Objectives (DQOs)** are defined as qualitative and quantitative statements regarding the design and management of appropriate collection and use of data. DQOs define the data to be collected, determine the most appropriate condition from which to collect the data, and specify the criteria that define the quality and quantity of the data to be collected.

Using data of unknown quality increases the probability and magnitude of decision-making errors if the data is used for purposes such as strategic planning, investment decisions, compliance assessment, enforcement and penalisation. There are decision-making techniques available that take into account uncertainties of input data or information²⁶ that should be employed by waste management strategic planners in CEECs.

Before the data is used, data quality assessment (DQA) should be carried out as a process that employs statistical methods to determine whether a set of data will support a particular decision with an acceptable level of confidence. The Project team has not received any information from individual CEECs on how the problem of data quality will be tackled in coming years.

6. Current State of Waste Production

Waste generation is the result of the overall economic activities in individual countries (national economies). Municipal waste generation depends on the consumption patterns and living standards of individual populations (consumption wastes). Hazardous and non-hazardous wastes are mainly generated by industries (production wastes).

Besides those broad waste categories there are several specific waste streams related more specifically to production and consumption, such as batteries and accumulators, tyres, waste oils, packaging waste, end-of-life vehicles, electric and electronic waste, etc. These waste streams deserve special attention and regulation (application of the producer responsibility principle).

This study mainly analyses the use of economic and information instruments besides traditional legal instruments used broadly in CEECs. Before discussing the applicability of economic instruments in waste management of CEECs, a concise description of the current situation and possible trends was attempted. This was based on the collected data and information. As the following paragraphs show, the quality of the basic data available allowed neither a detailed analysis of the situation nor any sound prognosis based upon socio-economic models.²⁷

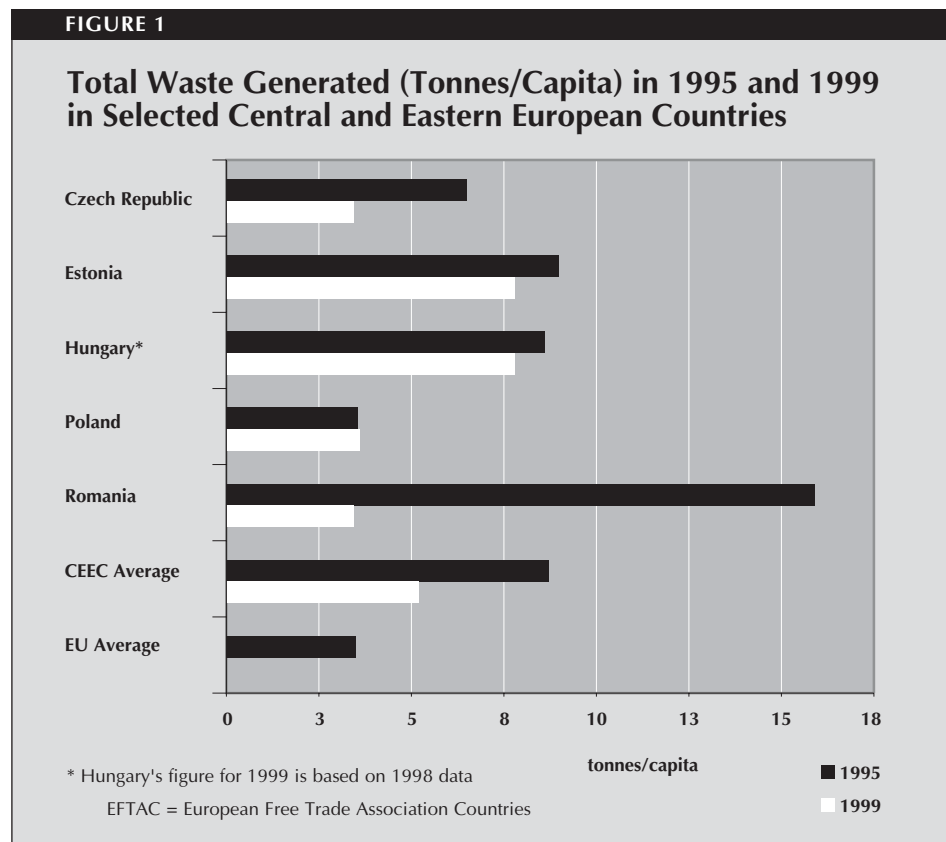
The Project team used the current situation in EU member states and OECD countries as a benchmark since CEECs mainly differ from EU and OECD members with respect to the development of their information base, strategic planning, regulatory procedures and disposal capacities (installations). Generally speaking, the majority of CEECs face the same problems the OECD countries were tackling some 10-15 years ago. The authors of this study feel that there is a strong convergence between those two broad groups of developed economies and that the development trajectory of CEECs follows that of the OECD countries in many aspects.²⁸

6.1 TOTAL GENERATED WASTE

There is an increasing amount of total generated waste within the EU and the European Free Trade Association Countries (EFTAC). Between 1990 and 1995 there was an increase of approximately 10 percent during the whole period,²⁹ while GDP growth was about 6.5 percent (constant prices). The total amount of waste generated (excluding agricultural waste) in 1995 amounted to the estimated 1.3 billion tonnes equating to **3.5 tonnes per capita**. It is expected that most waste streams will further increase over the next decade. Such excessive quantities of waste result from inefficient production processes, the limited durability of goods and unsustainable consumption patterns.

The quantities of total waste (including municipal waste, hazardous waste and non-hazardous waste) reported in CEECs in 1995 were approximately two and a half times larger than the EU and EFTA average per capita. The European Environment Agency (EEA) estimated that the quantities were approximately three times higher. Figure 1 shows differences in total generated waste per capita between selected countries in CEE and the EU average. The CEEC average of the selected countries exceeds five tonnes per capita.

The reasons for the higher average are most likely related to higher quantities of generated waste from the manufacturing industry as about 80 to 90 percent of waste is on average generated by industry (including energy production). Large quantities of mining waste, especially in Romania and Czech Republic, decreased with reduced mining activities in the 1990s. Due to industry improvements, the total generated waste, when compared with data from 1995 and 1999, seems to be decreasing.



Comparisons of data from 1999 and 1995 show a certain reduction in the total amounts of generated waste per capita from selected CEECs (see Figure 1). The average amount of generated waste in the CEECs per capita fell from 8.7 tonnes in 1995 to 5.2 tonnes in 1999, a decrease of approximately 40 percent. This is perhaps due to the phasing out of obsolete production facilities and improvements in the efficiency of processes in the manufacturing industry and energy production, although significant steps must still be made to achieve EU levels. In some cases, the economic crisis at the beginning of the 1990s led to the closing down of steel mills, mines, quarries, etc. that generated large quantities of waste.

6.2 WASTE COMPOSITION

The following discussion on CEECs was based upon data on three major categories of waste:³⁰

1. Municipal waste (households, services, small businesses, etc.);
2. Hazardous waste (national or EWC categorization); and
3. Non-hazardous waste excluding municipal waste (mainly production or production related waste, again depending on categorization);

The three categories are taken as the total waste generated by the whole national economy. The data given in the national questionnaires appears in Table 7. All data, as well as relative values (indicators), were tested for statistical outliers. Average values had to be estimated because incomplete data was used;³¹ the averages should therefore be taken as rough indicative values. Data from 1998, as it was the most comprehensive, was used after applying Grubbs statistical test to exclude "statistical outliers" (statistically improbable values) before average values were estimated.

The Bulgarian data on non-hazardous waste generation and total waste production offers a clear example of an outlier. Despite the fact that the data was taken from official statistics,³⁴ it indicates possible problems with statistics. Nevertheless, the CEEC average of total generated waste is more than five tonnes per inhabitant, which is substantially greater than the OECD average of 2.1 tonnes. Averages for three broad waste categories were calculated.

TABLE 7

Absolute Amounts of Waste Generated in CEECs (Millions of Tonnes) in 1998

Country	Municipal	Hazardous	Non-hazardous	Total ³²	Population	Total per capita
Bulgaria	3.2	0.55	218.4	222.2	8.2	27.1 ³³
Czech Republic	4.6	3.9	35.7	44.2	10.3	4.3
Estonia	0.56	6.2	7.0	13.8	1.45	9.5
Hungary	5.0	3.9	70	78.9	10.1	7.8
Latvia	0.60	0.11	n.a.	n.a.	2.46	-
Lithuania	1.5	0.24	6.9	8.6	3.70	2.3
Poland	12.3	1.11	132.0	145.4	38.7	3.8
Romania	6.2	2.3	75.4	83.9	22.5	3.7
Slovakia	3.9	1.7	n.a.	n.a.	5.4	-
Slovenia	1.2	0.03	1.4	2.63	2.0	1.3

Average amounts of waste generated in CEECs (1998):³⁵

- Municipal waste — 370 kilograms per inhabitant
- Hazardous waste — 190 kilograms per inhabitant
- Non-hazardous (production) — 4.5 tonnes per inhabitant

Despite the problems with categorisation, the structure of generated waste was compared between individual CEECs as shown in Table 8.

Applying Grubbs statistical test, Estonia was a “statistical outlier” with respect to the relative generation of hazardous waste, which meant that 53 percent of hazardous waste did not fit into the normal distribution (95 percent probability). This relates to energy resources where low quality oil shale is used. In Slovenia waste distribution resembles the situation in OECD countries. It must, however, be stressed that the Slovenian statistical data is fragmental and this distribution may be a result of statistical errors.

Roughly, municipal waste³⁶ is taken as a result of consumption while the rest (non-hazardous + hazardous) is supposed to be waste from production. The results are shown in Table 9 and compared with OECD countries in Table 10.

There is a substantial difference between OECD and EU countries’ production and consumption waste ratios, which are approximately calculated as a ratio between industrial and municipal waste. In the most developed OECD countries, where there exists industrial production with a large added value, this ratio is in favour of consumption waste. The industry does not generate as much waste from production of primary materials like steel, aluminium, construction ceramics and cement, glass, etc. Many OECD countries import energy and primary materials from less developed countries, including CEECs.

The waste from services, retail, etc., which is a part of solid municipal waste, can be viewed as consumption waste. Industrial waste is more related to primary production. In countries with excessive mining, pulp and paper production, metallurgy, coal-based energy production, etc., the production of industrial waste per capita or a GDP unit is substantially higher than in “post-industrial” economies importing energy and primary materials.

TABLE 8

Structure of Waste Generated (1998)

<i>Country</i>	<i>Municipal (%)</i>	<i>Hazardous (%)</i>	<i>Non-hazardous (%)</i>
Bulgaria	1.5	0.02	98.5
Czech Republic	10	9	81
Estonia	5	53	42
Hungary	6	5	89
Latvia	n.a.	n.a.	n.a.
Lithuania	17	3	80
Poland	8	1	91
Romania	7	3	90
Slovakia	n.a.	n.a.	n.a.
Slovenia	46	1	53

TABLE 9

Production/Consumption Waste Ratio (1998)

<i>Country</i>	<i>Municipal (millions of tonnes)</i>	<i>Production (millions of tonnes)</i>	<i>Production/ Consumption</i>
Bulgaria	3.2	219	68.4
Czech Republic	4.6	39.6	8.6
Estonia	0.56	13.2	23.6
Hungary	5.0	73.9	14.8
Latvia	0.60	n.a.	n.a.
Lithuania	1.5	7.1	4.8
Poland	12.3	133.1	10.8
Romania	6.2	77.7	12.5
Slovakia	3.9	n.a.	n.a.
Slovenia	1.2	1.4	1.2
CEEC³⁷	-	-	11.0

In CEECs, the ratio of production to consumption waste is about four times higher on average than in OECD countries. Only Slovenia seems to have a ratio comparable to OECD countries; their statistical data, however, requires more frequent collection.

The problem with waste definitions and categorisation has already been mentioned. Changes in the waste categorisation mainly influence redistribution of the generated waste into different categories. A precautionary principle applied in the Czech Republic to the hazardous properties of waste leads to large amounts of waste being categorized as "hazardous." When the European Waste Catalogue (EWC) is applied, the volume of hazardous waste is reduced to about 60 percent, while the total amount of waste remains unchanged. A modified waste definition may also change the total amount of waste generated. The total waste generated per capita is, however, the most robust indicator, while hazardous waste per capita (or GDP unit) relies heavily upon categorisation and the data collected, and can therefore only serve for very rough comparisons.

TABLE 10

Production/Municipal Waste for Selected OECD Countries

Country	Municipal (millions of tonnes)	Production (millions of tonnes)	Production/ Consumption
Japan	400	1,244	3.11
Australia	690	2,344	3.40
Belgium	470	1,391	2.96
Denmark	540	520	0.96
Finland	410	2,436	5.94
France	560	1,959	3.50
Germany	400	669	1.67
Greece	310	52.5	0.17
Ireland	430	1,235	2.87
Italy	470	398	0.85
Netherlands	580	552	0.95
UK	590	1,664	2.82
OECD average²⁸	500	1,566	3.1

TABLE 11

Material Classification for Solid Municipal Waste

Prime category	Subcategories
Paper	Newspaper, magazines, junk mail, catalogues and books, office waste paper, cardboard, etc.
Glass	Green bottles, amber bottles, clear bottles, other glass, etc.
Plastic	Beverage bottles, carrier bags, PE and PP sheets, polystyrene packaging, PVC, rubber, tyres, polyurethane mats, etc.
Metal	Ferrous cans, other scrap, aluminium cans and foils, batteries and accumulators, electronic waste, etc.
Organics	Food, other kitchen waste, garden plants and wood, etc.
Textiles	Used clothes/bedding, carpets, etc.

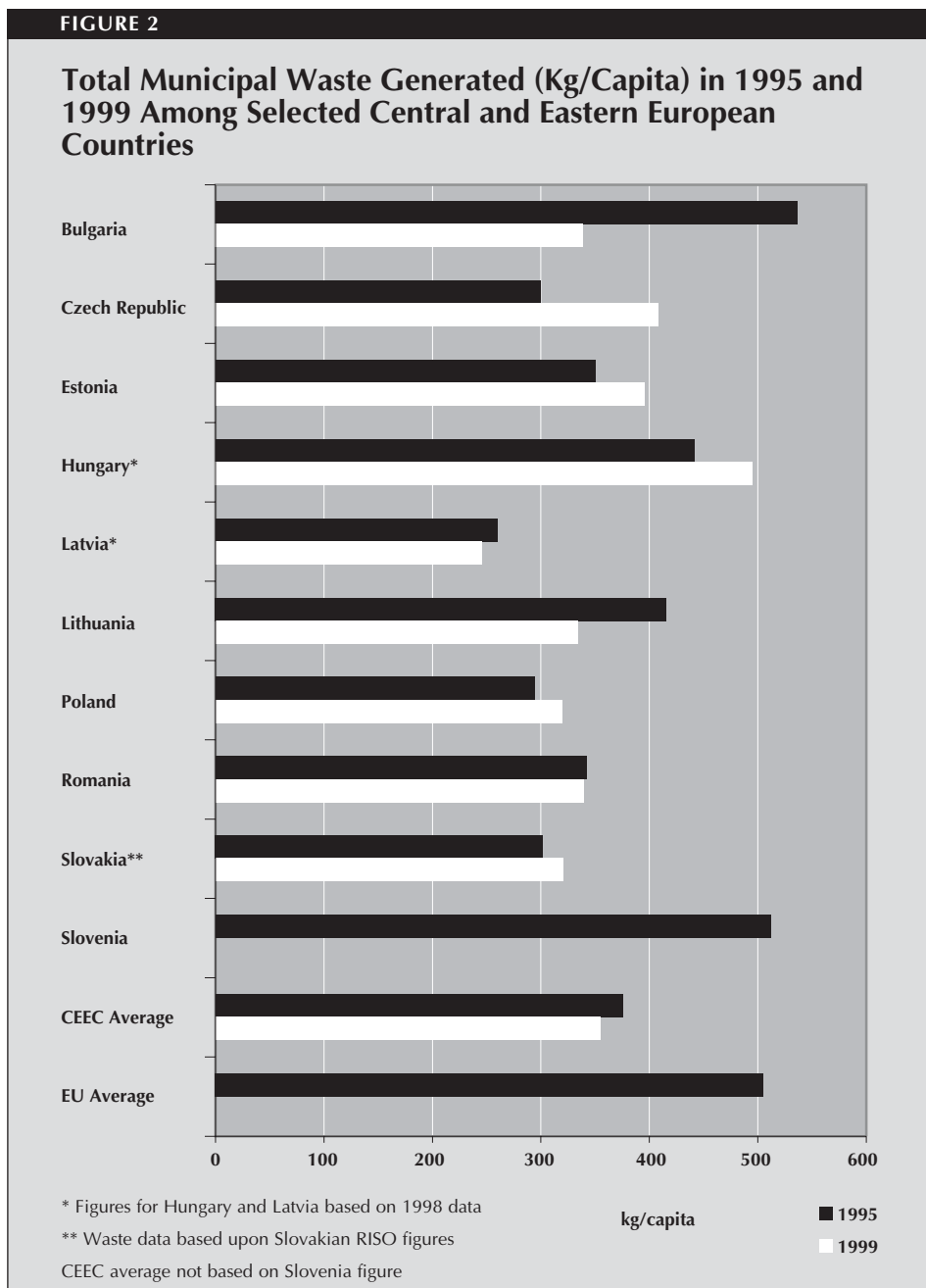
6.3 SOLID MUNICIPAL WASTE

Solid municipal waste, generated by individuals, households, shops and small enterprises, is made up of many components (see Table 11). It contains biodegradable materials and sub-categories of waste, that should be separated as individual waste streams, such as plastics, electronic waste (including domestic appliances), glass bottles, batteries and accumulators, etc.

As household waste constitutes a major share of solid municipal waste, the composition and amount of solid municipal waste depends on many socio-economical factors like character of the neighbourhoods, character and extent of payments, income, age, lifestyle, environmental awareness, availability of separated collection, composting or other methods of disposal, etc. There are also seasonal (time) variations in the amount and character of the solid municipal waste, e.g. increased content of ash and cinder during winter season in households equipped with stoves.

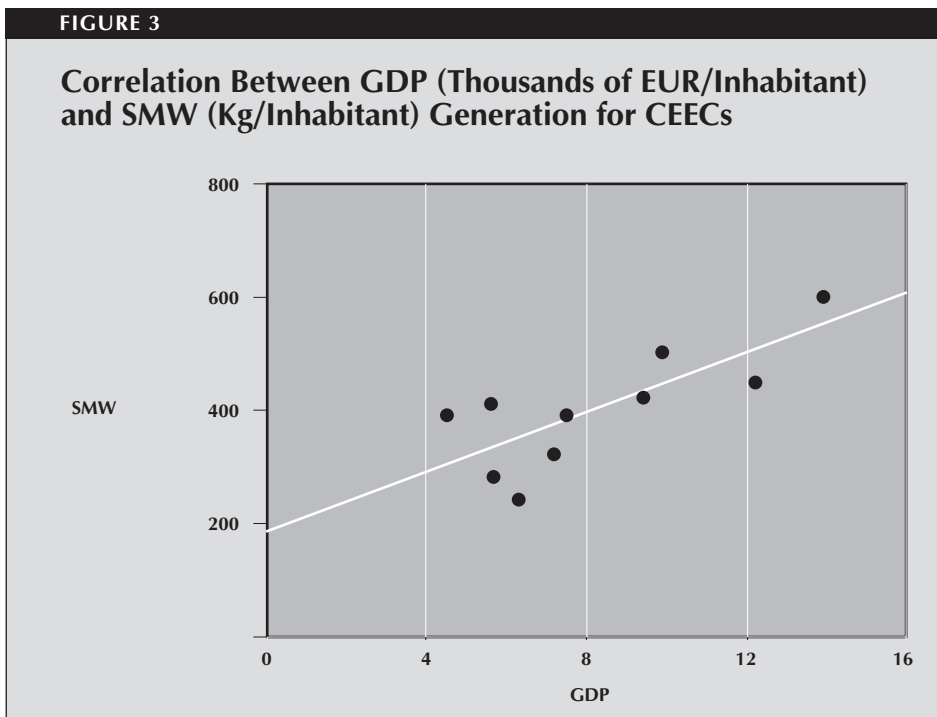
The average generation of municipal waste per capita within the EU (505 kilograms per inhabitant) was about 55 percent higher than within the CEECs (325 kilograms per inhabitant) in 1995. The EEA estimated this difference at about 40 percent. However, from 1995 to 1999 there was an increase in the generation of municipal waste in the majority of CEECs (see Figure 2). Interestingly, the increase in the CEE average, from 325 to 357 kilograms per capita, was just short of 10 percent as compared with a similar increase in the generation of municipal waste within the EU and EFTA as a whole between 1990 and 1995.

Solid municipal waste is strongly related to household consumption of products and services and is therefore expected to correlate with GDP or its largest component — final consumption of households, which is about 63 percent of total GDP in EU candidate countries compared with 58 percent in the EU-15.³⁹ We used GDP expressed as purchasing power standards (PPS) values, which better reflect relative economic differences between compared countries.⁴⁰



With regard to the lack of well-defined trends (time series) in the relationship between municipal waste generation and GDP (per capita) for individual CEECs, which are often available for EU or OECD countries,⁴¹ one can use the whole group of EU and CEE countries as a benchmark.

Correlation analysis has been carried out as a part of this study (see Annex III). The linear relationship between GDP and generation of solid municipal waste (SMW) exists at 99 percent level of probability for CEECs (Figure 3) as well as for EU members. The slope of the regression line, which is 26.4 kilograms per EUR 1,000 for CEECs, is about 70 percent greater than the slope for the regression line found for EU members, at 17.6 kilograms per EUR 1,000. This indicates that CEECs may experience serious problems with solid municipal waste in coming years.



The above growth of SMW as a linear function of GDP, however, serves only as a rough guide, as it does not take into account all policies and measures introduced and prepared. In their complete absence, the increase of SMW could be substantially higher (up to 40 kilograms per EUR 1,000). On the other hand, efficient waste management strategies can lead to the stabilisation of total amounts of solid municipal waste in CEECs. These strategies should derive from increased focus on prevention measures, such as production of returnable and recyclable materials, as well as reasonable changes of consumption patterns.

6.4 HAZARDOUS WASTE

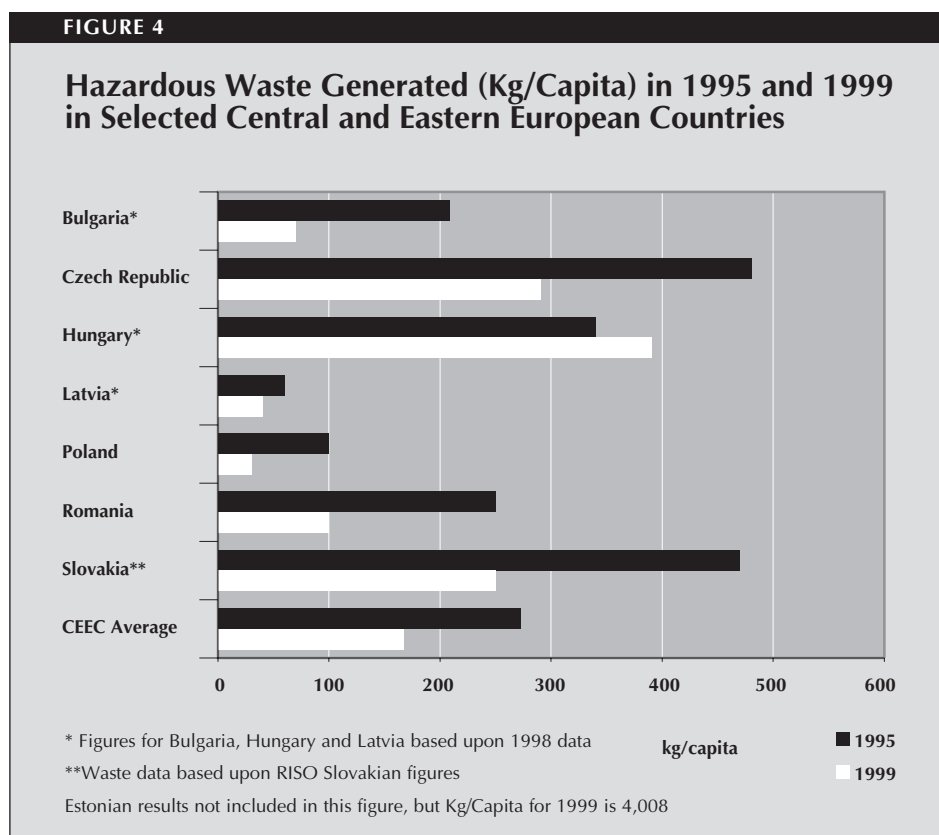
Hazardous waste, even in small quantities, has a very negative impact on the environment. The total amount of hazardous waste was as much as 36 million tonnes in EU member countries in 1995. The EU countries show apparent increases of approximately 65 percent in hazardous waste quantities between 1990 and 1995, although this is mainly due to amended definitions and new legislation. The UK and Germany, for example, show 1990-1994 figures that demonstrate a decrease of 21 percent before the introduction of the hazardous waste list. This can be explained by the penetration of cleaner technologies, by reuse and recycling, the closing down of heavy industry, and the moving of parts of industrial production outside the EU.⁴²

In CEECs, high quantities of hazardous waste were generated in 1995 (see Figure 4). However, the quantities of hazardous waste generated in most CEECs fell in 1999 (except in Hungary). The CEEC average in 1995 was 283 kilograms per capita while in 1999 this figure fell to 183 kilograms per capita, a decrease of about 55 percent. This could be the result of restructuring and modernisation of industry and the reclassification of industrial waste.

Results for Estonia were not included in the CEEC average, since extremely high amounts of hazardous waste were generated in this country. In 1995 for instance, 4,870 kilograms per capita were generated, falling to 4,008 kilograms per capita in 1999. This high amount was primarily due to the waste from oil-shale mining and power production. Due to the large amount of minerals in oil shale, such waste generation is unavoidable, and unfortunately, present technology offers no way to use the large amounts of oil shale waste. In the case of Slovenia,⁴³ almost all hazardous waste (97 percent) is exported, mainly to Austria, France and Italy. Moreover, data for Slovenia was available only for 1995 and the country is not included in Figure 4.

As stressed by the EEA,⁴⁴ the differences in hazardous waste production between the EU countries depend upon many factors, among others, upon classification. The variations between Austria, Denmark, Ireland, Germany and Spain are explained by the fact that the portion of hazardous waste, which related directly to the Hazardous Waste List, varies from 27 to 71 percent. One can also observe substantial differences in national hazardous waste classification and categorisation in the EU candidates. In the Czech Republic, for example, the total production of hazardous waste according to national classification is 3.1 million tonnes for 1999, while the total according to the European Waste Catalogue is only 1.32 million tonnes.

Keeping in mind the uncertainties in classification of hazardous waste, it should be stressed that this conclusion, drawn from Figure 4, should be reviewed once more reliable data is available. It is also impossible to judge whether the substantial decreases in hazardous waste generation are caused by technological changes and/or reclassification. One can conclude that the amount of hazardous waste per capita may decrease with increasing technological innovations and the more effective enforcement of increasingly stringent technical standards.



6.5 SELECTED TYPES OF WASTE

Records on selected types of waste show large differences, as the national questionnaires clearly reflect. The diversity was observed in all types of information — waste streams, years of recording, and quantities generated and disposed in different ways. All this shows that such data was not systematically collected over the past decade.

Values for 1990 are generally missing. Since 1995 the statistics of these waste streams have been improved, but the problem of a lack of some data still persists. The most comprehensive information was collected for waste generation and disposal, while the less comprehensive data refers to waste recycling, even though many related activities were described in the national questionnaires. One can conclude that insufficient attention is still being paid to separated collection and recycling in the current waste management strategies of the CEECs. Considering the information collected, it should be mentioned that:

- The highest volume of data was reported on waste batteries and accumulators (nine countries); and
- The lowest number of questionnaires (four) includes information on biodegradable waste and electric and electronic waste.

The reports on the Czech Republic, Estonia, Romania, Slovakia and Slovenia refer to between six and eight different waste streams. The common waste streams monitored in all these countries are:

- Batteries/accumulators;
- End-of-life vehicles;
- Metal and metal scrap;
- Waste oils; and
- Waste tyres.

The information mainly referred to waste quantities generated, landfilled and disposed in other ways, usually recycled. Incinerated quantities were reported especially for waste oils, waste tyres and packaging waste.

6.6 CONCLUSIONS

In spite of the far from ideal situation in waste statistics, it is evident that the amount and character of the waste generated in the CEECs differs on average from the situation in OECD countries. Analysing the data and information collected in the Project, we came to following conclusions:

- About five tonnes of total waste per capita are generated in CEECs, which is markedly more than the OECD average of 2.2 tonnes.
- Production waste constitutes the major share of total waste as the production/consumption waste ratio, which is approximated using the ratio of non-hazardous plus hazardous waste divided by municipal waste. This rate 11 for CEECs while the OECD average is 3.1, due to the character and structure of the industries and technology used.
- Waste from mining, metallurgy, quarrying, coal fired power and heat generation, fertilisers, and glass and cement manufacture make up the major share of production waste.
- The generation of production waste (about 90 percent of the total waste generated, see Table 8) decreased significantly during the 1990s. This was caused by economic transformation, the phasing out of the most obsolete installations, modernisation and the substitution of technologies. Due to the economic convergence and the pre-accession process, production waste volume is supposed to decrease to a level comparable with OECD countries (about two tonnes per inhabitant). This positive development will depend upon the pace of economic transition.

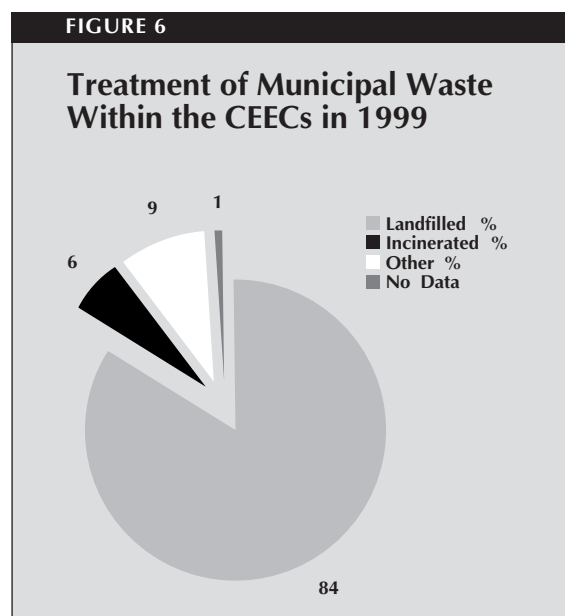
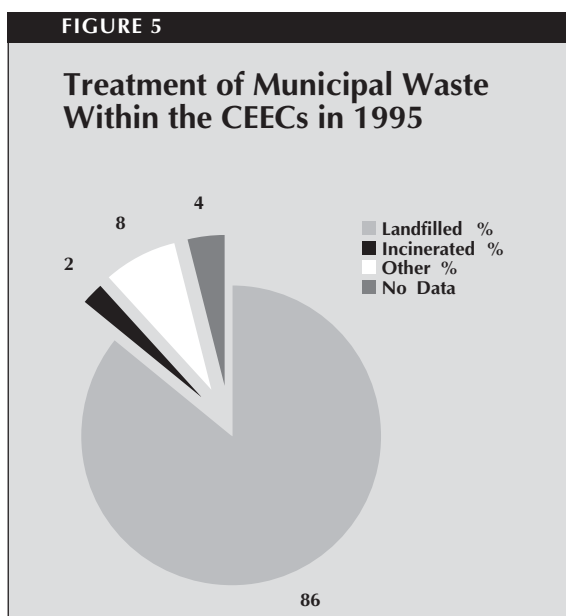
- On average, hazardous waste represents about four percent of total production waste. Because of variations in definition and industrial production (including raw materials), the share of hazardous waste in total varies from the 0.02 percent reported by Bulgaria to 53 percent in Estonia, which is a special case.
- Special waste streams like waste oils, batteries and accumulators, end-of-life vehicles, tyres etc. are often not monitored separately and the data on them is the most fragmental or even non-existent (e.g. Romania).
- The generation of solid municipal waste amounts to 370 kilograms per inhabitant per year on average, which is less than the OECD average of about 500 kilograms per inhabitant. Annual amounts as well as relative shares (expressed as percentages of the total) vary significantly across the CEECs. Latvia generated 244 kilograms per inhabitant in 1998, while Slovenia with 600 kilograms per inhabitant has the highest figure among CEECs.
- As family income began to increase in the CEECs and the life style approached that of EU members, the amount of solid municipal waste was already growing moderately by the end of the 1990s. The regression line between GDP and generated solid municipal waste per capita is identical in CEECs and OECD countries.
- The correlation between GDP and solid municipal waste generated per inhabitant reveals substantial differences between individual countries; the volume of waste generated by economies reaching the same GDP may vary plus/minus 40 kilograms per inhabitant. These differences may be caused by, among other factors, variability in separate collection and/or share of services and small business waste (which is not separately collected).

7. Waste Management

In this Chapter, waste management practices reported in CEECs were reviewed on the basis of national questionnaires. Special focus was paid to landfilling and incineration and also to separate collection and recycling. First, we identified the substantial requirements in EU waste management legislation⁴⁵ so that we could analyse how they were reflected in strategic planning in CEECs. National data and information collected by national correspondents, which are available at <www.euowaste.org>, were used in a concise manner. For more details, please visit the database.

7.1 LANDFILLING

In a few EU countries landfilling is still the preferred disposal route for waste. On the other hand in some EU countries substantial increases in recycling and a reduction in landfilling were apparent in 1985-1995. As far as municipal waste in the EU is concerned, there was no general improvement in the 1990s. Between 1985 and 1990, 64 percent was landfilled, while 19 percent was incinerated. By 1995, 67 percent was landfilled, with only 17 percent incinerated.⁴⁶



Similarly, within the CEECs landfill treatment is the most common disposal method for municipal waste. The overview of landfills used in individual CEECs is given in Table 12. The share of landfilling is larger than in the EU. In CEECs in 1995, approximately 86 percent was landfilled, while only 2.3 percent was incinerated (see Figures 5 and 6). The data for 1999 shows an improvement in reducing landfill treatment to 83.7 percent, while the share of incineration of municipal waste increased to six percent. This means incineration increased by 160 percent from 1995 to 1999.

The main reason for this large disparity between landfilling and incineration can be explained to a large extent by the fact that landfills are cheaper to construct and operate than incinerators. In the CEECs the situation seems to be the same. Indeed, landfill disposal costs seem to be far lower than incinerator disposal costs, although a detailed analysis is hampered by lack of reliable data. However, in the case of the Czech Republic, the approximate average cost of landfill municipal disposal is about EUR 5 per tonne, compared to EUR 32.5 per tonne for incinerator disposal. The situation is similar with hazardous waste, where there are again large differences in the costs of landfill and incinerator disposal in the Czech Republic and Poland (see Figure 7).

TABLE 12

Landfilling of Solid Municipal Waste

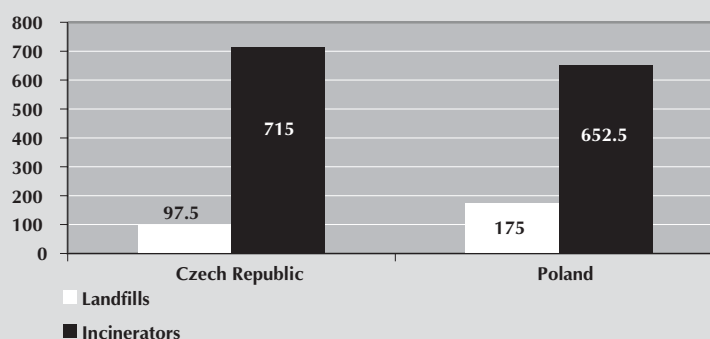
Country	Total number of landfills	Landfills over 50 t/day
Bulgaria	124 controlled, 9 meet the EU standards 720 reported by the MoE 2,500 observed by regional environmental inspectorates	More than 25 (estimate)
Czech Rep.	161	53
Estonia	351 (221 operated)	14
Hungary	725	n.a.
Latvia	565	n.a.
Lithuania	800*	85
Poland	998	n.a.
Romania	257	37
Slovakia	141 + 159**	n.a.
Slovenia	60	38

* Including contaminated sites and liquid waste reservoirs

** Closed in May 2001

FIGURE 7

Average Cost of Hazardous Waste Disposal (EUR/Tonne) in the Czech Republic and Poland



Therefore, unless other regulations are in place, the market mechanisms will direct waste to landfills instead of other waste treatment options such as recycling, composting and incineration with energy recovery, thereby acting in direct opposition to the official community strategy. The causes of current differences in treatment prices have to be counteracted either by regulatory measures, or by using economic instruments such as disposal charges.

Landfill capacity is another concern highlighted by EEA.⁴⁷ For countries where data on both capacity and total amount landfilled is available, it is possible to calculate the remaining capacity in years, based on the present rate of disposal. Within the EU there is a very high degree of variation in available capacity. While some countries have sufficient capacity for 10 years, others only have capacity for a shorter period.

Within the CEECs, data available for calculating such projections was limited and in most cases unavailable. Only data for calculating municipal landfill capacity existed, and then only for a few countries: Czech Republic, Slovakia and Lithuania. Based on current annual municipal waste generation, the Czech Republic has a landfill capacity for about 50 years and Slovakia for about 100 years. This is due to the fact that during the 1990s new safe landfills were built to solve a critical situation in waste management. In the Czech Republic several thousand old dumps were closed in 1996 and replaced by about 400 new landfills.

According to the data, the positive trend of a decrease in total waste generation from 1995 to 1999 has increased the lifetime of existing landfills. Substantial investment in the 1990s by the private and public sector into secured landfills should be used in an optimal way. In the future more detailed information databases on landfills must be established as a part of the pre-accession efforts. This would ensure better projections of landfilling in the context of growing incineration and recycling.

Another problem associated with landfilling is the production of methane, a major greenhouse gas. Methane from landfills was estimated to account for 28 percent of the total methane emissions in the EU in 1995 (EEA, 1999). Methane emission problems can be solved by avoiding the landfilling of biodegradable organic matter or by collecting and utilising gas at the landfill. The Directive on the landfilling of Waste requires gas collection from all new landfills receiving biodegradable waste and sets goals for the reduction of municipal organic waste going to landfills.

It should be noted that no hazardous waste landfill was reported in Bulgaria and Latvia, while Estonia, Hungary and Latvia have only one such landfill. Since some hazardous waste cannot be incinerated (including solid waste from hazardous waste incineration), these facts indicate an underdeveloped infrastructure for hazardous waste disposal.

Within the CEECs very little data is available on policies preventing landfilling of biodegradable waste or on methane gas collection and utilisation. In Estonia one large landfill is equipped with a gas collection system. A regulation to reduce landfill methane will soon be adopted in Estonia within the Draft Regulation of Ministry of Environment (which establishes procedures and requirements for management, use and the closing down of landfills).⁴⁸ In the Czech Republic several large landfills were equipped with methane collection equipment. The newly prepared Czech database of landfills should contain information on landfill gas.

Considering all problems associated with landfilling, as well as the time needed for finding suitable locations, obtaining public acceptance (EIA) and constructing the landfills, a timely decision on the eventual construction of new controlled landfills and enhanced development of alternative techniques must be made.

7.2 INCINERATION

Although data on the total quantity of incinerated waste in the EU is not available, the OECD indicates a minimum total annual incineration of municipal solid waste of about 26 million tonnes. Incineration has many positive aspects such as reducing the quantity of waste to be landfilled and the remaining slag becoming more stable than untreated waste. Thus it is far easier than landfilling or recycling. Energy is also utilised in many incinerator plants, and the focus on energy recovery has been increasing.⁴⁹

There were 533 incineration plants for municipal non-hazardous waste reported in operation in the EU member countries. There were also an additional 239 incineration plants for hazardous waste reported in operation. Many incinerators generate heat or power, or both (co-generation). Optimal efficiency is achieved through combined systems where heat is

used in district heating systems. Among the CEECs, the number of reported incinerators in operation for the treatment of municipal waste is very low indeed, while the number for the treatment of hazardous waste varies considerably among the individual CEECs.

By 1999, within the CEECs, there were only seven municipal incinerators (capacity exceeding three tonnes per hour) reported in operation in the Czech Republic, Hungary, Poland and Slovakia, and three smaller ones in Poland. There are 97 incinerators reported for hazardous waste, 22 of them having a capacity of over 10 tonnes per day. Due to the lack of detailed data, there is minimal evidence of energy utilisation at these incineration plants, except in Romania where two of the three hazardous waste incinerators in operation utilise energy recovery. It should be stressed that Latvia and Slovenia have no facility for the final disposal of hazardous waste.

Waste incineration is covered by Council Directive 89/369/EEC on the Prevention of Air Pollution from New Municipal Waste Incineration Plants, Council Directive 89/429/EEC on the Reduction of Air Pollution from Existing Municipal Waste Incineration Plants and Council Directive 94/67/EEC on the Incineration of Hazardous Waste. In addition, Commission Decision 97/283/EC on Harmonized Measurement Methods to Determine the Mass Concentration of Dioxins and Furans in Atmospheric Emissions in Accordance with Article 7(2) of Directive 94/67/EC on the Incineration of Hazardous Waste was adopted to supplement Council Directive 94/67/EC.

Recently, Directive 2000/76/EC on the Incineration of Waste was introduced. This new directive will repeal and replace Council Directives 89/369/EEC, 89/429/EEC and 94/67/EC as of December 28, 2005. In addition, Article 8(1) and the Annex to Directive 75/439/EEC on the Disposal of Waste Oils will be repealed and replaced by the same date. In the case of larger waste incineration plants, Council Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC) will also apply.

The EU approach is based on the application of emission limit values together with additional technical requirements and requirements related to emissions monitoring. National legislation should distinguish between municipal waste incineration plants and hazardous waste incineration plants. The requirements related to hazardous waste incineration plants are more stringent than those related to municipal waste incineration plants — though a substantial change to the EU legislation was made by the adoption of the new Directive on Incineration of Waste that imposes the same requirements on any waste incineration plant. In addition, provisions for the co-incineration of waste in cement kilns, large combustion plants or other industrial plants are included in the new directive. Directive 2000/76/EC is applicable to new plants as of December 28, 2002 and to existing plants (permit before December 28, 2002) as of December 28, 2005.

Certain waste incineration plants are subject to integrated pollution prevention and control, according to Council Directive 96/61/EC on IPPC (municipal waste incineration plants with nominal capacity exceeding three tonnes per hour and hazardous waste incineration plants with nominal capacity of more than 10 tonnes per day). In general, the emission limit values laid down in Directive 2000/76/EC are more stringent than those laid down in the existing CEECs' legislation, e.g. existing Czech legislation (Decree No. 117/1997, Coll.).

Existing national legislation must therefore provide for the monitoring of emissions, the specification of operating conditions (especially temperature of incineration, residence time, treatment of waste gases, delivery of waste) and other technical requirements (auxiliary burners). Requirements of the EU legislation are more detailed and usually more stringent than those provided for by the existing legislation.

However, there are many problems associated with incineration such as the release of air pollutants and the generation of secondary waste streams (slag and fly ash). Emissions from incinerators have been reduced considerably since 1990 due to the closing of many small installations and the introduction of new cleaning systems. The total amount of incinerator slag produced from plants is estimated to be between 6 million and 9 million tonnes per year in the EU countries. A number of countries use the slag for road construction, embankments, noise barriers, and for concrete production.⁵⁰

Based on the scarce information collected by national correspondents, the following conclusions on incineration could be drawn:

- Waste incineration plants may increase pollution levels in their vicinity significantly, which is especially important in the cases of dioxins and furans.
- A small fraction of the existing waste incineration plants seems to be in full compliance with the EU requirements, namely with Directives 94/67/EC and 2000/76/EC.
- In the case of municipal waste incineration plants, substantial investment is expected in the coming years; existing industrial incinerators have to be reconstructed or upgraded to meet the more stringent requirements.
- In the case of hazardous waste incineration plants, some are expected to close their operation soon; according to one expert opinion, for example, 50 percent of hazardous waste incineration plants are expected to be closed down before the accession date in the Czech Republic.
- Co-incineration of considerable amounts of tyres, waste oils, plastics and solvents is carried out in cement and lime plants, ironworks, etc.

The implementation of Council Directive 96/61/EC on IPPC could generate problems as compliance with emission limit values laid down by Directive 2000/76/EC should be regarded as a necessary but insufficient pre-requisite for compliance with the requirements of Directive 96/61/EC, providing for the use of best available techniques. Implementation by IPPC competent authorities must take into account actions necessary for achieving ambient air quality standards in zones and agglomerations, according to Directive 96/62/EC.

7.3 WASTE INCINERATION IN THE CZECH REPUBLIC

The Czech Republic reported 75 incinerators out of the total 107 operating in CEECs. This is why waste incineration in the Czech Republic will be discussed in greater detail. In 1999, 79 waste incineration plants were listed in the national register of air emission sources database (REZZO). Of this total, 63 plants were actually operating in October 2000.

Three plants for the incineration of municipal waste are under construction (SKO Praha, Malesice — 310,000 tonnes per year, SAKO Brno — 210,000 tonnes per year, SKO, Liberec — 96,000 tonnes per year). Major hazardous waste incineration plants are operated by large industrial plants (Kaucuk, Kralupy — 10,500 tonnes per year, Aliachem, Semtin — 14,000 tonnes per year, BC MCHZ, Ostrava — 10,000 tonnes per year, Spolek, Usti n.L. — 5,000 tonnes per year and Ekochem, Vyskov — 2,500 tonnes per year). The remaining plants are mostly hospital waste incinerators.

As for the technical requirements, the 75 permitted installations that were assessed showed the following results:

- All existing plants are able to maintain the required temperature of incineration (850 or 1100 C).
- Four plants are not able to achieve the required residence time.
- Thirty-six plants are able to block delivery of waste automatically before achieving the required temperature.
- Eleven plants are able to block delivery of waste automatically in emergency cases.
- All plants are equipped with auxiliary burners but four of them do not have any automatic control system attached.
- All existing plants are equipped to monitor carbon monoxide and oxygen.
- Only nine plants are equipped with automatic monitors for other parameters (usually sulphur dioxide, nitrogen oxides, hydrogen chloride).

The total amount of waste incinerated in the Czech Republic increased from 577,000 tonnes (one percent of the total waste generated) in 1998 to 828,000 tonnes (three percent of total waste generated) in 1999. The total amount of combustible waste generated in the Czech Republic was 11 million tonnes in 1998 and 9.6 million tonnes in 1999.

Cement plants are the major players in co-incineration. The amounts of co-incinerated commodities in 1999 was as follows:

- Tyres: 16,000 tonnes per year (Mokra, Cement Plant, Cizkovice Cement Plant)
- Waste oils: 12,000 tonnes per year
- Solvents: 4,000 tonnes per year
- Tars: 18,000 tonnes per year
- Plastics: 100,000 tonnes per year

Another 8,000 tonnes of waste oil was incinerated in ironworks in 1999.

Today several waste incineration plants operating in the Czech Republic seem to be in full compliance with the requirements of the EC legislation.⁵¹ Significant reduction of emissions from waste incineration plants can be expected due to the implementation of emission limit values and other requirements provided for in EC directives. It must be taken into account that waste incineration plants may have a significant influence on local pollution levels.

7.4 SEPARATED COLLECTION AND RECYCLING

Paper and glass waste recycling has increased among the EU member states, although this has only been a partial success since the total amount of waste paper and glass waste (container glass) generation has also increased in the same period. In the EU and Norway, the recycling of paper and cardboard increased from 36 percent in 1985 to 49 percent in 1996. The total amount of generated waste paper and cardboard consumption in the EU has also risen from approximately 41 million tonnes in 1983 to 64 million tonnes in 1996 (3.5 per cent per annum, EEA, 1999).

TABLE 13

Collection of Secondary Raw Materials in the Czech Republic⁵² (Thousands of Tonnes)

<i>Year</i>	<i>Ferrous metals</i>	<i>Non-ferrous metals</i>	<i>Paper</i>	<i>Glass</i>	<i>Total⁵³</i>
1986	491	32	363	48	977
1987	477	29	375	54	979
1988	523	32	386	49	1,034
1989	516	24	367	42	983
1990	525	28	354	38	970
1991	275	27	208	24	546
1992	300	22	183	22	471
1993	350	19	128	24	529
1994	306	16	112	18	459
1995*	1,343	42	127	18	1,534
1996*	1,203	41	124	24	1,401
1997*	1,179	38	730	19	1,314
1998*	780	28	478	10	867
1999*	1,303	41	437	9	1,398

* From 1995 also includes statistics of SPDS and APOREKO (metal scrap collectors)

Source: Union of Secondary Materials Industry (SPDS) — Association for Metal Waste Recycling (APOREKO), 2000

Glass recycling increased by almost 50 percent from 5.0 to 7.4 million tonnes per year. Nevertheless, once again the amount of waste glass for disposal was only reduced by 12 percent from 6.7 to 5.9 million tonnes, due to the increase in waste glass (EEA, 1999). It was estimated that to keep paper/cardboard and glass waste levels identical to those in 1996, recycling would have to increase by 100 percent and 90 percent respectively (EEA, 1999).

Unfortunately, within the CEECs there is so little consistent data that glass waste or recycling projections cannot be provided. During past decades, evidence from the CEECs shows that recycling capacity was based largely on the need to conserve raw materials due to a previous lack of imported products and raw materials.

In recent decades many national schemes of separate waste collection (so-called "secondary raw materials") were in operation. In many countries the reuse of containers and materials became an economic necessity and recycling was subsidised by the government. However, the markets in most countries for recycling have now been fully or partially privatised and the subsidies have been removed. Reuse and recycling rates have dropped, as was the case in Estonia where the collection of paper and cardboard had a long tradition but decreased steadily over the past ten years. The same situation developed in the Czech Republic, as indicated in Table 13.

Table 13 clearly shows that the amount collected decreased during the first half of the 1990s. Collection rates depend on the market demand for individual commodities. Despite the lack of overall national statistics, the individual collectors or associations of private companies have their own statistics.

Table 14 summarizes the content of national questionnaires describing collection and recycling of selected waste streams. Collected waste is sometimes traded regionally, e.g. Ni-Cd batteries collected in the Czech Republic are exported abroad. In some cases wastes are imported for processing, e.g. lead batteries are sent from Hungary and Croatia to be recycled in Slovenia (see case study). Second-hand commodities, like tyres or personal automobiles are imported from EU countries to CEECs. Such activities may belong to the "black market economy" or relate to criminal activities, e.g. the "export" of stolen personal cars to NIS, for which the official statistics are incomplete.

Since packaging waste was the major contributor to the growth in household waste in the CEEC as a result of the introduction of many new packaging materials, the promotion of reuse, recycling and recovery of packaging is one of the main objectives for most CEECs. In

TABLE 14

Separated Collection and Recycling in CEECs

<i>Waste stream</i>	<i>BUL</i>	<i>CR</i>	<i>EST</i>	<i>HU</i>	<i>LAT</i>	<i>LIT</i>	<i>POL</i>	<i>RO</i>	<i>SR</i>	<i>SLO</i>
Batteries		•	•	•	x	x	•	x	•	•
Biodegradable						•				x
WEEE		x					x			x
Metals	x	•	•	•		•	•	x		•
Oils		•	•	x	•	x	x		•	•
Packaging	•	•		•	•	x	x		x	x
Paper, cardboard	•	•	•	•		•	•	x	•	•
Glass containers	•	•	•	x		•	x	x	•	•
Plastic containers		•	x	x		x	x		x	
Tyres		x	x	x	•	x	x	x	•	•
ELVs		•	x			•	•		x	x

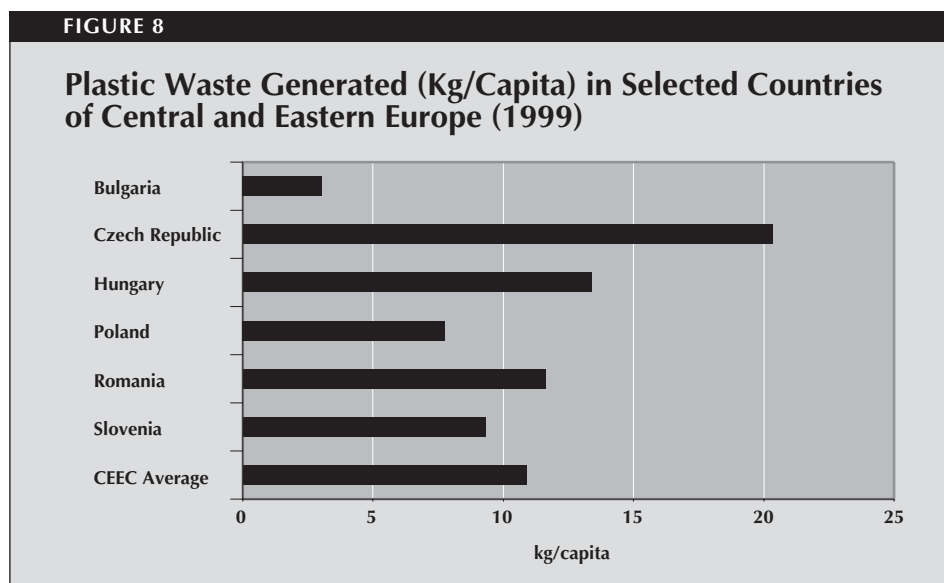
x to some extent

• developed, examples given

Estonia, for example, an economic incentive regulating this process is the introduction of a taxation system for non-recovered packaging with excise tax — the taxation scheme that was established under the Packaging Act of 1996. The Czech system EKO-KOM may serve as a good example of separated collection and recycling of packaging waste.⁵⁴

7.5 PLASTIC WASTE

Plastic waste must be dealt with in a more innovative way since the EU (as well as Norway and Switzerland) is facing an increasing amount of generated plastic waste. In 1990 the figures amounted to 13.6 million tonnes, while during 1994 this figure rose to 17.5 million tonnes (EEA, 1999). Handling and disposing of municipal waste — by far the largest source of plastic waste — in an efficient and sustainable manner can be difficult. While only 20 percent of plastic waste is subjected to material recovery or energy recovery, 80 percent is disposed of either by incineration without energy recovery or by landfilling (EEA, 1999).



Among the CEECs, once again it is difficult to make projections on any increase in the generation of plastic waste due to lack of data. However, as Figure 8 shows, there was a variation in the quantity of plastic waste generated per capita in 1999 among selected countries of Central and Eastern Europe. The average amount of plastic waste generated in the EU was about 47 kilograms per inhabitant in 1994; in this context, CEECs could face four to five times more plastic waste generated as a result of a growing economy and rising living standards.

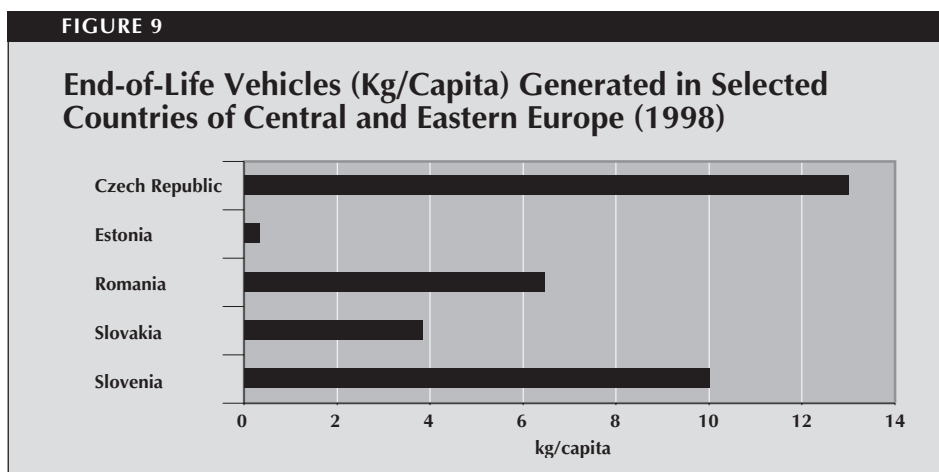
Polyvinyl Chloride (PVC) waste is a current issue discussed within the EU, where a roughly 30 percent increase of PVC waste is expected in this decade.⁵⁵ PVC incineration may cause problems with respect to increased emissions of dioxins, phthalates (softeners) and stabilisers (lead, tin, barium and cadmium compounds). It is important to carefully monitor discussions on PVC environmental issues to avoid improper disposal of PVC waste.

7.6 END-OF-LIFE VEHICLES

The present quantity of waste from scrapped cars in the EU is estimated at between 8 million to 10 million tonnes and is expected to increase.⁵⁶ Thus the situation calls for more efficient waste management practices. In particular, the waste treatment of the non-metal parts (shredder waste) is considered to be the most problematic since it is often highly contaminated and landfilling is often the only disposal performed (EEA, 1999). With the exception of a few CEECs, which have adopted a system for end-of-life vehicle collecting and process-

ing, the practices in CEE are very different. The problem is rather grave in Slovenia where there is no regulation and the reality of thousands of end-of-life vehicles abandoned everywhere is a real concern to be tackled (see Figure 9).

As the ELVs case study prepared during the Project demonstrates, a successful solution to the problem requires a legal framework introducing “minimum technical standards” for dismantling and shredding of ELVs. The market for spare parts and scrap metals, plastics, glass, scrap car batteries, etc., has a positive influence on the economy of recycling companies. Accreditation or authorisation (permits) of shredder operators seems to be a first step



as well as improvement of car registry and the introduction of product or recycling charges. For details see the case study “Management of End-of-life Vehicles in Poland” on <www.eurowaste.org> or its executive summary in Annex II of this final report.

7.7 WASTE OILS

Waste oils are a specific waste stream that have been dealt with closely, allowing the process of EU standards implementation to be analysed. The requested data was based on the questionnaires for the member states reporting on the implementation of certain waste management directives.⁵⁷

Specific regulations transposing Directive 75/439/EEC on waste oils disposal into national legislation exist in three countries: Bulgaria, Estonia, and Slovenia. The other countries have provisions for waste oils included in general regulations only. Waste oils are usually considered as hazardous waste.

National limits for PCB/PCT content in regenerated oils (which are reported) exist in eight countries where waste oils collection is a current practice. There are no limits reported for Hungary and Latvia. Specific national limits for air pollutants in waste oils incineration are legally established only in Estonia, Lithuania and Bulgaria.

Awareness and promotion campaigns for waste oils collection and recycling were reported from Poland and Slovenia. No subsidies are granted to companies that collect or dispose of waste oils. Collection is governed by market rules in Poland and Romania. Latvia and Lithuania have no reported organized collection, but only local initiatives functioning under market rules. Functional collection systems are reported in the Czech Republic, Estonia, Latvia, Slovakia and Slovenia.

7.8 LEAD BATTERIES

Among other separately collected specific wastes, like metal scrap, paper and cardboard, lead batteries are the most common and, as demonstrated by the Slovenian case study, an interesting waste commodity.⁵⁸

In several CEECs there are similar private sector initiatives under which waste lead batteries (from cars, industry, telecommunications, railways, warehouse vehicles, etc.) are collected and dismantled. The lead is eventually refined and sold, or used in manufacturing.

Such systems are reported in Bulgaria (rather obsolete installations), Estonia (only collection and dismantling), Hungary (no details), and Slovakia (no details). In the Czech Republic, Poland and Slovenia, there are domestic capacities for refining the lead extracted. The collection rate in the Czech Republic is about 80 percent. In Poland, there are two installations reprocessing lead batteries utilising an established collection system.

It can be concluded that in the countries with suitable metallurgy, car batteries are collected without special product charges or refund fees. Nickel-cadmium and other types of small batteries and accumulators are collected in limited amounts and often exported, e.g. the export of alkaline batteries from the Czech Republic to Sweden.

7.9 PACKAGING AND PACKAGING WASTE

The questions referring to the transposition of Directive 94/62/EC on packaging and packaging waste into national legislation yielded a broad spectrum of answers. Specific new acts transposing this directive have been passed in Estonia, Hungary and Slovenia. Romania has an old regulation, which only partially satisfies the directive requirements. Partial transposition of the directive into the general waste act was completed in Bulgaria, Latvia, Lithuania, Poland and Slovakia.

Measures taken in respect to packaging management were reported from nine countries (no information from Bulgaria). Limits for heavy metals in packaging were included in legal acts in the Czech Republic, Estonia and Slovenia. Some of the other countries have included such limits in their draft regulations (Poland).

A large diversity of responses resulted from the description of packaging and packaging waste collection systems. Several functioning systems are based on market instruments, as reported for Bulgaria, Poland, Romania and Slovakia. Refund schemes for some beverage glass bottles are still in place.

In some countries packaging waste is treated as municipal recyclable waste and municipalities take care to place special containers for collection (Estonia, Lithuania). The practices in Hungary can be included in the same category, where packaging waste is collected by a consortium of communal service enterprises; this activity is financed by product charges and occasionally from the Environmental Protection Fund.

The Czech Republic and Latvia have collection systems based on agreements signed between the MoE and voluntary associations of companies that produce or use packaging. The collection system is organized and financed by the associations of private subjects like Czech EKO-KOM or the Latvian and Hungarian Green Dot. Measures such as the refunding of product charges or tax reduction (Latvia) are in force to stimulate collection. Description and analysis of EKO-KOM is the subject of a case study (see Annex II).

7.10 NEW PROBLEMS

New problems were identified as a result of society's attempt to solve other environmental issues such as water and air pollution. These solutions have given rise to new problems such as sewage sludge, residues from the cleaning of flue gases, mining waste, biodegradable waste, construction and demolition waste, WEEE and PVC-content waste.

In the case of sewage sludge, thousands of treatment plants for urban wastewater constructed over the past decades reduced the pollution of lakes, rivers and coastal waters, but they also represented the source of a rapidly growing waste problem — sewage sludge.

The annual production of sewage sludge in the EU was estimated as 7.2 million tonnes of dry solids in 1992. This amount is expected to increase by 50 percent to 11.2 million tonnes by 2005. The expected increases are a challenge for waste management and the choices of treatment and disposal methods will have large economic and environmental implications (EEA, 1999). Although such problems are not as identifiable among the CEECs, mostly due to the lack of consistent data, the example of sewage sludge generation in Estonia is raising concerns. Sludge generated by Estonian wastewater treatment plants increased from 246,000 tonnes per year in 1997 to 421,000 tonnes per year in 1999, an increase of nearly 71 percent in just two years.

Amendment to Directive 86/278/EEC on sewage sludge use is expected.⁵⁹ This revision should permit sludge to be used not only as fertiliser, but also in forestry and land reclamation. The new directive should introduce not only stricter limits for agricultural use (new limits for heavy metals and chromium) but allow more flexible treatment since not all uses of sludge require the same degree of treatment.

The area of mining waste (waste from prospecting and extraction, treatment, and storage of mineral resources) is also under focus, as a possible “mining directive” is being discussed.⁶⁰ The working document examines a broad spectrum of issues, e.g. mixing hazardous, non-hazardous and inert mining waste, disposal of liquid mining waste, disposal of other waste in mining waste sites, treatment of mining waste before disposal, etc. There will be an obligation of reserve funds ensuring closure, restoration, reclaiming, after-care, etc., including the safe disposal of mining waste.

The commission is preparing recommendations for construction and demolition waste management improvements. Prevention should be the preferred method, followed by recycling and energy use with landfilling as the last option. The hazardous construction components containing asbestos, lead, mercury, cadmium, PVC, halogenated compounds, etc., will have to contain a reduced share of hazardous (contaminated) construction and demolition waste. Reuse/recycling targets higher than 50 percent can be realistically achieved by 2005. Construction and demolition waste should not be landfilled but reused as inert material (closure and reclamation of landfills, construction of roads, dams, etc.).

At present, a new draft directive on WEEE is being prepared by the commission, which would allow private households to return WEEE free of charge. In some EU countries a refund fee or product charge has been introduced to finance collection and reprocessing. In practice, producer (distributor, importer) responsibility is applied. When supplying a new product to the market, retailers may offer to take it back provided that the waste is free from contamination. Equipment includes domestic appliances, electrical and electronic instruments, PCs and IT, household appliances, medical equipment, etc.

Waste, on the market before a directive comes into force will also be covered. WEEE has to be dismantled in such a way that no fluids, CFCs, etc. leak. The directive will establish the targets that producers will be obliged to meet in five years. Whatever system is implemented, producers would be jointly responsible for historical waste.

Special attention has to be paid to PVC waste because of its high content of organically bound chlorine, stabilisers based on lead, cadmium or tin compounds and phthalate plasticisers, which create problems when landfilled or incinerated. PVC production in the EU (1994) was 4.8 million tonnes and is increasing rapidly (EEA, 1999). The use of PVC has risen in recent decades mainly in buildings, electric insulation, car interiors, etc.

At present the main waste route in the EU for all types of PVC is landfilling, and about 2.6 to 2.9 million tonnes of PVC are landfilled each year.⁶¹ Only three percent of the total PVC wastes are recycled and about 0.6 million tonnes are incinerated, which represents about 10 percent of the plastic incinerated. During incineration large quantities of hydrogen chloride (HCl) are formed and it is estimated that about 40 percent of dioxines formed during incineration of solid municipal waste originate from PVC pyrolysis. There are two types of PVC, hard — with a large content of chlorine — and softened — with a high content of phthalates, which are leachable.

In the Resolution on the Green Paper on PVC, the European Parliament recommends examining health and waste management aspects related to PVC. The use of cadmium and lead-based stabilisers should be banned and the search for substitute softeners should be initiated. The internal discussions on PVC are expected to yield an EU regulation on PVC use and disposal.

7.11 CONCLUSIONS

The disposal structure in the CEECs is not adequate in respect to the community strategy for waste management,⁶² which defines the following hierarchy of disposal routes:

1. Waste prevention;
2. Waste recycling and reuse; and
3. Safe disposal of non-recoverable residues.

Besides waste prevention, which will be discussed in following chapters, waste recycling and reuse is insufficient, and even the last priority — safe disposal — is not met in all cases. There are a number of unsafe landfills and incinerators of industrial waste which do not meet EU emission limits. Information on technical details of large landfills and disposal facilities are not available and probably do not exist in an accessible form, e.g. central electronic database.

Incineration of municipal waste combined with energy recovery is insufficient in CEECs and the waste is mainly landfilled. It should be stressed that total incinerator numbers in the EU, Switzerland and Norway have grown from a low point of 275 in 1997 to 304 in 2000, an 11 percent increase.⁶³ Total processing capacity grew by six percent — from 47 to 50 million tonnes over the same period. About 96 percent of plants recovered energy in 2000, and total energy recovered grew from 43 terawatt hours (TWh) in 1997 to 50 TWh in 2000.

The extent of recycling (material use) is also insufficient despite numerous initiatives by the private sector. ELVs, car batteries, waste oils and tyres are frequently collected and used as a “secondary raw material” or fuel, without a legal framework protecting human health or environment. In the Czech Republic, for example, waste oils from car repair shops were often used for home heating (small boilers) instead of heating oil. On the other hand, previous collection systems that functioned for decades and were aimed at substituting expensive raw materials either ceased to exist or lost their effectiveness (i.e. collection rates decreased). New problems are arising with strengthened linkages between the global economy and the national economies of the CEECs.

In the following paragraphs, we will try to register our conclusions on the inadequacies of disposal structures to handle waste on the basis of a pressure-state-response (PSR) model. As proposed in the methodology, a pressure-state-response model of waste management in

TABLE 15

Key Problems

<i>Key Problem</i>	<i>Pressure</i>	<i>State</i>	<i>Response</i>
Large volume of production waste, growing volume of municipal waste	Landfills — loss of better land use options, loss of biodiversity, excessive transport.	Growing number and area of landfills.	BAT and investment in production area, use of better raw materials (investment).
High consumption of materials and energy	Excessive mining, bulk transport, export of raw materials and fuels.	Unnecessary emissions, landfill methane emissions, ground water pollution.	Prevention, reuse, recycling (investment, economic instruments).
Contamination of environment by hazardous waste	Large share of improper landfilling.	Water and air contamination, toxic time bombs.	Technical standards on landfilling and other disposal options, classification, monitoring, enforcement, inspection.

CEECs can be used to link major key problems which have impact on the environment and health, with rational and adequate actions by society. Suitable indicators are usually proposed to measure the extent of pressure (human activity), state (impaired environment or human health) and societal response (regulation, investment, enforcement etc.).

Describing in short the generation of waste and present disposal capacities and techniques available in CEECs, we can try to draw a PSR matrix for the whole area, keeping in mind problems specific to individual countries. The resulting key problems are described in Table 15.

The disposal structure cannot solve those problems that are characterised by the enormous generation of production waste. First, the structure of the national economy must be transformed to be less dependent on energy and material. Building expensive end-of-pipe

solutions to obsolete and inefficient production technologies is the worst solution. In such a situation, it is inevitably necessary to invest into best available production technologies, attract foreign investors and develop economic activities that cause less pollution.

Evidently, there is a large potential for the recycling industry, not only on the national but also on the regional scale. Small economies, as found in most of the CEECs except for Poland and Romania, cannot improve their waste management independently. Waste management strategies should also be integrated with other sectors' policies, but even more importantly, with other national policies on the regional level. According to the Directive on Waste, national plans should be used for the development of a disposal and recycling regional structure (EU wide), which would allow the more efficient transportation of waste and raw materials.

Hazardous waste management plans should be viewed as most important at this stage. In many CEECs there is no safe infrastructure for hazardous waste disposal. In spite of the fact that hazardous waste is not visible — like the plastic bottles from soft drinks that many people find so irritating — unsafe dumps of hazardous waste are time bombs presenting a risk to many future generations. Management of hazardous waste requires efficient monitoring and enforcement.

CEECs should take advantage of its lower volume of solid municipal waste generated in comparison with the OECD average. The selected collection of paper and cardboard, scrap metals, WEEE, biodegradable and hazardous components of solid municipal waste, which also contains a certain share of small business waste, should start as soon as possible, with the simultaneous support of the private sector. In actuality, private initiatives already exist without government subsidies or the redistribution of centrally collected taxes and charges. The application of producer responsibility, as in the case of the Czech EKO-KOM, leads to more efficient results than public sector involvement. Activities like the separate collection of packaging, tyres, or batteries, ELV disposal, composting of biodegradable waste etc. may create thousands of new jobs.

Beyond common problems discussed above, individual CEECs will have to identify the specific starting point of their strategic planning. In the following chapters, we will focus on the applicability of economic instruments in the strategic planning of waste management in EU pre-accession conditions. It is evident that new problems emerging at the EU level (see the overview above) must be taken into account before key problems can be solved. There are possible synergies between individual solutions, and proper planning may therefore be the way to utilise them efficiently instead of repeating well-known mistakes.

8. Strategic Planning for the Waste Sector

Before assessing national strategic plans in the waste sector, the Project team discussed a general structure of the waste management strategy/plan in order to establish a suitable benchmark. A working paper was drafted, based on the general principles of strategic planning and methodology recommended in the Handbook on the Implementation of the EC Environmental Legislation.⁶⁴ The paper (see <www.euowaste.org>) was drafted in October/November and sent to the Project team members for their comments, serving as a starting point to discussions on methodology during the validation meeting. Using the general benchmark (value model) described in the paper, the national correspondents were able to report in a uniform way on those strategic documents that existed, mainly in national languages.

As a part of the project, basic information on the content of national waste management plans or strategies (WMPs) and short-term implementation plans were carried out using a standardised questionnaire for data collection, available at the Project Web site. They are based on a checklist recommended in the Handbook on the Implementation of EC Environmental Legislation (European Commission, 1999). As not all CEECs have prepared the WMP as a single document focusing only on waste management, the Project team also took into consideration existing national environmental policies, EU approximation strategies and other relevant documents. Detailed analysis of the content of the questionnaires is given elsewhere.⁶⁵

The existence of a waste management strategy or plan was investigated on the basis of relevant documents describing this strategy, and subsequently on the basis of a checklist which dealt with the content of a waste management strategy.

This checklist included: a system description, objectives, instruments and enforcement, resources management, political support and an implementation plan. The questionnaire included separate questions on sub-national waste management plans, national waste management legislation (including legislative instruments) and economic instruments. A specific part of the questionnaire dealt with investment.

The general data (Table 16) shows population and overall economic performance (represented by the GDP indicators) in the CEECs covered by the study. As all these factors also have a significant influence on waste management it is necessary to keep them in mind when comparing countries. Detailed information on the general background can be found at the Project Web site.

8.1 BULGARIA

Bulgaria's waste management strategy is outlined in four documents: the National Development Plan until 2006 (sector programme "Environment"), the "Environment-health" National Action Plan, the ISPA Strategy Paper for the Environment, and the National Waste Management Program. These documents were issued in 1998 or 1999 and are available to the public. The checklist indicated that almost all areas were at least partially covered; it also included a chapter on instruments as well as an enforcement and implementation plan.

It was indicated that there are specific legislative instruments for municipal waste, hazardous and non-hazardous waste, waste batteries and accumulators and waste oils. As regards economic instruments, the municipality sets municipal waste user charges according to the value of the property (0.1-0.4 percent of the value). By expert estimation⁶⁶ this means an average of EUR 1.8 per inhabitant. Charges for businesses are higher, with revenue going into municipal budgets. Product charges related to batteries and tyres are EUR 0.05-0.5 per kilogram, and the National Environmental Fund undertakes revenue collection.

TABLE 16

Background Socio-economic Characteristics of CEECs (1999)

Country	Population (millions of inhabitants)	GDP ⁶⁶ per capita (thousands of EUR)	Urban population (% of total)	GVA ⁶⁷ by industry (%)	GVA by services (%)
Bulgaria	8.19	4.7	69	25	50
Czech Republic	10.3	12.5	75	35	52
Estonia	1.44	7.7	69	21	66
Hungary	10.1	10.7	64	28	62
Latvia	2.44	5.8	69	23	65
Lithuania	3.70	6.2	68	24	57
Poland	38.7	7.7	65	28	59
Romania	22.5	5.7	56	30	48
Slovakia	5.40	9.8	57	28	62
Slovenia	1.98	15.0	50	32	58

It was reported that total investment into the waste sector was about EUR 45 million. However, it is estimated that in order to meet EU standards this will have to amount to EUR 3 billion. The main categories of investment are landfills of municipal and hazardous waste, with some additional investment necessary for incinerators, and collection and recycling schemes. Total revenues from the above charges generate about EUR 20-30 million annually. It is evident that these revenues do not cover all investment needs. For a more detailed analysis see the paper by Chmelik and Geuss on the Project Web site.

8.2 CZECH REPUBLIC

The waste management strategy of the Czech Republic is dealt with in two basic documents: State Environmental Policy (most recent version, January 2001) and Implementation Plan, Chapter 22 "Environment." Both documents are available to the public.

Additionally, the newly adopted Waste Act establishes a national waste management plan revised periodically and accompanied by regional waste management implementation plans. The first national management plan has to be prepared by the end of 2002. The act lays down the content of this plan, an obligatory part of which will be submitted to the government and subsequently published in the Collection of Acts.

The recently approved Waste Act⁶⁹ is a part of legislation that will come into force starting January 1, 2002. Specific legislative instruments are take-back obligations for waste batteries and accumulators and a total ban on the landfilling of Pb and Ni-Cd batteries. A take-back obligation for waste oils, waste tyres (together with a ban on landfilling) and some packaging and packaging waste (together with targets for recovery and recycling) has been introduced. The landfilling of sorted paper waste and tyres is prohibited.

In the area of economic instruments, disposal charges and product charges are used. The disposal charge is divided into two parts — a base rate, used as a cost recovery for all waste and what is called the "risk rate" (paid in hazardous waste cases only), used as revenue for the State Environmental Fund. The base rate is collected by municipalities and is used as part of the municipal budget. Landfill operators are obliged to create a financial reserve (deposit) for the costs of closing down and after-care.

The act stipulates a gradual increase of the rates. Thus the base rate will increase from EUR 5.7 per tonne in 2002-2004 to EUR 14.3 per tonne after 2008 for solid municipal waste. The base rate for hazardous waste will rise from EUR 31.4 per tonne in 2002-2004 up to EUR 48.6 per tonne after 2008. The "risk rate," at EUR 57 per tonne in 2002-2004 will increase to

EUR 128.6 per tonne after 2008. There are also payments on a per capita basis established by relevant municipalities. These should also cover costs connected to waste management (landfill, incineration).

As the total waste generated annually amounts⁷⁰ to about 40-45 million tonnes, including about 1 million tonnes of hazardous waste,⁷¹ the total revenue for municipal budgets will be up to EUR 24 million annually in 2002-2004, if the present high share of landfilling is maintained. The revenue of the State Environmental Fund will be about EUR 10-15 million annually.⁷²

The new Waste Act establishes product charges on the basis of the producer's responsibility to ensure the take-back and recycling of specific product waste such as packaging waste. A deposit scheme for the recycling of glass beverage bottles plays a decreasing role as new non-returnable packaging (mainly PET bottles) penetrates the Czech market. For a more detailed analysis see the paper by Chmelik and Geuss on the Project Web site.

8.3 ESTONIA

The waste management strategy and implementation plan is included in the Estonian National Environment Strategy and Estonian National Environmental Action Plan. Both documents were issued in printed form and should also be available to the public on the homepage of the Ministry of the Environment of Estonia. The checklist indicates that a system description, objectives, instruments and enforcement, and an implementation plan are dealt with in these documents sufficiently, while resource management and political support are not. The strategic goals of waste management strategy should be achieved by:

1. Support of sustainable use of raw materials;
2. Prevention of waste generation, stimulation of recycling;
3. Reduction of environmental damage caused by waste; and
4. Reduction of areas contaminated by waste and improvement of waste management as a whole (especially hazardous waste).

The priorities are: reduction of waste generation, promotion of recycling, use of biological processes (composting), and the environmentally friendly and safe disposal of waste.

Quantitative targets are set for the years 2000 and 2010. With regard to the 2000 targets, the following can be considered as the key issues:

- To stabilise waste generation in industry and households at the 1995 level;
- To increase the degree of recycling to 30-40 percent;
- To establish new landfills and close down old dumps that are not in compliance with EU technical standards;
- To introduce a hazardous waste management system; and
- To dispose of 40 percent of municipal waste in accordance with environmental and health protection requirements.

Key targets for 2010 are the following:

- To improve disposal methods and the use of oil-shale processing waste;
- To further increase the share of recycling;
- To stabilise municipal waste generation (250-300 kilograms per year per capita);
- To optimise the number of municipal landfills;
- To treat waste according to accepted environmental and health standards; and
- To increase coverage of waste management services in all areas of the country.

Both short-term and medium-term priorities have been influenced for the better by transposed EU legislation along with improved national environmental and health protection, increasing quality of landfills (new landfills meeting stricter technical standards, the closing down or improvement of old ones) and by the establishment of an efficient network for inspection and information. In the medium-term, the signing of voluntary agreements in the area of waste management (specification of waste volume to be recycled) is planned between the Ministry of Environment, the Association of Enterprises and large companies. For the year 2000, the establishment of a competent authority and a relevant local coordination centre within the programme implementing the Basel Convention is planned.

Because of waste management legislation, sub-national waste management plans should be adopted according to following schemes:

- Regional waste management plans one year after the adoption of the national waste management plan (revised every five years);
- Municipal waste management plans as a part of the overall management plan (taking into account the regional waste management plan).

Several regions have already completed their waste management plans but only one of them has legal status and public availability (published as a legal document).

Currently, the legislation under preparation mainly focuses on the transposition of EU directives. The specific legislative instruments in force include: the separate treatment of hazardous waste, prohibition of the production, import, export, sale and use of some types of batteries (listed in the legislation), the treatment of some types of metal scrap (list of metal wastes to be considered as hazardous), requirements on the collection and disposal of waste oils, requirements regarding packaging, PCBs/PCTs, sewage sludge and radioactive waste.

In the area of economic instruments, a landfill tax will be introduced together with a non-compliance fee for municipal waste. The revenue will be used as part of the government budget earmarked for environmental purposes, and a pollution charge will be used only if the waste is not properly disposed of. There is also a disposal tax and a non-compliance fee for hazardous waste.

In the case of batteries there is a payment for collected car batteries, paid by a waste management company, and a similar situation exists for metal scrap where the recycling companies pay for collected scrap metal. There is a tax/charge on packaging waste, paid by users and importers of packaging. The excise is paid for each unit and volume of the packaging of alcoholic (1997) and non-alcoholic (1999) beverages; 50 percent of the revenue goes into the central budget, 50 percent is used for financing the collection and disposal systems of packaging waste. This product tax/charge is not paid for packaging when the recycling rate is over 60 percent.

These instruments are supplemented by several voluntary agreements (industrial solid waste, use of chemicals, effective use of resources) and an educational campaign on sustainable waste management.

From the point of view of investment, the total volume of finances going into waste management was EEK 95.4 million (EUR 2.7 million) in 1998 and EEK 52.2 million (EUR 1.5 million) in 1999. An estimation of total investment into the waste sector is not available yet. Preliminary data, however, indicates that expenditures connected with the closure of old landfills and construction of new ones will make up the largest share of the total figures. For more detailed analysis see the paper by Chmelik and Geuss on the Project Web site.

8.4 HUNGARY

In Hungary, the waste management strategy is covered by the National Environmental Protection Programme, which is issued as a publication and is thus available to the public. No specific documents focusing exclusively on waste management have been issued in Hungary, though based on the checklist, the area of waste management is covered relatively well by this single document. The National Environmental Protection Programme contains objectives and conditions for key areas of policy implementation; among key sectors of the environment, it includes tasks for the waste management sector. Provisions and schedules must be elaborated on an annual basis and realisation of the programme is prepared in coop-

eration between the central government, local governments, NGOs and institutions in the scientific and economic spheres. There are no sub-national waste management plans reported at the moment.

Part of the current waste management legislation already covers some areas of the *acquis*. New legislation, which is under preparation, provides mainly for the transposition of EU legislation into national acts and decrees. In the area of legislative instruments there are provisions for hazardous waste; regulation in the area of batteries and accumulators, and biodegradable waste is under preparation.

Municipalities set user charges individually; their objective is cost recovery, and the revenue goes to waste collection companies. There is also a hazardous waste non-compliance fee. The amount paid depends on quantity and character of the waste, and revenue is earmarked for the environment. The deposit refund scheme in Hungary covers some alcoholic drink bottles, plus glass and PET bottles for soft drinks.

Product charges have been introduced in Hungary on accumulators, packaging materials, tyres, refrigerators and refrigerants with revenue going into the central budget.

The information provided in the questionnaire is not detailed enough for the development of any strategic approach analysis in this area. It declares that relevant objectives related to the EU directives have to be met, but no estimation of costs or investment is made publicly available.

8.5 LATVIA

National waste management strategy and implementation plans are dealt with in two documents: the National Municipal Solid Waste Management Strategy for Latvia and the National Hazardous Waste Management Strategy for Latvia. Both documents are available to the public. The checklist indicates that all waste management areas are well covered; the missing points are voluntary preventive instruments (agreements, EMAS, eco-labelling, cleaner production), commodity programmes, product policies and waste stream strategies, and SEA (public participation in the preparation of strategy).

Taking into account forecasts for population and economic growth the strategy proposes several scenarios concerning waste production and composition. No references to other policies are made. The most important objectives in this strategy are:

- To reduce environmental impact caused by illegal dumping;
- To reduce environmental impact caused by landfills; and
- To prevent waste production and increase reuse and recycling.

The implementation framework does not specify any legislative instruments but it presents a plan for necessary legislative changes (in terms of new laws, amendments to the existing ones, etc.) up to 2010. There are also no specific provisions related to the use of economic instruments in this strategy. The focus of the programme is on collection systems and technical and operational standards for hazardous waste disposal in sanitary landfills. No sub-national waste management plans are being prepared in Latvia.

From the legislative point of view, current legislation already covers some EU directives. A new waste management law is under preparation and it should serve as a framework for legislation.

In the area of economic instruments, there is a product charge on batteries and accumulators with revenue earmarked for the environmental fund. A similar charge is used in the case of disposable containers and packaging, tyres, CFCs, light bulbs and lubricants. A disposal charge is used with rates based on toxicity of the waste. The central environmental fund receives 40 percent of the revenue with the remainder going to local environmental funds. Waste non-compliance fees are applied for solid waste dumping, and the revenue goes to the state environmental fund. No data on investment is available.

8.6 LITHUANIA

In Lithuania, the waste management strategy is covered by the Outline of the National Waste Management Strategy and the Action Programme, issued in 1999 and available to the public.

National legislation in force already covers some EU directives. Draft legislation focuses mainly on the area of packaging waste and landfills. Specific legislative instruments regulate municipal waste, hazardous and non-hazardous waste, tyres and animal bones.

In Lithuania there are user charges on municipal waste set by individual municipalities; these include hazardous and non-hazardous disposal charges. There is a product charge on batteries and accumulators, packaging and packaging waste, and tyres. Information regarding the total revenue and use of this revenue is not available. Also lacking is information about previous and proposed investment to meet EU standards. For a more detailed analysis, see the paper by Chmelik and Geuss on the Project Web site.

8.7 POLAND

The Polish national waste management strategy and implementation plans are elaborated in two documents: Strategy for Balanced Development in Poland till 2025 and the Second Ecological Policy of the State. Both documents are available to the public. The checklist indicates that most of the topics are partially covered, while the national characteristics, objectives, resources management and implementation plan are dealt with sufficiently.

Waste management is covered in the Second Ecological Policy of the State in the "Waste Management" chapter, in which the following issues are set as a priority:

- To minimise waste production and increase reuse; reuse and recovery are the main objectives;
- To complete adjustments of Polish legislation to EU standards and to prepare a waste management strategy regarding national, regional and local limits for landfilling as a short-term priority;
- To implement waste management plans and create a collection system as the medium-term priority; and
- To reduce the amount of biodegradable waste landfilled, to achieve successful removal of old landfills as the long-term priority.

There are no sub-national waste management plans available. Specific legislative instruments provide for municipal waste, hazardous and non-hazardous waste and wastewater treatment sludge.

As for economic instruments in Poland there are both disposal charges (differentiated between hazardous and non-hazardous waste), and landfill charges as revenue to environmental funds (about EUR 41 million in 1999). Municipalities base user charges (municipal waste) on the volume of waste and adjust them annually. No product charges/taxes are reported.

8.8 ROMANIA

In Romania some elements of waste management strategy and implementation plans are included in the following documents: Strategy for Environmental Protection for 2000-2020, National Environmental Action Plan, Report on Environmental Quality in Romania, Governmental Urgency Ordinance No. 78/2000 on the waste regime, ISPA financing strategy and programme, international projects (PHARE) and the national research programme *HORIZON 2000*. The general public has access to all the documents. Our checklist indicates that a major share of the strategy was not included in these documents; only a general description is given and some enforcement instruments and resource management are covered partially.

However, the following objectives can be extracted from the aforementioned documents:

- To reduce the quantity of waste produced;
- To reduce the toxicity of waste;
- To improve waste collection;

- To organise the collection of recyclable waste and to increase the overall rate for recycling;
- To close dump sites and ensure land remediation;
- To create a new system for hazardous waste management;
- To improve monitoring and control systems;
- To stimulate market competition in waste management; and
- To introduce incentives to foreign investors and national capital to enter waste management activities in Romania.

The national legislation in force already covers selected areas of EU directives. The new legislation, which is under preparation, mainly focuses on the transposition of other directives into national legislation.

Specific legislative instruments include the treatment of municipal waste, hazardous and non-hazardous waste, metal scrap, packaging and packaging waste, paper and cardboard, and waste tyres. Measures to regulate waste batteries and accumulators, and waste oils are under preparation.

User charges for municipal, hazardous and inert waste were introduced. The revenue is used for cost recovery and as a source of investment. A disposal charge for packaging, waste paper, cardboard and tyres was also reported. The revenue is used to run the collection and recycling network. A deposit refund scheme is proposed for waste oils and waste batteries.

There is no data on investment expenditures to date, but compliance costs for the waste management sector are estimated at about EUR 6 billion. Waste management is one of the priority areas of the overall investment strategy, with the following priorities:

- To construct, modernise and expand urban landfills in large cities;
- To construct secured industrial waste deposits, especially regional deposits for hazardous waste;
- To implement EU standard incinerators for clinical and other hazardous waste; and
- To establish a network for the separate collection of recyclable waste in selected municipalities.

International funding is reported as an important aspect of waste management strategy in Romania and some investment has already been made. It is expected that international investment, both through international funds or private foreign investors, could help to promote participation of domestic capital in waste management projects. Due to the limited performance of the national economy, present revenues coming from economic instruments seem to be inadequate in consideration of the above investment needs.

8.9 SLOVAKIA

Waste management is covered by the following documents: Waste Management Programme for Slovakia, Implementation Plans for Individual EU Directives, Waste Management Programme for Slovakia till 2000, and Recycling Strategy Paper Towards the Year 2000 in Slovakia. All documents are available to the public.

Our checklist indicated that the instruments and enforcement are covered in a mediocre fashion, though with relatively well-defined objectives.

In Slovakia the regional and district authorities have to release their regional/district waste management programmes within two months of the release of the national waste management plan. Waste generators (defined on the basis of a volume and type of waste produced) are also obliged to release their own waste management plans in a given period after the regional/district waste management plan is issued.

There are no specific legislative instruments in force, but most types of waste are covered in several laws or regulations. As for economic instruments, there are user charges for municipal waste (cost recovery principle) and waste disposal charges for hazardous (EUR 6.4-82 per tonne) and non-hazardous waste (EUR 0.23-2.3 per tonne). Revenue is divided between

the national environmental fund and municipal budgets. The system is supplemented by non-compliance charges with revenue going to an environmental fund; there is also a deposit refund system for bottles.

Data is available about investment made in the waste management sector as follows: EUR 4.4 million in 1994, 3.5 in 1995, 5.8 in 1996, 3.2 in 1997 and 3.1 in 1998. Estimations on necessary investment to meet EU standards depend on which forecast scenario is used, the difference being in compliance deadline dates to EU standards; the highest estimate is about EUR 2 billion.

The main priorities in the national investment strategy are the following:

- Hazardous waste incineration;
- Safe landfilling of hazardous waste;
- Municipal waste incineration;
- Collection and recycling of batteries, collection of oil;
- Packaging recycling;
- Treatment of tyres; and
- Solidification of sludge.

8.10 SLOVENIA

The waste management strategy is covered by the Strategic Guidelines of the Republic of Slovenia for Waste Management, which is fully available to the public. The document covers all areas quite well.

There are general (e.g. the reduction of waste production and increase of recycling and reuse) and quantitative objectives (reduction of municipal waste by 35 percent by 2000, 55 percent by 2010 with the 1995 level as the base year). There are also targets for inert mineral waste, construction waste and industrial waste in terms of reduction, material recycling and heat recovery.

In Slovenia three regional waste management plans have already been implemented; the public availability of information on these plans is, however, limited (i.e. the plans are not published). Legislative instruments cover municipal, hazardous and non-hazardous waste, batteries and accumulators, biodegradable waste, waste oils and packaging waste.

In the area of economic instruments there are user charges (municipal waste), while cost recovery, and taxation of municipal, hazardous and non-hazardous waste are under preparation.

Overall investment figures are not available. The largest amount was spent on landfills of municipal and hazardous waste (data for incineration not available) with significant investment into collection and recycling schemes. Investment is expected to follow similar priorities with the highest share going to landfills and incinerators.

8.11 CONCLUSIONS

Based on the above analysis the following general conclusions can be drawn:

- Only a limited number of countries have drafted and adopted national WMP independently of the EU accession process. This can be explained in relation to the inapplicability of old command-and-control planning procedures, so different from the approaches of modern strategic planning. The lack of human resources experienced in this modern type of planning and suitable methodologies is a serious drawback. In this respect, multilateral (Phare projects) or bilateral cooperation should serve as a transfer of know-how. The cooperative efforts between the Czech Republic and the Netherlands on hazardous waste planning (SENTER Project, 2001-2002), based on the open planning procedure used in the Netherlands, which involves a wide group of stakeholders, can be given as a positive example.⁷³

- At present, detailed planning is limited by the lack of reliable monitoring mechanisms based upon the reporting obligations and the permitting of waste generators, collectors and the operation of disposal industries. Additionally, the recent harmonisation of waste definitions and the adoption of the European Waste Catalogue are leading to a situation where time periods are limited to a few years and for this reason planning is taking place with relatively large uncertainty. Moreover, it is difficult to use predictions based upon economic scenarios, production or consumption statistics, etc., because of turbulent economic development (ongoing economic transformation, privatisation of public utilities, greater vulnerability of relatively small national economies, etc.). Short, turbulent time periods do not allow for the use of statistical models.⁷⁴
- One or more waste management plans should be prepared as an obligation made clear by waste directives (Directive 75/442/EEC, Art.7, Directive 91/689/EEC, Art. 6). The main purpose of the planning is to adopt the EU waste management strategy, and cooperate with other member countries in the area of waste disposal. EU candidates should use their waste management plans to enhance international cooperation.

Comparison of the extent to which WMP structures meet the recommended “benchmark structure,”⁷⁵ is given in Table 17. The “ideal” structure for the plan was one of the subjects of discussion during the validation meeting of the Project team and invited experts. On the basis of individual experts’ judgements (questionnaires based on pair comparison) all elements are viewed as equally important. This shows that the issues covered in the Handbook on the Implementation of EC Environment Legislation are truly the key ones.

The fact that WMP elements are mainly dealt with in the sections of several different documents should point out the necessity of preparing integrated national WMPs to serve all stakeholders (central governments — including ministries of industry, trade, health, transport, finance, etc. — local governments, waste generators, collectors and disposal industries)

TABLE 17

Frequency of Coverage of the Main WMP Elements Across CEECs

<i>Main element of the plan</i>	<i>Coverage (%)</i>	<i>Sub-elements identified by the Project team</i>
Description of the national waste management sector	67	Basic definitions, waste classification, legal framework, main national characteristics, analysis, main problems, trends and scenarios, integration with other policies, monitoring and assessment, indicators.
Objectives (quantifiable targets, deadlines)	68	Overall waste management hierarchy, targets for collection, landfilling, recycling, etc., overall deadlines to meet the targets (including indicated transition periods).
Instruments and enforcement	46	Legislative and economic instruments (disposal charges, product taxes, take-back payments, etc.) voluntary preventive measures, subsidies for collection systems and recycling, technical standards, BATs, inspection and monitoring systems, commodity programmes, product policies, specific waste stream measures, etc.
Resource management	47	Human resources (institutional and organisational arrangements, training), financial strategies and plans, research and development, use and improvement of existing disposal capacities.
Political support	46	Legally binding WMPs, public participation, awareness and educational campaigns, access to information.
Implementation plans	54	Definition of key tasks, allocation of responsibilities, decision points and milestones, timetables, detailed resource/cost estimates.

as guidance for their strategic planning. In this respect, an open planning procedure,⁷⁶ which would involve all major stakeholders in early stages of plan drafting, may reduce problems that occur when the plan is submitted to the government or parliament.

It should be kept in mind that the general public (e.g. represented by environmental NGOs) must have the opportunity to comment on the draft plans that are expected to be subject of strategic EIA procedure. Wide participation of stakeholders and general public at all levels of planning is in accordance with the Aarhus Convention, to which all the CEECs are party.

The following “weak points” have been identified when comparing the existing elements of the national WMPs with the “benchmark structure” above. The listed sub-elements are the least covered (with less than 40 percent of coverage in questionnaires):

- Public participation in strategy preparation (22 percent);
- Commodity programmes, product policies, waste stream strategies (33 percent);
- Public awareness, educational campaigns, dissemination of information (33 percent);
- Human resource management (38 percent);
- Definition of the key issues (tasks) for strategy implementation (38 percent);
- Voluntary preventive instruments (38 percent); and
- Research and development of technologies and markets (38 percent).

Most of these sub-elements were not a historically important part of planning under the “command-and-control” economy. Public authorities and state planning bodies did not communicate with the public, independent consultants and stakeholders and this inherited pattern is sometimes hard to change.

Commodity programmes, product policies, and waste stream strategies are mainly related to specific directives covering defined waste streams (biodegradable waste, waste oils, batteries and accumulators, end-of-life vehicles, electronic waste, tyres, etc.), which require more specific regulations as well as a portfolio of waste stream plans as a part of the overall WMP. In the Czech Republic, part of the national WMP related to hazardous waste has been prepared in this way.⁷⁷

Such a modular structure of WMP (general section plus a portfolio of implementation plans on selected waste streams) enables breaking the planning procedure into parts undertaken by various working groups (involvement of experts and stakeholders). This approach, however, requires efficient coordination between the different planning activities. A Dutch Consultative Body on Waste Management (AAO) can serve as an example of such coordination.

Waste management strategy should have clear short-, medium- and long-term objectives together with solution proposals on how to reach them. These solutions should be relatively transparently defined, but on the other hand they should allow flexibility, especially with respect to medium- and long-term objectives. The proposed solutions should be followed by proper political support with enough resources to enable their fulfilment. Fulfilment of these objectives should be controlled, monitored and adjusted to current conditions if necessary and, last but not least, there should also be a way to enforce them.

Economic instruments are frequently used in the plans, but in many cases the information related to them does not suffice to provide a good basis for sound overall comparison.⁷⁸ With respect to economic instruments the following conclusions can be made:

- Each country uses command and control instruments in some areas, especially in the case of the hazardous waste disposal. Solely economic instruments cannot manage the risk related to hazardous waste; bans or other regulations are therefore applied in the case of hazardous wastes. These regulations set “boundaries” of a sort in the waste sector, though on the other hand, they do not represent a significant instrument from an economic point of view.
- The mix of instruments used in waste management is variable and it is rather difficult to compare the countries in detail (due to country-specific circumstances and limited information). One of the payments generally imposed in all reviewed countries is the municipal waste user charge. The second relatively common economic instruments are waste

disposal charges. As landfilling represents the most common option of final waste treatment, these charges are the most significant instruments used in the waste sector to decrease the high share of landfilling and promote other disposal options.

- Rates for disposal charges usually reflect the type of waste, imposing higher rates on hazardous or toxic waste (in some cases an even more detailed, toxicity-based categorisation is used, e.g. in Latvia). The revenue of the charge is used for various purposes, mainly as share of revenue to environmental funds (central or regional) and/or revenues earmarked for environmental purposes to central or municipal budgets. A detailed review of the economic instruments used in CEECs will be the main subject of the following chapter.

9. Control Instruments for Waste Management

Part of the national questionnaires focused on legal and economic instruments. We also used the *Sourcebook on Economic Instruments for Environmental Policy, Central and Eastern Europe*⁷⁹ and the *Database of Environmental Taxes and Charges (1998 and 2000)* (Speck and Ekins) available on the DG Environment Web server as a benchmark for rough comparison. It must be stressed, however, that the penetration of the market-based approach has been relatively fast due to EU pre-accession and that our study takes into account the situation in CEECs at the end 2000, which is compared with the countries of Western Europe during the period 1997-1998. The conclusions drawn by the Project team are therefore only qualitative.

9.1 LEGISLATIVE INSTRUMENTS

The purpose of this study is not to compare or even quantify the national transposition of the EU legislation. The information collected, however, shows that the ways by which the *acquis* is transposed and implemented is country-specific. In all the countries, transposition made substantial progress by the end of 2000.⁸⁰ In the coming years, all CEECs will have much better and more comprehensive waste legislation. The number of newly drafted pieces of legislation or amendments varies from several to more than ten regulations per country.

All countries reported diversified legislation related entirely or partially to specific waste streams, e.g.:

- All countries have legally established rules for municipal, hazardous and non-hazardous waste.
- Regulations for packaging and packaging waste management exist in five countries (Czech Republic, Estonia, Latvia, Romania, Slovenia).
- Sewage sludge management is regulated by a special act in three countries (Poland, Estonia and Bulgaria).
- Oil waste and batteries/accumulators management regulations are drafted in several countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Slovakia and Slovenia).

We must also mention the existence of special regulations for the management of:

- Medical waste (Lithuania);
- Animal bones (Lithuania);
- Fluorescent tubes (Slovakia, Bulgaria); and
- Biodegradable waste (Slovenia).

9.2 DEFINITION OF ECONOMIC INSTRUMENTS

The use of economic instruments has become an important issue in both EU member states and CEECs. The most recent trend in the use of economic instruments in the EU member states is the abandonment of a purely regulatory approach and adoption of market-oriented instruments with incentives to minimise environmental degradation. Such development is in line with the overall policy of the EU and makes environmental policy more efficient and cost-effective.⁸¹

Economic instruments are used for several reasons: first as an incentive for environmentally friendly behaviour, for implementing the polluter pays principle and for financing the costs of the environmental policy. Economic instruments are the driving force in developing BAT (BATNEEC).⁸²

Various types of economic instruments are used. The OECD distinguishes five main categories:

- Taxes and charges;
- Deposit refund systems;
- Tradable permits, liability;
- Enforcement incentives (non-compliance fines, performance bonds); and
- Subsidies.

There is, however, no generally accepted definition of the term “environmental taxes.” In the area of environmental taxation, different meanings are applied to similar terms in different member states, and no precise definitions are offered by the EU legislation.⁸³ Hence, this is a rather problematic area because different countries appear to work with different definitions.

Communication elaborated by a working group consisting of experts from the European Commission, Eurostat and OECD defined “environmental tax” as “a tax whose tax base is a physical unit (or a proxy of it) that has a proven specific negative impact on the environment.”⁸⁴ This defines an environmental tax by “tax base.”⁸⁵

Further discussion of environmental taxes and charges, and the differences between the terms taxes, charges, fees, etc., can be found in the recent Eurostat publication. It emphasises that “it is important to make a distinction between a tax as defined in the national accounts and other kinds of payments (e.g. fees) to the government.”⁸⁶

From a national accounts perspective, taxes are compulsory, unrequited payments to the general government. Taxes are unrequited in the sense that benefits provided by the government to taxpayers are not normally in proportion to their payments. However, required payments to the government, such as fees and charges that are levied more or less in proportion to services provided are also called taxes.⁸⁷

Eurostat states that information related to taxes provided in public finance accounts on one hand and the description of taxes in national laws (purpose of tax, tax base, etc.) on the other hand are relevant to the definition and identification of environmental taxes: “The legal definition of taxes has an influence on how these can be used for environmental protection. The national account definition permits international comparisons and allows an integration of tax data with the national accounts as well as with systems of integrated environmental and economic accounting.”⁸⁸

The EC defines taxes and charges as “all compulsory, unrequited payments, whereas the revenue accrues directly to the Government budget or is destined for particular purposes (e.g. earmarking).”⁸⁹ This EC publication also introduces the term “levy” as follows, “the word levy will be used to cover ‘taxes and charges’...”⁹⁰ Under this definition, charges are implicitly defined as compulsory unrequited payments with a counterpart flow (since these are not taxes under the earlier EC definition). Charges are frequently used to cover the provision costs of specific services for which the revenue is intended. Environmental charges are those where the charge base is a physical unit, or proxy thereof, which is known to be harmful to the environment.

On the contrary, in most CEECs the term “charge” is used when revenue from the instrument is earmarked for environmental expenditure; if the revenue is not earmarked for any environmental expenditure, the term “tax” is used. For more information see OECD and EU databases on environmentally related taxes.⁹¹ In the waste management sector, taxes and charges play a fundamental role. Specific cases include instruments for individual products which are mostly represented by product charges, deposit refund systems, etc.

In this study we distinguish between:⁹²

- User charges covering the cost of services related to municipal waste collection and disposal (usually based upon volume);

- Disposal charges/taxes are payments based on quantity (weight) of the waste disposed. They are used to change the price ratio between different disposal options (e.g. landfilling versus incineration or recycling);
- Deposit refund systems with payment/surcharge made when purchasing a product. The payment is reimbursed when product (container) is returned to the dealer or specialized collection facility; broadly used for beverage glass bottles.

Non-compliance fines are imposed on polluters not meeting legal requirements, e.g. not using safe landfills. Fines should be high enough to change the polluters' behaviour.

TABLE 18

Economic Instruments Used by Selected Countries of Central and Eastern Europe

Country	BG	CZ	EE	HU	LV	LT	PL	RO	SK	SI
Type of waste:										
Municipal waste	Uc+ Ncp	Uc+Dc	Tax+Ncp	Uc	Uc	Uc	Uc	Cdt	Uc+Dc+ Ncp	Uc
Hazardous waste	No	Dc	Tax+Pc	Ncp	Dc	Uc	Dc	Cdt	Dc + Ncp	No
Non-hazardous waste	No	Dc	Tax+Pc	Dc	Dc	Uc	Dc	Cdt	Dc + Ncp	No
Waste batteries/ accumulators	Pc	No	Pc	Pc	Pc	Pc	No	Cdt	Pc	No
Biodegradable waste	No	No	No	No	No	Pc	No	Cdt	No	No
Electrical waste	No	No	No	No	No	No	No	Cdt	No	No
End-of-life vehicles	No	No	No	No	No	No	No	Cdt	No	No
Waste oils	No	No	No	Pc	No	No	No	Cdt	No	No
Packaging waste	Drs	Pc+ Drs	Packaging excise	Pc+ Drs	No	Pc	Drs	Cdt	Drs	No
Waste paper and cardboard	No	No	No	No	Pc	Dc	No	Cdt	No	No
Waste tyres	Pc	No	No	Pc	No	Pc	No	Cdt	No	No

Pc = product charges; Ncp = non-compliance penalties; Uc = user charges; Dc = disposal charges.

Eec = earmarked environmental charge; Drs = deposit refund system (beverage bottles).

Cdt = collection and disposal tax.

Source: Questionnaires of national correspondents; Sofia Initiative on Economic Instruments: Database on Environmental Taxes and Charges (REC 1999)

9.3 ECONOMIC INSTRUMENTS IN WASTE MANAGEMENT POLICIES OF CEECS

Although a wide range of applied economic instruments was reported (e.g. disposal charge/tax, user charge, product charge, deposit refund scheme, non-compliance fines and subsidies), additional information is often needed in order to define them exactly.

A wide spectrum of new economic instruments was implemented in CEECs in recent years (see above Table 18).

Since they have only recently been introduced, an assessment of efficiency of these instruments would be rather speculative. It should be also stressed that in a situation where reliable waste monitoring (including tractability of hazardous waste transports and efficient enforcement) is missing, any abrupt increase in waste taxes, fees and charges would only lead to clandestine or even criminal practices such as home incineration, illegal dumping, mixing of waste and the disposing of hazardous waste at unsecured disposal sites.

To compare the overview of the use of economic instruments in CEECs with the EU-OECD by the end of 2000, we extracted the information from the Database of Environmental Taxes and charges⁹³ into Table 19.

It is evident that only a few EU countries (Belgium, Denmark, Finland, Italy, France, Sweden) have introduced a wider spectrum of economic instruments while the majority use one to three instruments, mainly in the area of municipal waste management. Significant differences can be seen between individual EU and CEECs countries.

TABLE 19

Environmental Taxes and Charges in the Waste Sector in the Countries of Western Europe (EU Member States, Norway and Switzerland) in 1998 and 2000

<i>Country</i>	<i>Number of Instruments</i>	<i>Remark</i>
Austria	4	User charge, waste tax, tyres, batteries, disposable containers.
Belgium	10	Batteries, disposable containers, disposable razors, disposable cameras, package, paper, waste charge (federal), waste management (municipal), waste charge (landfills and incinerators), hazardous waste.
Denmark	12	Batteries, carrier bags, disposable containers, tyres, CFCs, oils, disposable items, light bulbs, waste tax (landfill and incinerators), waste management — user charge (municipal), hazardous waste.
Germany	4	Batteries, packaging, waste management (municipal), hazardous waste.
Finland	6	Disposable containers, tyres, oils, waste charge (national and municipal), hazardous waste.
France	7	Oils, packaging, landfill levy, industrial waste, waste management (municipal), and hazardous waste.
Greece	1	Waste management (municipal).
Ireland	1	Waste management (municipal).
Italy	6	Batteries, plastic bags, oils, packaging, waste charge, waste management (municipal).
Luxembourg	1	Waste management (municipal).
Netherlands	4	Waste tax (incineration and landfilling), waste management (municipal), white and brown good degree, disposable containers.
Norway	3	Disposable products, oils, waste management (municipal).
Portugal	1	Waste management (municipal).
Spain	2	Oils, waste management (municipal).
Sweden	7	Batteries, disposable containers, tyres, ELVs, packaging, waste management (municipal), landfill tax.
Switzerland	2	Waste management (municipal), landfill tax.
UK	2	Landfill tax, waste management (municipal).

9.4 USER CHARGES ON MUNICIPAL WASTE

Comparing available information on tax levels per one unit of waste, it is evident that despite differences in real wages, the difference between EU members and CEECs is not so fundamental. Table 20 shows user charges for municipal waste collection/treatment in CEECs. It is based upon a survey made by national correspondents in municipalities of different sizes (large and small towns). Charges (in EUR per cubic metre) were reported in local currencies from five to 10 municipalities. Data was obtained from various sources including interviews with service providers and town halls. Values reported in euro per cubic metre were recalculated to euro per tonne using specific density of SMW in bins and containers as 250 kilograms per cubic metre.

In many CEECs, municipalities that are responsible for the disposal of solid municipal waste operate a separate collection of small hazardous waste, paper, metal scrap, plastics, glass, etc.

In some countries, (e.g. the Czech Republic, Slovakia), an increasing number of municipalities issued their decrees on municipal waste on their Web sites, informing about collection yards and allocation of large volume containers for separate collection of paper, plastics and glass. This can be considered a positive result of the new acts on waste management and access to information adopted by various candidate countries. The separate collection of biodegradable waste and waste from small enterprises and shops remains a problem that is frequently solved via individual contracts for collection/treatment.

User charges for municipal waste management taken from the database of environmental taxes and charges⁹⁶ are reviewed in Table 21.

Range of User Charges for Municipal Waste		
<i>Country</i>	<i>Charge (EUR⁹⁴/tonne)</i>	<i>Explanatory remarks</i>
Bulgaria	Not based on amount of waste generated	Charges are related to the value of property (house, flat) in the range of 0.1-0.4% annually; about 1.8 EUR per /inhabitant.
Czech Republic	15-20	Charges are set individually by municipalities with respect to all costs, frequency of services, type of containers etc. In rural areas, charges are less than 2 EUR/m ³ .
Estonia	16-43 (incl. 18 % VAT)	Depending on municipality and types of containers.
Hungary	7-25 ⁹⁵ (incl. 25% VAT)	Large local variety in charges depending on size of containers and frequency of service, lower value is an average for small municipalities (rural areas).
Latvia	n.a.	
Lithuania	8-30 (incl. 18% VAT)	Depending on service provider and municipality.
Poland	22-80	Depending on frequency of services, transport costs, size of containers. In some municipalities charges are negotiable.
Romania	9 EUR/inhabitant annually	12.53 EUR/m ³ charge for commercial users.
Slovakia	7-9	Depending on frequency of services and size of containers (110 or 1100 litres). In Bratislava (capital), SMEs are charged about 30% more.
Slovenia	19-75 (incl. 8% VAT)	Depending on municipality, other charges are set for SMEs. In Ljubljana (capital) specific charges are set for street waste, green waste and non-hazardous waste from SMEs.

User charges for municipal waste differ between the EU countries from less than EUR 10 per tonne (Greece, Portugal) to more than EUR 100 per tonne (Denmark, France). On average charges in the EU countries are higher than in CEECs. In relation to GDP (PPS) or average income, the waste management charges in CEECs are more comparable with the EU average — about EUR 50 per tonne (end of the 1990s).

9.5 DISPOSAL CHARGES/TAXES

Disposal charges/taxes are the most common economic instruments in use in the waste management policies of candidate countries. They are usually applied to municipal, hazardous and non-hazardous waste. Comparing CEECs with EU members, it is possible to summarise that disposal charges/taxes levied in candidate countries are set on a rather low level, therefore they play a limited role as an incentive for waste reduction.⁹⁷

TABLE 21

Charges for Municipal Waste Management in Western Europe (EU-OECD) in 1998 and 2000

<i>Country</i>	<i>Charge</i>	<i>Explanatory remarks</i>
Austria	53 EUR/inhabitant (average) per year	Rates vary considerably according to the municipalities.
Belgium	68-83 EUR/tonne	Partially flat rate, in other municipalities — volume based.
Denmark	182 EUR/family per year (average) or 20-40 EUR/tonne	In 1996, rate set by local authorities.
Germany	35-100 EUR/tonne	Set either according to the number of persons per dwelling or volume (container).
Finland	67 EUR/tonne (average)	Based on quality of service.
France	116 EUR/tonne (average)	7% annual increase till 2002 to 163 EUR/tonne.
Greece	6-15 EUR/tonne	—
Ireland	2.5 EUR/bin (1995)	Different schemes adopted by municipalities, e.g. tagging of bags.
Italy	28-95 EUR/inhabitant per year	Depending upon the size of municipality and region.
Luxembourg	n.a.	Flat rate or volume based.
Netherlands	75 EUR/tonne	Flat annual fee.
Norway	24-121 EUR/household per year	—
Portugal	6-15 EUR/tonne	—
Spain	15-30 EUR/tonne	Depends upon quality of service.
Sweden	102 EUR/year	Flat rate for households.
Switzerland	n.a.	Charge based (for households) on flat rate in most municipalities — in others on actual measurement.
UK	18-33 EUR/tonne	Financed from local taxes.

On the other hand, the reduction of disposal charges as an incentive to get waste generators to finance the construction of new disposal facilities was not reported. This was a common practice in the Czech Republic to reduce emission charges (40 to 60 percent) to those polluters who were investing in technical measures providing emissions reduction (air, water). In the case of large investments into safe landfills, incinerators, recycling facilities, etc. this principle should also be applied in the waste sector as an incentive.

The main objective of disposal charges/taxes in candidate countries is to generate revenues for waste disposal and treatment. This corresponds with the fact that the most preferred disposal option in candidate countries is landfilling.⁹⁸

Unlike in the CEECs, for the EU member states the primary focus of economic instruments is on waste reduction. In order to support the main target of the EU waste strategy — reduction of the total volume of waste and a shift from primary dumping of household waste to recycling, reuse and energy recovery⁹⁹ — a waste tax was introduced in most of the EU member states. Different types of waste are subject to different tax rates and tax rates are differentiated according to the types of disposal.

Generally, incineration is preferred to landfilling, and incineration with energy recovery to standard incineration (Denmark, Flanders). Recycling is in some cases also exempt from tax (Flanders).¹⁰⁰ Examples are presented in Table 21.

Another progressive instrument is the “green tax reform” that has usually been introduced into a revenue-neutral context: taxes were shifted to pollution, while taxes on labour or capital were cut. In practice most governments that have implemented green tax reforms have also reduced the tax wedge on labour in order to reduce unemployment. Such tax shifting provides an opportunity to achieve a “double dividend” in terms of environmental improvements and an employment dividend flowing from lower labour taxation.

The aforementioned green tax shifting policies are ongoing in a number of OECD countries, e.g. Denmark, Finland, Germany, Italy, Norway, the Netherlands, Sweden, Switzerland and the UK. An example of such a green tax shift in waste management is the UK landfill tax introduced in 1996. It was accompanied by a 0.2 percent reduction in employers’ social security contributions. More recently, in 1999 the German government implemented its ecological tax reform package. In the same year the Netherlands initiated a three-year policy to shift taxes to pollution and resource use (e.g. energy, wastewater, groundwater) and cut labour taxes.

Despite some limited discussion, green tax reform is neither implemented nor being extensively prepared in CEEC countries. As stressed in the OECD report above, such changes require substitutability between factors of production and the competitive market.

9.6 PRODUCT CHARGES

Product charges were applied for oils, batteries and tyres in some CEECs. Economic instruments to support the recycling of other individual products (e.g. tyres, electronic and electrical waste, ELVs, packaging, etc.) are not so common, mainly due to the difficulties with organising collection.

On the other hand there are special programmes for individual products in the EU member states, their common idea is to organise treatment of such products collectively. Under such a scheme, the role of economic instruments is to generate proper funding. This has been done via various fees, subsidies, etc. that are allocated to responsible bodies by special private or public funds. One example could be the product tax on batteries in Sweden, which is revenue from their “Battery Fund” (revenues of EUR 1.7 million in 1995) and should finance the collection and disposal of hazardous batteries (similar to Austria, Italy, etc.).

In France one business group formed a private company called Eco/Emballages that collects about EUR 0.5 for each package to finance selective collection and sorting at the municipal level. In Denmark there is a fund for the recovery of electric and electronic waste (WEEE) that receives a part of the household waste tax revenues (EUR 6.7 per household and year). A new directive on WEEE is being prepared by the commission, which would lay down obligatory take-back systems financed by the producers for the collection, treatment, recovery and disposal of WEEE either through collection or individual systems.

Revenues from the tyre tax are used for financing tyre reuse and waste management. The system is run by the private sector in Denmark and Finland. In Germany, with respect to producers’ responsibility to collect and recycle their waste products, a waste collection and dis-

posal system called Duales System Deutschland (DSD) was established by retailers and packaging firms in 1992. In Great Britain producers with a turnover of more than EUR 8 million are required to take the responsibility for the collection and recycling of the waste they produce.

TABLE 22

Waste Charges/Taxes in Selected Member States (EUR/Tonne of Waste)

Country	Charge/tax base	Charge/tax rate	Comments
Austria	Non-hazardous and hazardous waste	5.8-29.1*	Rates increase if landfill is not built according to BAT.
Belgium/ Flanders	Recyclable waste	0	Residual waste stream.
	Landfill	61	
	Incineration with energy recovery	10.2	
Denmark	Landfill waste	49.8	The share of reused and recycled waste increased from 21% to 50% (1985-93). Amount of incinerated waste kept constant, reuse of demolition waste increased from 12% to 82% (1985-93).
	Incineration without energy recovery	43.9	
	Incineration with energy recovery	37.2	
Finland	Municipal waste	15	Around 70% of municipal waste deposited on landfills.
France	Industrial waste treated	6.1	
	Landfill	12.2	
Netherlands	Landfill	13.6	Calculated on the weight of the waste.
	Incineration	29.7	Since year 2000.
Sweden	Landfill	29	Pay back scheme is developed for any waste sorted or removed from landfill. It is expected that this will lead to 70% reduction of landfilled waste by 2005.
	Composting	0	
	Incineration	0	
UK	Active waste	17.6	Reduced rate is frozen. Five-year escalator was introduced, which raises standard rate by 1.6 per year up to 24 in 2004.
	Inactive waste (reduced rate)	3.2	

Source: Ekins and Speck, 2000.

* From 2001: EUR 7.3-43.9/tonne. The main force to change was the need to provide incentive to meet the EU targets for reducing landfill of biodegradable municipal waste, which was not successful because households were not directly subject to the price incentive.

In order to reach full compliance with the EU system, candidate countries must incorporate such instruments into their national systems. EKO-KOM can be looked on as a positive example in the Czech Republic. It is a private scheme for packaging recovery that organises packaging treatment at the level of municipalities in the Czech Republic. More information can be found in the Project case study, “Voluntary Agreement on Packaging Take-back and Recovery: System EKO-KOM.” Another positive development can be seen in Slovakia, where the National Council adopted a new waste act in May 25, 2001. It implemented product charges for batteries and accumulators, PET packages, and wastes from oils, paper, glass, and end-of-life vehicles. The revenue is earmarked for financing recycling activities via a public recycling fund, and for disposal programmes. Financial reserve for landfills was imposed as an obligation.

9.7 EXTENDED PRODUCER RESPONSIBILITY¹⁰¹

The solution for the future, which CEECs will adopt in their national systems, is extended producer responsibility (EPR). Once EU directives on end-of-life vehicles, batteries, and WEEE are implemented they will have an important impact on EPR. Under these directives, it will become the producer’s responsibility to collect and recycle a high proportion of such products at the end of the products’ lives.

The aim of EPR is to shift the physical and/or financial (full or partial) responsibility from municipalities to producers. EPR forms the basis for a new generation of pollution prevention policies that focus on the product instead of on the production facility. The key objective of the EPR policy developed by national governments is to provide incentives for the development of less wasteful products. The result would be to reduce waste disposal and raw material use (amount of raw/virgin material input per unit of product) and to increase resource efficiency.

This instrument tackles the problem of final disposal of products after their sale and use by consumers, when the responsibility for post-consumption product waste is extended to the producer of the product — a responsibility that was traditionally held by municipalities and taxpayers. The aim of such an approach is to shift the physical and/or financial (full or partial) responsibility from municipalities to the producers.

New regulations suggest that many more and more diverse economic instruments will be used in the waste management sector of CEECs in coming years. Examples include a guarantee for hazardous waste handling (Estonia), for landfill site remediation (Romania), or product charges and a recycling fund in Slovakia. As the new instruments are being introduced during the EU pre-accession process, it will be necessary to assess their effectiveness in several years. An efficient legal framework, monitoring and enforcement must be in place to create an environment in which the economic instruments are fully effective. Otherwise, the increased taxes and charges may lead to illegal practices (illegal dumping, mixing of waste, declaring hazardous waste as non-hazardous, etc.).

9.8 OTHER INSTRUMENTS

This category includes the following implementation instruments:

- Information and educational campaigns;
- Labelling systems;
- Voluntary agreements; and
- Extended producer responsibility (take-back schemes).

The main types of implementation instruments reported by the CEECs are voluntary agreements and information campaigns. Voluntary agreements are signed between ministries of the environment and associations of producers who generate specific types of waste. The purpose of such agreements is to ensure that waste producers are carrying out satisfactory management of their own specific waste. Table 23 gives details on the reported voluntary agreements in force in Estonia, the Czech Republic and Latvia.

Information/educational campaigns were reported by Estonia (for municipal waste management), Czech Republic (EKO-KOM for packaging waste), Slovenia and Poland (for collection of waste oils from industrial sources).

TABLE 23

Voluntary Agreements in CEECs

<i>Country</i>	<i>Area</i>	<i>Implemented by</i>	<i>Financed by</i>
Czech Republic	Packaging and packaging waste	ECO-KOM Ltd.	Association of packaging producers
Estonia	a) Lime waste	NITROFERT Ltd.	NITROFERT Ltd.
	b) Chemical waste and effective use of chemicals	NORMA Ltd.	NORMA Ltd.
	c) Industrial waste	ELCOTEQ Ltd.	ELCOTEQ Ltd.
Latvia	Packaging and packaging waste	Latvian Green Point Programme (LGP)	Association of packaging producers and users

9.9 CONCLUSIONS

On the basis of the overview it can be concluded that economic instruments are used by the CEECs to a larger extent due to the EU accession process. Their use should be, however, related to a sounder planning process and their effectiveness regularly evaluated. As the process of the transposition of the *acquis* into national legislation accelerates in 2000-2002, it is difficult to evaluate the effect of the newly introduced economic instruments. We must also remember that their further adjustment will also depend on economic growth and increasing purchasing power of the population.

Based on information collected in this study and compared with the EC and OECD member countries, it can be summarized that:

- Compared to the EU member states, economic instruments in the waste management policies of the CEECs are more revenue oriented. Nevertheless, they present weak financial incentives for preferred disposal options (landfilling vs. incineration vs. recycling). landfilling charges must be raised substantially. This is, however, not enough for the construction of new incinerators (which require large investment) and/or for reconstruction of existing incinerators.
- In many cases, disposal charges seem to be preferred to taxes. The disposal charges become revenue for environmental funds (central, regional) and/or municipal budgets.
- User charges are widely used as a common economic instrument; charges are generally lower in CEECs and full cost recovery is questionable.
- Deposit refund schemes were used in candidate countries in past decades, mostly for beverage glass bottles. As these bottles are replaced by plastics, the efficiency of such a system decreases.
- Development of product-based schemes is taking place in the CEECs as product charges are reported in six of the ten analysed countries.

- A system of payment for collected waste (paper, bottles, etc.) brought by individuals to the collecting centres could be taken into consideration since this economic instrument functioned in CEECs for decades.
- There is inadequate focus on composting and recycling, which are low cost options in comparison to incineration.¹⁰² An increase in the separate collection of biodegradable waste and also an increase in recycling of other waste types to reduce the total amount of waste disposed in landfills seems to be a viable option for some share of organic waste.

ANNEX I

Waste Oils in the Czech Republic

The annual consumption of lubricating oils (engine, gear box, industrial and other) amounts to about 150,000 tonnes. The share of individual types of oils as a part of total consumption in the years 1993-1998 is given in Table 1.

TABLE 1				
Share of Individual Types of Oil in the Total Consumption (%)				
<i>Period</i>	<i>Oil type</i>			
	<i>Engine oils</i>	<i>Gear box oils</i>	<i>Industrial oils</i>	<i>Other oils</i>
1993	35.0	6.7	25.0	33.3
1994	34.8	6.8	24.7	33.8
1995	34.1	6.7	24.2	35.0
1996	33.0	6.5	24.2	36.3
1997	33.2	6.4	23.7	36.7
1998	32.0	6.6	23.4	38.0

Process oils for plastics and rubber production amount to about 30,000 tonnes. These are fully spent by the processes and cannot be recovered. Forming (casting) oils, conservation oils, cutting emulsions and white oils form about 10,000 tonnes. Their feasible recovery is close to zero percent. The remaining 150,000 tonnes of annual oil consumption (110,000 tonnes) can be collected and recovered (Table 2).

TABLE 2			
Collection of Waste Oils in the Czech Republic in 1999			
<i>Waste oil type</i>	<i>Total (tonnes)</i>	<i>Of which</i>	
		<i>Halogenated</i>	<i>Halogen free</i>
Waste oils from metal forming and processing	14,054	626	13,428
Hydraulic, motor, gear box and other lubricating oils, insulation and heat-carrying and synthetic oils	58,396	2,080	56,316

Collected waste oils are disposed of by the following methods (data for 1999):

- **Incineration (14.2 percent)** — disposal of waste oils by direct combustion without preliminary treatment.
- **Physical and chemical treatment (73.7 percent)** — mainly physical treatment via filtration or dewatering, especially for purpose of producing alternative fuels.
- **Regeneration (0.20 percent)** — the share of regeneration is minimal, because Ostramo, the only regeneration company, was closed pursuant to non-compliance with the requirements of environmental legislation in 1997. This does not include oil regeneration in mobile units, the capacity of which represents about 2,500 tonnes per year for transformer oils (about one percent of the total oil production is treated in this way).
- **Other methods (11.9 percent)** — solely storage before further recovery.

Landfilling and underground deposition is not permitted.

Source: Czech Association of the Petroleum Industry

ANNEX II

Executive Summaries of Case Studies¹²⁰

VOLUNTARY AGREEMENT ON PACKAGING TAKE-BACK AND RECOVERY: EKO-KOM SYSTEM

Bohumil Cernik and Martina Vrbova

Introduction

Legislative requirements of the Act No. 125/1997 Coll. on waste include an obligation for communities to collect municipal waste separately, and a simultaneous obligation for producers and retailers to take back packaging and packaging waste. Several systems of separate collection have therefore been established, which cover about 80 percent of the Czech population at present. EKO-KOM is the major system of separate collection.

The summarised case study describes and assesses the current system on the take-back of packaging in the Czech Republic, including its technical and economic conditions, and identifies both advantages and likely problems for the near future.

Generation of packaging waste in the Czech Republic

Packaging waste makes up a substantial share of solid municipal waste, the generation of which fluctuates with changes in GDP. The Czech Republic, like other CEECs, has faced a substantial increase in waste production during its transition to a market economy. In the context of a previously modest lifestyle and the use of traditionally recycled materials, waste problems are basically a new phenomenon resulting from the open market, the demands of trade organisations and the import of a consumer lifestyle from Western Europe. According to projections, a further increase in waste generation in the Czech Republic is expected (Table 1).

TABLE 1

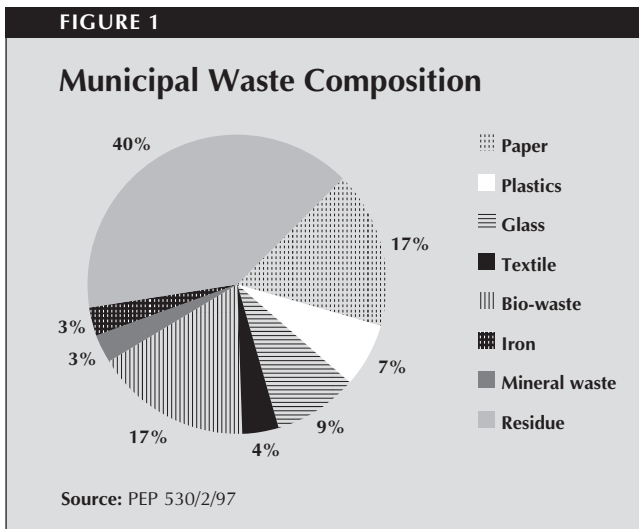
Generation of Municipal Waste in the Czech Republic

	1998	1999	2000*	2005*	2010*
Total (millions of tonnes)	4.5	4.2	4.3	4.4	4.5
Per capita (kg/inhabitant)	441	409	418	426	446

* Projection of 4% increase in GDP

Source: ISO CEI

Analyses of municipal waste composition show that paper and organic waste (mainly remnants of food) are the main components. Composition (Figure 1), however, varies with season, size and type of community. In certain areas coal ashes (home heating) are the main component during wintertime, when a share of household waste is also incinerated in coal stoves and small boilers.



Composition of packaging waste in the Czech Republic

During the past seven years the share of plastics in municipal waste has increased to 14 percent, and the share of glass has decreased to about six percent. This change reflects the growing share of plastics used for packaging. Due to changing lifestyles and the structure of retail in the Czech Republic, the amount of packaging waste continues to increase after reaching the European level (83.5 kilograms per inhabitant for 1999). Plastics (40.2 percent), paper (25.6 percent) and glass (12.3 percent) are the packaging materials most used.

Plastics dominate in the form of carrying bags and bottles for soft drinks. Practically all producers of packaged mineral water have built manufacturing lines for bottling into PET bottles, in full compliance with demands of trade organisations. Looking at the sales network of the Czech

Republic, there is basically no possibility for consumers to choose the type of packaging.

Glass is used primarily in beverage packing (70 percent of packaging in use) and preserved foods (22 percent). Returnable glass packaging maintains a strong position with beer and wine. A new trend is the production of light glass and glass packaging with improved mechanical resistance. Despite the large increase in plastic packaging use in recent years, especially in the case of packaging for carbonised water and other soft drinks, producers of glass packaging expect a continuous increase in their production, due to exports.

Paper, carton and cardboard are packaging materials with an important manufacturing history in the Czech Republic. Despite the fact that paper products still comprise about 25 percent of all packaging in the Czech Republic, there is a clear trend of decreasing consumption. However, the prognosis made by Marius-Pedersen for paper and glass packaging indicates a 5.5 and 3.0 percent annual growth up to the year 2005 respectively.

The proportion of metal packaging (food conservation, tubes, spray containers) as compared with other materials is very low; tin-plated steel sheets comprise approximately 50 percent, and aluminium 12 percent. In the area of sale packaging, non-returnable one-way packaging dominates. Transport and grouped packaging are designed to be returnable on the basis of agreements between suppliers and consumers, predominantly for economic reasons.

Future of packaging waste management in the Czech Republic

To estimate generated packaging waste it is necessary to examine the basic conditions:

- The material composition of packaging waste will remain unchanged.
- The quantity of municipal waste will grow proportionately to GDP.
- The quantity of industrial packaging waste (grouped and transport packaging) will grow proportionately to GDP.
- Recycling and recovery systems for commercial packaging waste (municipal waste) will be developed.

This data indicates that recycling and recovery targets for the year 2001 as provided in Directive 94/62/EC (35 percent recovery and 15 percent recycling) will be achieved in the Czech Republic (Table 2). Targets for year 2005 (50 to 65 percent recovery and 25 to 45 percent recycling) will be achieved with difficulty. The Czech Republic therefore requests a transition period.

Establishment of EKO-KOM system

There are basically three approaches to packaging waste management including its recovery and recycling:

TABLE 2

Outlook for Packaging Waste Management in the Czech Republic

<i>Activity</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>
Production of sales packaging waste — municipal waste (thousands of tonnes/year)	420	435	451	467	483	501
Production of transport and grouped packaging waste (thousands of tonnes/year)	300	318	325	333	341	349
Recovery of sales packaging waste (%)	27	31	35	41	47	53
Recycling of sales packaging waste (%)	20	24	28	33	38	43
Recovery of transport and grouped packaging waste (%)	55	57	59	62	64	67
Recycling of transport and grouped packaging waste (%)	55	57	59	62	64	67
Recovery of packaging waste total (%)	38	42	45	50	54	59
Recycling of packaging waste total (%)	35	38	41	45	49	53

Source: EKO-KOM, 2000, MSB Logistik, 2000

- Deposit systems for selected types of packaging (Sweden);
- Isolated packaging waste collection, separately from municipal waste, such as the dual system (DSD Germany); and
- Integrated approaches to municipal waste recovery, including packaging component of municipal waste (Eco-Emballages France).

EKO-KOM was established to use foreign experience with similar systems in consideration of conditions given by current legislation and the state of waste management in the Czech Republic. After comparing advantages and disadvantages of the aforementioned systems, it was decided to choose an integrated approach stemming from its favourable economy and compatibility with the structure of public services in most Czech municipalities. Main milestones are described in Table 3.

There is an obligation applied to municipalities to separately collect paper, glass and plastics, and simultaneously an obligation applied to suppliers of products launched onto the Czech market to take back packaging and selected products. In 1994, the Czech Industrial Coalition for Packaging and the Environment (CICPEN) was established. CICPEN owns EKO-KOM, an operator of a packaging waste system. A voluntary agreement between the main stakeholders was signed on April 1, 1999.

Main principles of the EKO-KOM system

EKO-KOM is based on integrated municipal waste management principles. Within its framework, consumer packaging waste is sorted and recovered. In accordance with the Act on Waste No. 125/1997 Coll., communities and municipalities in the Czech Republic have an obligation to sort recoverable municipal waste components. Part of the separated components of municipal waste is also used as consumer packaging, which is delivered for other uses by means of community separate collection systems. Incorporation of the common municipal waste management concept allows the system to operate in acceptable financial and organisational boundaries for all stakeholders.

Besides industry and retail, municipalities (as municipal waste generators) are the main contractual partners to EKO-KOM. The system is also engaged in cooperation with other subjects operating in the process of managing packaging waste via working groups (processors of secondary materials, operation firms and firms that are purchasing secondary materials). The objective of these working groups is to create conditions for integrated manage-

TABLE 3

Main Milestones in EKO-KOM's Development

Before 1989	In the Czech Republic before 1989, there was a functional system of back-purchase of wastes and secondary materials (Sberne suroviny and Kovosrot). The privatisation of these companies, in connection with the failure of recycling support on behalf of the state administration at the beginning of the 1990s had a negative impact on the collection and recovery rates of wastes and secondary materials, especially in relation to the high volume imports of secondary materials from neighbouring countries (mainly glass and paper).
1991-1993	<ul style="list-style-type: none"> • Act No 238/1991 Coll. on Waste — introduction and development of separate collection of municipal waste in communities. • Rectification of prices of secondary materials with global market prices — great reduction of back-purchase from citizens. • The advent of new packaging materials, e.g. use of PET bottles in the beverage industry, caused a reduction of take-back systems of beverage packaging.
1993-1994	<ul style="list-style-type: none"> • Czech Industrial Coalition for Packaging and the Environment (CICPEN) established. • The preparation of a system for packaging management in connection with expected legal obligations.
1995	<ul style="list-style-type: none"> • Commitment of the government to establish a functioning system. • Collaboration with ERRA and the launching of pilot projects.
1997	<ul style="list-style-type: none"> • Act No. 125/1997 Coll. on Waste — introduction of take-back obligation, recovery and recycling for producers and importers of packaging. • EKO-KOM founded as a joint-stock company. • Implementation of pilot projects. • Training-educational projects for schools. • Proposal of Voluntary agreement.
1999	<ul style="list-style-type: none"> • Government Regulation No. 31/1999 Coll., laying down take-back obligation on packaging and selected commodities. • Conclusion of Agreement between the MoE and CICPEN. • Development of the system.
2000	<ul style="list-style-type: none"> • Significant increasing of involved packaging. • Spread of the system into municipalities. • New scheme of remuneration and fees. • Green Dot licensing award.
2001	<ul style="list-style-type: none"> • Act No. 185/2001 Coll. on Waste — active contribution of EKO-KOM in preparation. • Draft Act on Packaging — active contribution of EKO-KOM in preparation. • Preparation of accreditation of the system. • New pilot projects aimed at intensifying separate collection.

ment of municipal waste in the Czech Republic. As an instrument to achieve this objective, an accreditation system will be established. It should ensure sufficient control of waste and packaging waste flow.

Economy of EKO-KOM system

EKO-KOM collects charges from producers, importers and retailers and redistributes the funds to municipalities according to the amount of separately collected waste. The level and structure of awards to municipalities has been changed significantly since the beginning of the EKO-KOM system. Until June 2000, a unified charge for all separately collected waste was applied to municipalities. Average awards increased up to about CZK 400 per tonne.

The structure of awards arises from the different cost efficiency of collection, hauling, transport and recovery for the individual municipal waste components. The proportional part in costs is represented by the costs of packaging component collection in municipal waste (50 to 90 percent by commodities). The costs of separate collection are about twice as high, and EKO-KOM covers a major part of the economic losses.

Sale of secondary materials reduces total costs. Further reduction may be achieved through savings in respect to the prevented landfilling. Approximately 80 percent of these net costs include the costs of waste collection. The aim of EKO-KOM is to cover all community financial losses related to separate collection and the recovery of the packaging component of municipal waste.

About 80 percent of the collected funds are redistributed to the municipalities, while administrative costs represent approximately 18 percent of total system operational costs at present. It is expected that the economy will improve with the growth of the system. A substantial share of income is used for raising awareness, the training of municipal boards in waste management and for marketing the system.

TABLE 4

Summary of Performance Indicators for 1999-2000

<i>Indicator</i>	<i>1Q/99</i>	<i>2Q/99</i>	<i>3Q/99</i>	<i>4Q/99</i>	<i>1Q/00</i>	<i>2Q/00</i>	<i>3Q/00</i>	<i>4Q/00</i>	<i>1Q/01</i>
Number of municipalities	10	10	10	754	1,280	1,620	1,714	2,099	2,322
Tonnes of waste	1,763	1,790	1,830	9,889	10,750	15,462	18,982	24,015	n.a.
Number of inhabitants	120,000	120,000	120,000	2,136,000	3,156,000	3,560,000	5,138,000	5,840,000	6,220,000
Population (%)	1	1	1	21	31	35	50	57	61
Number of companies	7	7	15	41	61	788	7	307	442
National rate of recovery (%)	2	2	2	9	10	15	18	23	n.a.

Results achieved by EKO-KOM

EKO-KOM appears to be very successful in comparison with other systems. Over two years EKO-KOM has come to cover about 60 percent of the population of the Czech Republic. The collection rate for plastics (19 percent), glass containers (66 percent), paper packaging (57 percent) and metal scrap (seven percent) are approaching the present quantitative targets of the EU. This represents in total about 40 percent of all packaging materials.

Overall results achieved for two years since the first quarter of 1999 (1Q/99) are presented in Table 4.

Conclusions and Recommendations

- The production and consumption of packaging is a dynamic activity which is influenced by market demands. The market dictates composition of packaging and traditional materials are thus often suppressed. The generation of packaging waste, mostly plastics, is still likely to increase.
- Back-purchase systems for wastes and secondary materials were functioning before 1989. The privatisation of collection companies and the failure of recycling support on behalf of state administration at the beginning of the 1990s had a negative impact on collection and the recovery rates of wastes and secondary materials.

- An efficient collection system seems to be of great importance in order to manage the increasing generation of packaging waste and also to meet strict national and EU targets, as well as EU targets that are being introduced in the accession countries.
- The application of producer responsibility appears to be a solution in the case of participation of packaging producers, importers and distributors in the collection and recovery system. The active participation of all stakeholders, including the MoE and environmental inspectors is needed.
- EKO-KOM appears to be a well-functioning collection system for packaging waste. It has already shown successful results in terms of rather high collection rates. EKO-KOM cooperates with NGOs and pays substantial attention to public awareness and information dissemination. Furthermore, EKO-KOM regularly generates statistical data on its performance. Active support is obtained from the MoE.
- Despite its considerable success, EKO-KOM is obviously facing some difficulties. The most serious problem seems to be insufficient supervision by the Czech Environmental Inspectorate, which should be inspecting how municipalities meet their legal obligations on separate collection more intensively. Some problems appear in record keeping as the subsidies of separate collection are paid against quarterly reports and accounts, which some smaller municipalities are unable to prepare in time. Furthermore, the system only has a limited influence on the final utilization of collected waste, which is usually traded by the collection companies. Finally, the high transparency stated in the voluntary agreement makes the system rather vulnerable vis-à-vis the competition.
- Experiences with voluntary agreement in the Czech Republic might be analysed and possibly applied in other CEECs.

MANAGEMENT OF END-OF-LIFE VEHICLES IN POLAND

*Bozena Kuzio and Stanislaw Karuga***Introduction**

Dynamic developments in the automotive industry, the increasing demand for passenger cars and tendencies to introduce new materials and technologies have caused the number of end-of-life vehicles (ELV) to grow, not only in the EU but also in CEECs. About 10 million end-of-life vehicles are disposed of in the EU, generating around 2 million tonnes of hazardous wastes. The uncontrolled disposal of end-of-life vehicles represents a serious threat to the environment. The controlled management of ELVs allows for the diminishment of waste generation and conservation of natural resources via material recovery and recycling, and, therefore, a special directive was adopted in the EU last year.

TABLE 5

Vehicles in Use in Poland, 1990-1999

<i>Road Vehicles</i>	<i>Number of cars (thousands)</i>				
	Years				
	1990	1995	1997	1998	1999
Vehicles and tractors	9,041	11,186	n.a.	12,709	13,169
Motor cars (passenger cars)	5,261	7,517	8,533	8,891	9,283

Directive 2000/53/EC

Directive 2000/53/EC on end-of-life vehicles currently represents the main legislative instrument on this issue in Europe. Both EU and candidate countries will have to implement this piece of legislation in the near future. The directive will obligate car producers to produce cars of which 85 percent can be reused or recovered. Furthermore, lead, mercury, cadmium and quadrivalent chrome will be banned in newly produced vehicles. ELVs will have to be delivered to recycling plants authorised by competent authorities. The withdrawn vehicles will have to be granted a certificate as a precondition for deregistration. Cars disassembled in recycling plants have to be devoid of all liquids, tyres, batteries, air conditioning, air bags, catalysts and other hazardous materials. All dismantling and storage operations should take place to enable the reuse of individual components from vehicles. Storage of used vehicles and proceedings of generated waste have to be done in accordance with Directive 75/442/EEC on wastes.

The directive sets a responsibility on car producers and importers. They are obliged to deliver detailed inquiry documents to the recycling plants. Documents should include instructions for disassembling and a description of where hazardous materials are situated in cars. Producers and importers are obliged to cover all costs for delivering used vehicles to recycling plants. Administrative authorities should encourage all players to participate in the collection system of used vehicles. Special attention needs to be paid to registry (database of vehicles), enforcement and inspection.

Situation in selected EU countries

In many EU countries (e.g. Germany, Denmark, Netherlands) the economic and legal regulations referring to ELVs were introduced before the directive was implemented. The most interesting legal and economic solution can be observed in the Netherlands, where product charges are applied. The Auto Recycling Nederland organisation coordinates all activities connected with car recycling. Car producers undertake actions to support car recycling (e.g. designing cars with thought to further possible reuse and recycling).

Situation in Poland

During the last few years the number of cars in Poland has increased. In 1999 the number reached 13 million, out of which 9 million were passenger cars. Of the passenger cars, approximately 40 percent were older than 10 years. The number of registered vehicles in 1990-1999 is presented in Table 5, while the age structure of vehicles is presented in Table 6.

Following the rapid growth in the total number of cars in the 1990s, an increasing tendency to replace old vehicles with new ones is expected to follow, which will lead to growing numbers of ELVs. A study carried out by the Industrial Research Institute for Automation and Measurement (PIAP) indicates that 100,000 to 300,000 ELVs are generated annually depending on the national economic performance. It is also forecast that up to the year 2010 the number of such cars will increase to 650,000-700,000 annually. The uncertainty of the matching of such projections with existing disposal capacities is influenced by the absence of a central register containing information on disassembling sites (individual firms).

TABLE 6

Age Structure of Vehicles in Poland

Age of cars	Share (%)		
	1994	1997	1998
10 years or more	45	43	40
7-9 years	17	15	15
4-6 years	17	18	18
New (up to 3 years)	21	24	27

National market for ELVs

The existing processing base for materials from ELVs, such as scrap metal, glass, accumulators, tyres, plastics, cooler and brake liquids, is quite well developed. In Poland, there are also plants regenerating car parts, alternators and starters. It is estimated that up to 500 companies with legal permits operate in Poland, where the largest 20 to 30 dismantle more than 500 cars annually.

Besides the licensed sites there are about a thousand operating illegally which rarely meet proper technical and environmental standards. Most of the dismantling is carried out manually.

Up to 50 percent of some parts are reused on the second-hand spare parts market (doors, windows, wheels, engines, gear-boxes, alternators, starters, coolers, etc.). The rest, which is composed of steel, non-ferrous metals, oil, brake fluids and plastics, is sold as secondary raw material or reprocessed (e.g. waste oils and brake fluids). The average prices of dismantled parts represent on average 10 to 30 percent of the prices of new parts, (e.g. PLN 60 per door, PLN 40 per alternator, PLN 40 per starter, PLN 700 per engine). The average basic income from car dismantling can be broken down as follows:

- Sale of dismantled parts: 70 percent;
- Sale of materials: five percent; and
- Other activities: 25 percent.

Generally, owners do not receive money for ELVs, unless ELVs have substantial value, e.g. the value of a new car damaged in an accident is reimbursed.

All major waste streams (waste oils, brake fluids and coolants, car batteries, catalysts, metal scrap, plastics, tyres, etc.) are reprocessed or used as alternative fuel or raw material in industry (cement and steel manufacturing). Ground tyres are used as an additive to asphalt, floor mats, etc. Selected parts obtained from dismantled ELVs are repaired and tested before their reuse, e.g. there are specialised companies that repair and test alternators and carburettors.

Legislation and policy

The present disposal of end-of-life vehicles in Poland is based on the Waste Act, Traffic Act and Act on Maintaining Cleanness and Order in Public Space. The current legislation is, however, not fully efficient, especially in the case of deregistering and withdrawing cars. Thus there are still some unauthorised dismantling stations which do not meet environmental protection standards.

At present, new legislation is being drafted to harmonise national law with the *acquis*. The MoE is currently working on the full transposition of Directive 2000/53/UE while preparing an act on waste, environmental protection and product and deposit fees.

Designing a new system for ELVs

Recently, the Polish Forum for Car Recycling (FORS) was established by a group of car producers and importers, collectors, disassembling firms, government, media and research bodies. FORS undertakes the following activities:

- Legal support of members and activities related to newly drafted national legislation;
- Information support and exchange; and
- Awareness raising campaigns.

Furthermore, a governmental working group was established in February 2001 composed of the Ministry of Environment, Ministry of Economy, Ministry of Transport, National Environmental Inspectorate and research institutes, the main task of which is to implement Directive 2000/53/EC on ELVs. To date, the following decisions have been made:

- The Existing Waste Act will be amended.
- Changes to the Traffic Act will follow.
- A certification system for the private sector will be prepared and implemented.
- A central Register for Vehicles and Drivers will be made operational by 2004.
- A definition of ELV harmonised with Directive 2000/53/EC will be used in national legislation.

Furthermore, a recycling fee (a 50 percent deposit, refunded to owners once the ELV is received by a certified firm) is being discussed and enforcement mechanisms are also being considered. There is a pilot project for the development of a company information system based on the Web, which would be leased by FORS to firms de-assembling ELVs.

Car recycling in Poland depends on the development of a well-organised system. This system should be based on regional networks of car dismantling plants, similar to networks in EU countries, and should comply with the following principles:

1. The investment elements of the system are profitable.
2. The creation of the system is voluntary.
3. The system complies with the regulations of local authorities and central environmental protection authorities.
4. Each element of the system is licensed, certifying its compliance with environmental protection requirements and with quality standards for parts and materials obtained from dismantling.
5. The system creates a network of different plants and dismantling stations, recycling points and the users of metals, plastics, glass, rubber and hazardous materials such as used oils and used liquids.

Conclusions and Recommendations

- The rapid development of the automotive industry in Poland necessitates the development of the vehicle recycling system. This system should enable the environmentally safe dismantling of ELVs and the recovery of dismantled parts and materials.
- The fact that Poland is a candidate country is accelerating the transposition of EU legislation. In order to develop successful car recycling in Poland, the EU directive should be fully transposed into national legislation.
- A wide range of economic and administrative stakeholders should actively participate in the whole life cycle of cars, i.e. producers and importers of cars, central and local authorities, producers of materials and car parts, consumers and owners of cars.
- The collection system should be designed as an integrated logistic scheme able to assist the efficient distributions of parts and materials to specified receivers in time.
- Better economic conditions should be developed for the development and modernisation of dismantling plants, for example by creating special funds or low-interest bank credits. It is estimated that the costs of creating a dismantling plants organisation by 2010 will be PLN 600 to 1,320 million.
- The recovery targets for ELVs should be set and included into national legislation. Producer liability and take-back obligations should be stated clearly in legislation and voluntary agreements between the industry and the authorities should be initiated.
- Incentive oriented economic instruments should be also introduced, e.g. obligatory product charges or recycling fees. The authorisation and certification of dismantling companies should be encouraged.
- An effective monitoring system, functional reporting and a reliable database are also needed. The public should be regularly informed about collection and recycling availability for ELVs.

MANAGEMENT SYSTEM FOR WASTE BATTERIES AND ACCUMULATORS IN SLOVENIA

Viktor Grilc and Dimitrij Segel

Introduction

This study presents the recent situation and trends of the management system for waste batteries and accumulators in Slovenia. Recent legislation, harmonised with the EU, emphasised the development of a rational and sound system. Due to the absence of data, the quantities of waste streams were assessed based on national input-output analysis. The existing and planned legislative and waste management system was analysed and discussed in the given transitional socio-economic circumstances. Special attention was paid to measures for waste prevention, separate collection and recycling, which are the main attributes of sustainable processes.

Background

Batteries are portable power sources able to convert chemical energy into electricity. They can be divided into primary batteries and secondary batteries (accumulators). Primary batteries may be used only once since the electrochemical reaction involved is irreversible. The most common types are zinc-carbon and alkaline-manganese, whereas button shape batteries can be made of mercuric or silver oxide, or zinc-air. Accumulators can be recharged by means of an external source of electricity due to the reversible nature of the electrochemical reaction. The most common types are lead-acid and nickel-cadmium (recently replaced by less harmful nickel-metal hydride or lithium-ion batteries). Accumulators are used in home appliances, cars and portable phones.

During the past few decades the number and diversity of batteries and accumulators have grown dramatically, especially in the EU countries. Similar situations also developed in CEECs as a result of the developing consumer society.

Since primary batteries are small and so widely used, it is difficult to prevent them from entering the municipal waste streams. If disposed of together with municipal waste they face fast corrosion by inherent acidic leachate, so that heavy metals are released and pollution of the environment by batteries and accumulators is extremely likely. Cadmium from waste Ni-Cd cells, which makes up 90 percent of all anthropogenic cadmium in the environment, is particularly dangerous. High pollution rates have also been registered with mercury, lead and zinc. For this reason, most European countries have banned hazardous battery types from being co-disposed of with municipal waste. The preferred method should be separate collection and recycling, followed with production of non-hazardous types of batteries in order to conserve valuable resources.

Situation before the transition period

Until 1991 Slovenia was a part of the Socialist Federal Republic of Yugoslavia. Data for collection and recycling of waste batteries and accumulators for individual republics from that time does not exist. Practically no primary batteries were collected; all were disposed of, mixed-up with municipal waste. There are estimates that about 10 percent of all Yugoslavian lead accumulators were collected. The former Yugoslavia had two smelters for recycled waste lead accumulators: Mezica in Slovenia and Trepca in Kosovo (Serbia). The Slovenian smelter had to comply with the then national laws (Act on Waste Management, 1979, Regulation of Special Waste, 1986). No such legislation existed in Kosovo. The smelter in Trepca often worked without filters due to problems with spare parts or bad maintenance. Consequently, Trepca was considered the most polluted place in the former Yugoslavia.

Even in Slovenia, waste batteries were fed into lead blast furnaces generating strong emissions and performing with a bad yield. Captured dust contained high values of chlorine caused by the non-separated PVC from other battery components. Emissions of sulphur dioxide (SO₂) and lead dust were well above the limit, which was at that time at 1,400 milligrams per cubic metre for SO₂, and 150 milligrams per cubic metre for dust (present values are 800 milligrams per cubic metre and 10 milligrams per cubic metre respectively).

Until 1992, there was no organised collection system in Slovenia. Like in other parts of former Yugoslavia, the main collectors of used lead batteries were Roma. Collecting accumulators was part of the general waste business for them. They sold collected waste to municipal retailers, which finally delivered it to smelters. The price that retailers paid to

Roma was a matter of permanent negotiation depending on the market situation. The retailers got about twice the price of the London Metal Exchange for the waste. Still, because of the small quantities of collected accumulators, business with such waste was relatively small. Annual collected quantities of acid batteries were about 1,000 tonnes (less than 20 percent of lead waste in Slovenia), in addition to another 1,000 tonnes in the rest of Yugoslavia.

Situation during the transition period

During the past decade, the growing consumer society in Slovenia has generated significant amounts of waste batteries and accumulators. The generation coefficient is, however, still approximately half that of the developed European countries, though the overall trend is still increasing.

Exact figures on the generation of waste batteries and accumulators are difficult to obtain due to the lack of data. The national information system on special types of waste is still under development. Using a rough estimation based on the input-output flow analysis of these products, approximately 380 tonnes of primary batteries were sold on the Slovenian market in 1999, which gives a generation coefficient of about 0.2 kilograms per inhabitant. The main stream is, however, represented by lead accumulators whose quantity is assessed at about 10,000 tonnes per year. This quantity is less affected by the consumption pattern due to the much longer lifetime of the accumulators and their improved performance.

Separate collection of primary batteries is minimal due to the absence of appropriate legislation. No recycling of primary batteries takes place in Slovenia though large municipalities (Ljubljana, Maribor, Celje) have started to organise their own separate collection systems. In the various, mostly voluntary actions, only some five percent of waste batteries were collected and sent abroad for recycling.

Separate collection and recycling of used lead accumulators is far more efficient due to the existing market for secondary raw materials (lead, plastics). Waste accumulators are collected by special companies, as well as by municipal companies. The amount collected in 1999 was 6,500 tonnes, which represents 65 percent efficiency. The entire collected amount was recycled in the local recycling plant in Mezica and reused in the production of new batteries. The installed capacity of the lead smelter is 25,000 tonnes per year; 6,000 to 7,000 tonnes are collected domestically and 18,000 tonnes are exported from Hungary and Croatia. Collection and recycling rates in Slovenia have increased during the past five years. The recycling mass balance is presented in Figure 2.

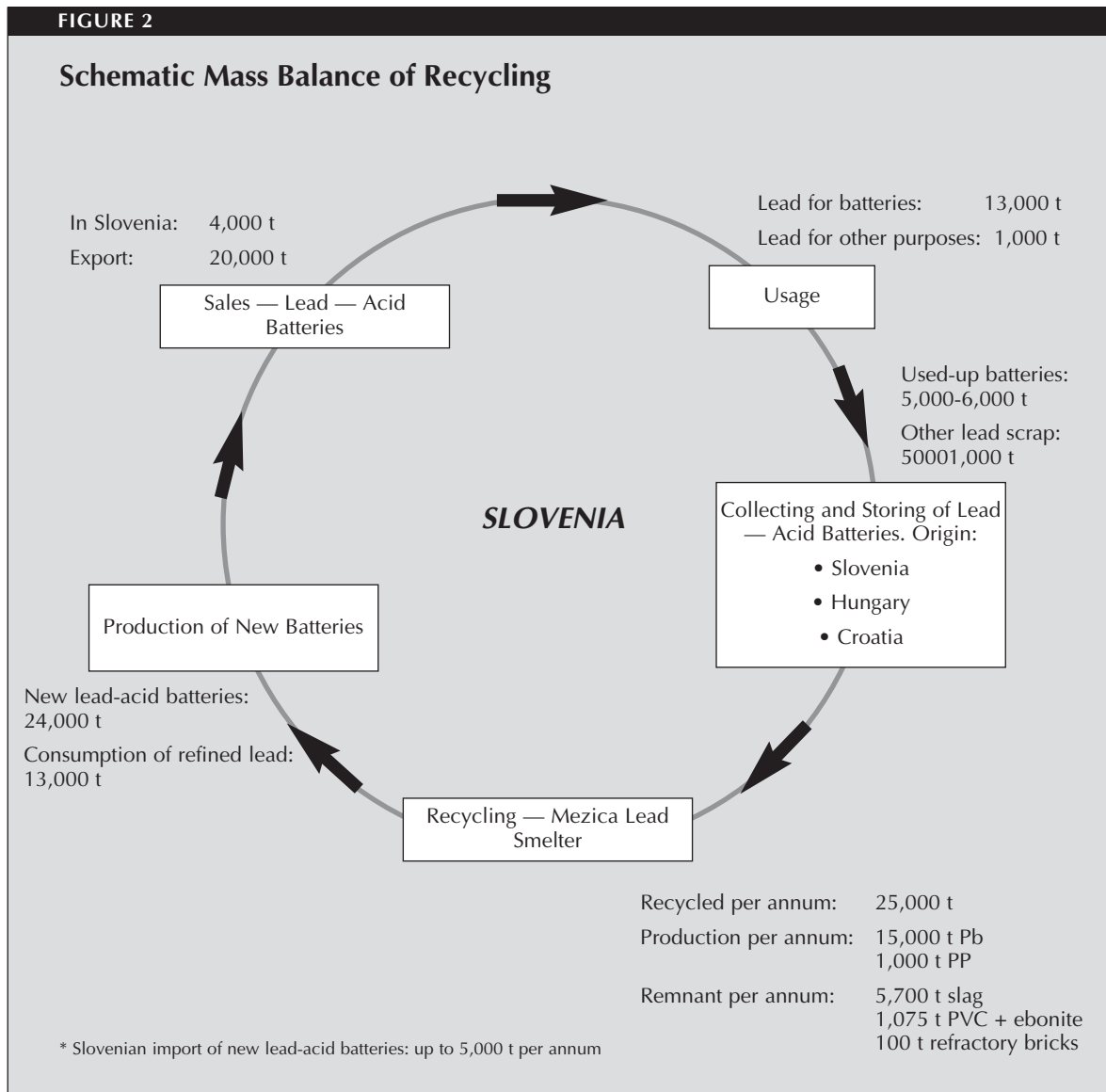
The present situation is more under control than it was before the transition period, mainly due to new legislation that calls for mandatory prevention, separate collection and proper management of this type of waste, irrespective of its origin and hazardous potential.

Policy and legislation

Until November 2000 there were only fragments of special policy or legislation on waste batteries and accumulators in Slovenia.

- **Concept of Waste Management in Slovenia (1995)** recognised waste batteries and accumulators as a potentially hazardous grouping of waste that would require special attention; it predicted expansion of separate collection and recycling of lead accumulators, whereas the export of batteries was noted as a possible solution.
- **Strategic Guidelines for Waste Management in the Republic of Slovenia (1996)** did not specify any tasks on this type of waste.
- **National Environmental Action Plan (1999)** considered waste batteries and accumulators only indirectly.
- **Waste Management Act (1998)** contains the European waste catalogue that distinguishes between the following types of waste batteries and accumulators: lead batteries, nickel-cadmium batteries, batteries containing mercury, alkaline batteries, other batteries and accumulators and separately collected batteries.

In November 2000, the Regulation on Waste Batteries and Accumulators Containing Dangerous Components was issued based on the corresponding EC directive from 1991. The aim of the regulation is to introduce several mandatory activities, as follows:



- The promotion of programmes for the reduction of heavy metals use in the production of batteries and accumulators;
- The promotion of marketing of batteries and accumulators which have improved functional and environmental performance, promotion of research and environmentally friendly products;
- The labelling of hazardous types of batteries and similar products;
- The separate collection and recycling of batteries and accumulators when possible; and
- Safe disposal when recycling is not possible or feasible.

These regulations cover only hazardous types of batteries and accumulators. According to recent trends in the EU where attention has moved from environmental protection (due to emissions of hazardous components from batteries) towards resource conservation, two additional documents relating to waste batteries and accumulators have recently been prepared in Slovenia:

- **Decision on Management of Hazardous Municipal Waste (to be issued)** aiming at mandatory separate collection of hazardous batteries and accumulators in the municipal sector;
- **Decision on Management of Separately Collected Fractions of Municipal Waste (Off. J. RS 21/01)** aiming at the mandatory separate collection of other (non-hazardous) types of batteries and accumulators in the municipal sector.

In order to stimulate implementation of the new legislation, an Operational Programme was developed in the year 2000 proposing the following actions, participants and deadlines.

I. *Planning* (MoE, producers, importers, merchants, trade inspectorate — December 31, 2001)

- Preparation and approval of the operating plan for the implementation of the regulation on batteries and accumulators (both new and old);
- Preparation of programmes to reduce the heavy metal content of produced and imported batteries and accumulators;
- Control measures for the proper labelling of hazardous batteries and accumulators;
- Concrete measures to implement new legislation on waste batteries;
- Registration of producers, importers, marketers, collectors, processors and disposers of spent batteries and accumulators;
- The establishment of an information system for spent batteries and accumulators;
- Programme for public information and education.

II. *Implementation of the waste battery system* (MoE, producers, importers, chamber of commerce, trade inspectorate — permanent tasks)

- To prepare and implement the programme for battery/accumulator users;
- To control heavy metal content in batteries on the market;
- To undertake research/development programmes for battery producers;
- To run and use the information system;
- To implement proper labelling, separate collection, processing and disposal of spent batteries and accumulators;
- To control proper labelling on new hazardous batteries and accumulators;
- To develop a collection system for used batteries and accumulators and control its effectiveness.

III. *Reporting* (MoE — permanent task)

- To elaborate annual reports on streams of waste batteries and accumulators;
- To study effectiveness and trends and prepare corrective measures;
- To prepare reports for the European Commission.

Battery waste market

The recycling industry, retailers and collectors are very interested in the market for waste batteries, including recycling fees and deposit payments. The stakeholders, namely industry and government, are discussing how to establish such a market since legislation does not include any state incentives for the waste market. There is a proposal to set up a private association or a fund that will be formed to prepare the first steps for establishing a waste market similar to the Austrian Ecoforum. Because of the opposing interests held by retailers and collectors, this will not be an easy task. According to the latest proposals, the Slovenian

Chamber of Commerce and Industry should coordinate the initiation of the market. The scheme, outlined in the operational plan (Figure 3), includes two interlaced collecting lines: industrial and municipal.

Economic aspects

In contrast to the current situation, the formation of prices for waste lead and waste lead batteries in the 1980s was not ruled by the market but by the “agreement economy.” The price of refined lead and simultaneously lead waste was based on the production cost of the biggest lead smelter in the former Yugoslavia — the Trepca Lead Smelter. Prices were announced in an official journal with little chance of them being changed, average prices were approximately twice the prices of the London Metal Exchange (LME).

Nowadays prices are controlled entirely by the market and correspond to the LME prices. No state intervention was observed in this sector during the transition period. The system efficiency reflects steady growth, so that a collection rate of about 70 percent for lead-acid accumulators is expected this year.

Costs associated with environmental protection are the largest single cost of the recycling process. Direct environmental costs are represented in waste batteries (51.2 percent) and energy consumption (14 percent). More than half of these costs is consumed by the bag filter and the scrubber. Labour costs represent about 29.8 percent; the rest is comprised of other costs like maintenance, auxiliary chemicals, etc. Indirect costs reflect investments in environmentally sound techniques and procedures (e.g. the construction of a new separation plant, construction of new landfills for hazardous wastes, a desulphurisation plant [scrubber] for exhaust gases, and wastewater treatment plants). These costs were about EUR 0.9 million per annum in the last four years.

The lead accumulator recycling company sells two products: refined lead with its alloys, and polypropylene chips. Lead materials account for 97 percent of the entire income, while polypropylene chips are two percent and other sources one percent.

The sale value of recycled lead is calculated from the average daily price of lead on the London Metal Exchange (LME) with the addition of a premium, which is between 10 and 15 percent. The premium depends on:

- The actual prices of refined lead on the LME;
- The average price of battery waste during the previous month on the LME;
- The proportion of sales via barter (in lead) or cash;
- The currency exchange rate between USD/SIT;
- The currency relation between USD/DEM; and
- The company’s cash flow during the last quarter.

The profit-breaking point of a smelter is EUR 500 to 600 per tonne of refined lead on the LME. If the price were lower, the smelter would have to reduce production costs or accept that it would produce at a loss.

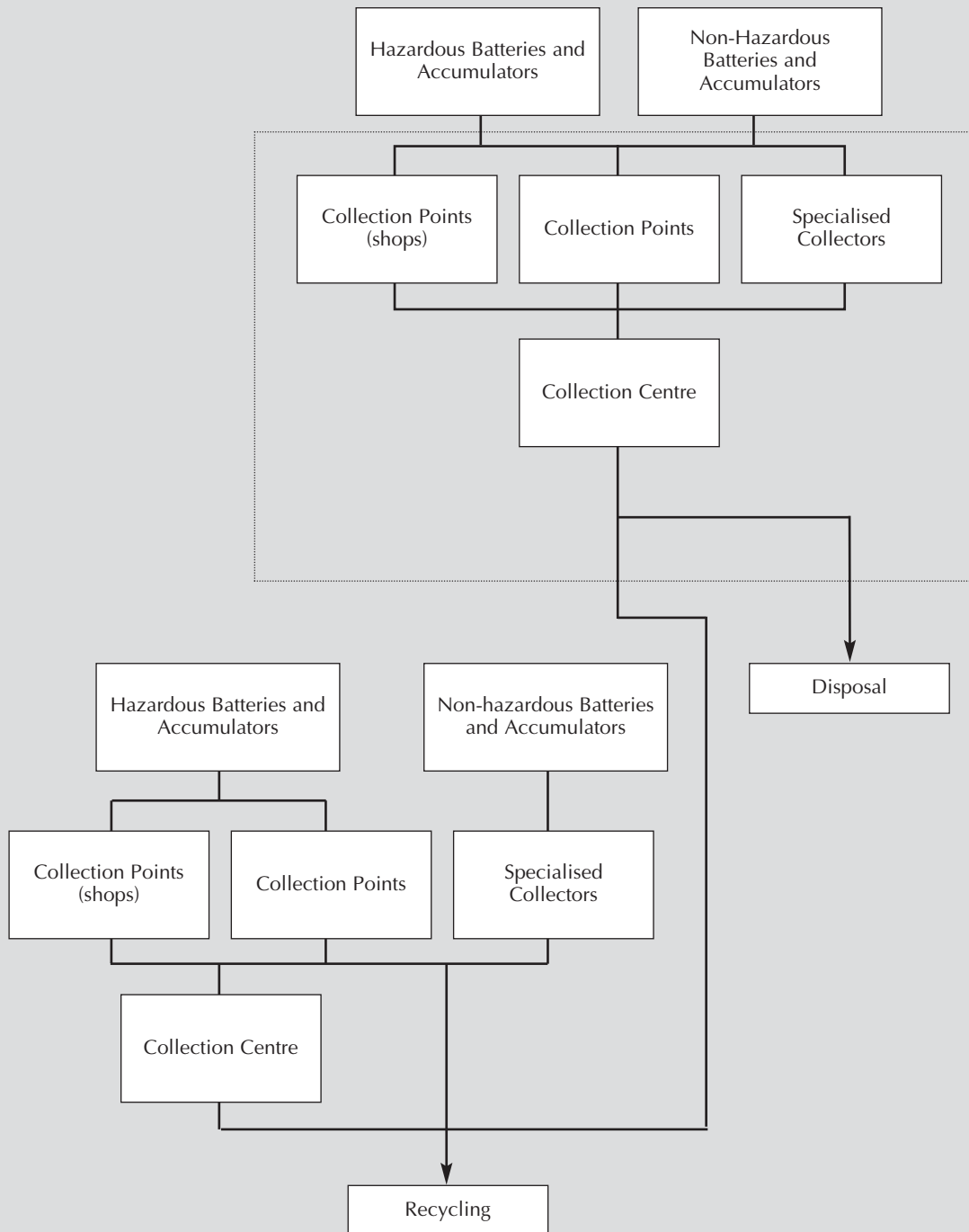
Calculating the lead metal price in the recycling company would depend on the ability to pay for raw material (battery waste) in cash or with recycled, refined lead (barter). This means that the company would pay for the conveyed raw material with the percentage of refined lead gained from the same raw material. This percentage depends on the retailer and his negotiation skills and power. The ratio in Slovene lead recycling is 60/40, which means that 60 percent of refined lead goes to the smelter and the rest to the retailer.

Import, export, and transit of hazardous batteries in Slovenia

The biggest problem is connected to Annex VII of the Basel Convention, which lists countries that enjoy the privilege of trading with waste batteries. Slovenia is a non-annex country, which means that Slovenian companies cannot trade with OECD countries in waste lead batteries. Slovenia is discriminated against by other OECD member states. For example, the Slovenian lead smelter in Mezica cannot import waste from neighbouring Austria or Germany, which run their own processing plants, but is allowed to import waste from Croatia and Hungary, which do not have such capacities. In this way the collection and transportation costs are much higher than competitors’ costs, e.g. in neighbouring Austria.

FIGURE 3

Collection/Disposal Scheme for Waste Batteries and Accumulators in Slovenia



Major problems are also generated by discriminative bilateral agreements and special import licenses required by the Ministry of Environment in both importing and exporting countries. These must be renewed every year and negotiations are never concluded in advance but during the current year, so the processing country has to wait several months to obtain these secondary materials.

Conclusions and recommendations

- During the past few decades the consumption, volume and diversity of batteries and accumulators has grown intensively, especially in EU countries but also in CEECs.
- The economy of smelters depends upon the lead price at the London Metal Exchange. Profitability also depends on the price of waste bought from collectors, the exchange rate and barter trading with collectors, who are sometimes paid in refined lead. This makes the system economically vulnerable.
- Slovenia faces a problem with import restrictions from Austria and Germany because it is not listed in Annex VII of the Basel Convention, which engenders discrimination against non-OECD countries.
- Collection systems for waste batteries and accumulators have to be improved. In order to be effective enough, the system should not be solely dependent on the economy of one recycling factory and should be independent upon the volatility of lead prices.
- Active state involvement seems to be unavoidable. The government should set collection and recovery targets and possibly include them in national legislation. Furthermore, producer liability and take-back obligations should be stated clearly on a legal basis. Voluntary agreements between industry and authorities should be initiated.
- Incentives improving economic instruments should also be introduced, e.g. obligatory product charges, recycling fees or VAT tax reduction applied to lead obtained from the recycling of batteries.
- An effective monitoring system, reporting method and reliable database are also needed. The public should be regularly informed about the collection and recycling opportunities for waste batteries and accumulators.

ANNEX III

Gross Domestic Product and Solid Municipal Waste

INPUT DATA

GDP data are taken from S. Stapel, *The GDP of the Candidate Countries, Annual data for 1999*, Statistics in Focus 27/2000, Eurostat 2000. Data on the generation of solid municipal waste (SMW) are taken from average values from the *OECD Environmental Data Compendium*, "Waste," Paris 1999. Data collected in this study are used for CEECs (non-OECD). Data are summarized in Table 1.

TABLE 1		
Generation of SMW with GDP for 1998		
<i>Country</i>	<i>SMW (kg/inhabitant)</i>	<i>GDP (thousand EUR/inhabitant)</i>
Slovenia	600	13.90
Ireland	560	21.70
Denmark	560	24.00
Netherlands	560	22.80
Austria	510	22.40
Hungary	500	9.90
France	480	19.90
Belgium	480	22.50
UK	480	20.50
Germany	460	21.80
Italy	460	20.40
Czech Republic	450	12.20
Slovakia	420	9.40
Lithuania	410	5.60
Finland	410	20.50
Bulgaria	390	4.50
Estonia	390	7.50
Spain	390	16.30
Portugal	380	15.10
Greece	370	13.30
Sweden	360	20.50
Poland	320	7.20
Romania	280	5.70
Latvia	240	6.30

LINEAR RELATIONSHIP BETWEEN GDP AND SMW

The generated amount of solid municipal waste (SMW) correlates with GDP for a group of countries with similar consumption patterns and character of SMW management. We have therefore formulated two hypotheses to be tested statistically:

- A. EU members and CEECs are a single group;
- B. EU members and CEECs are two different groups.

Linear regression has been therefore applied to:

- A. The whole set (EU plus CEECs) of countries;
- B. Two separate sets (EU and CEECs) of countries.

TABLE 2

Results of Linear Regression and Correlation for Both Hypotheses

<i>Countries</i>	<i>Intercept y-axis (kg of SMW)</i>	<i>Slope (kg of SMW /thousand EUR)</i>	<i>Correlation coefficient - critical value (99%)</i>
EU + CEECs (n=24)	308.4	8.4	0.6251/0.515
EU (n=14)	107.4	17.6	0.7692/0.661
CEECs (n=10)	182.8	26.4	0.7702/0.765

Resulting slopes, intercepts and correlation coefficients are shown in Table 2.

Comparing correlation coefficients with their critical values given for n-2 degrees of freedom, it is evident that statistically satisfying linear relationships have been found in all three cases. It is impossible to reject either hypothesis on a purely statistical basis.

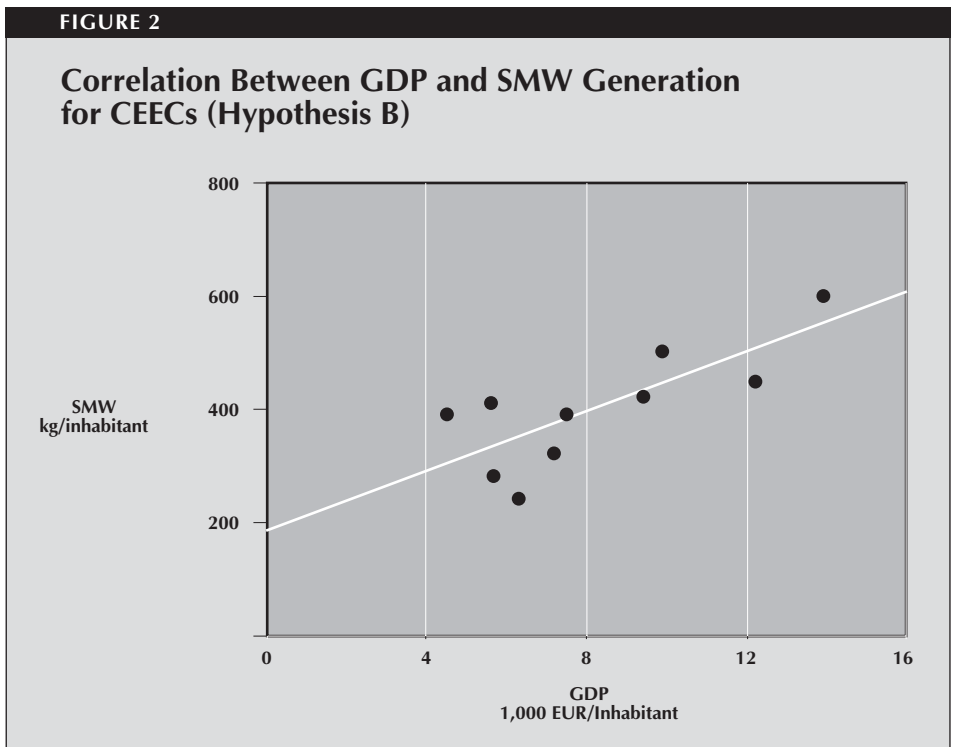
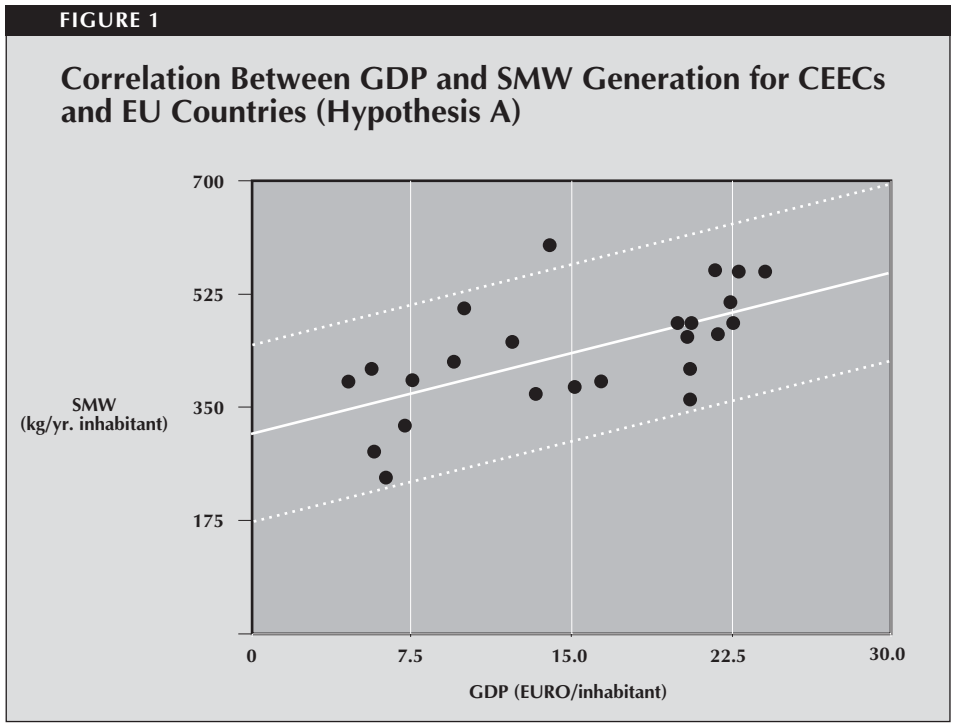
Despite the differences in collection efficiencies and in composition of municipal waste (e.g. varying share of commercial waste from SMEs, ashes in areas with coal-heated houses, packaging waste etc.), there is a strong correlation between those two indexes.

In Figure 1, Slovenia is an outlier¹²¹ with 600 kilograms of solid municipal waste per capita per year. As the country has only very fragmental statistical data (five-year period) and a relatively low amount of non-hazardous waste generated (see Chapter 6 and 7), the categorisation of some non-hazardous waste as municipal is a plausible explanation.

However, the relatively high value of intercept (308.4 kilograms per EUR 1000) resulting for the whole set of countries (hypothesis A) is somewhat improbable. It is therefore more plausible that the two separate linear relationships (first for CEECs, second for EU members) describe the behaviour of EU and CEECs better than one common linear equation. The correlation between GDP and SMW for CEECs is shown in Figure 2.

Consequently, CEECs seem to generate on average more SMW per unit of GDP than the EU countries. For example, the statistical model predicts for the Czech Republic, where about four percent growth of GDP is expected until 2005, that SMW generated will grow by 16 percent to about 520 kilograms per inhabitant, if no preventive measures are taken.

Despite the relatively good correlation (99.9 percent level of significance) indicated in Table 2, it is evident that countries with the same economic performance may differ substantially with respect to the amount of solid municipal waste generated. These differences are caused by the statistical error of waste quantification (volume mass recalculations, double-counting, etc.), and/or different share of mixing of commercial waste from SMEs with solid municipal waste.¹²²



Endnotes

- 1 Secretariat of the Sofia Initiative on Economic Instruments (SIEI) at the Regional Environmental Center for Central and Eastern Europe (REC), Szentendre, Hungary.
- 2 A Community Strategy for Waste Management, Council Resolution of May 7, 1990 (OJ C 122, 18.5.1990, p.2).
- 3 *Environment in the European Union at the Turn of the Century*, Waste generation and management, Copenhagen, 1999.
- 4 *Caring for Our Future - Action for Europe's Environment: 25 Issues at a Glance*, European Commission, 1997.
- 5 ENDS Daily for biodegradable waste 27/04/2001.
- 6 In September 1989 the commission made a communication to the council and to the European Parliament on a *Community Strategy for Waste Management* (SEC (89) 934 final of 18.09.1989). The council and the parliament approved this strategy in their respective resolutions of May 7, 1990 (OJ C 122 p2, 18.5.1990) and February 19, 1991 (OJ C 72 p. 34, 1.3.1991). In 1994 the European Parliament presented a resolution arguing for further development of the Commission Waste Management Strategy (OJ C 128 p. 471, 09.05.1994). In 1995 the commission made a report to the council on waste management policy (COM (95) 522 final). A review of *Community Waste Management Strategy* was published as a Commission Communication in 1996 (COM (96) 399 final). At the beginning of 1997 the Council also passed a resolution on a *Community Strategy for Waste Management* (OJ C 76 p.1, 11.03.1997).
- 7 See <<http://europa.eu.int/comm/environment/waste/report3.htm>>.
- 8 In some cases, the implementation plans should be rather prepared for clusters of related directives.
- 9 For overview see monthly *EU Environmental Issue Tracker and Manager*, Eamonn Bates Env., Brussels.
- 10 By the end of July 2001, 29 persons from nine countries (Czech Republic, Denmark, Estonia, Germany, Latvia, Netherlands, Slovakia and Turkey) registered; 13 persons from state institutions, 10 from private companies and six from universities.
- 11 *Information on Waste Management Practices: A Proposed Electronic Framework*, Technical reports No 24, EEA, July 1999.
- 12 *Environmental Indicators, Towards Sustainable Development*, OECD, Paris 1998.
- 13 Council Directive 91/692/EEC, *Standardising and Rationalising Reports on the Implementation of Certain Directives on the Environment*.
- 14 See <www.eurowaste.org>.
- 15 New Waste Acts approved by the Czech and Slovakian Parliaments in May 2001 are good examples of such changes. In January 2001, a Dutch-Czech project on hazardous waste management plan was launched.
- 16 *Information on Waste Management Practices, A Proposed Electronic Framework*, Technical Report No 24, EEA, July 1999.
- 17 See study of ETC/Waste, Copenhagen, *Hazardous waste generation in: Austria, Denmark, Germany (North Rhine-Westphalia), Ireland and Spain (The Basque Country and Catalonia), Comparability and Non-comparability in Relation to Classification and Quantities for the Period 1993-96*.
- 18 This was found in the Czech Republic, where the Czech Statistical Office and the MoE monitor hazardous waste producers using different methodologies.
- 19 Data validation is a part of data quality management and requires definition of data quality objectives and establishment of quality management policy. Validation is the last step before data is given to the final users, see e.g. *Guidance for the Data Quality Objectives Process (EPA QA/G-4)*, US EPA, 2000.
- 20 *Hazardous Waste Generation in Selected European Countries, Comparability of Classification Systems and Quantities*, EEA Topic Report 14/1999.
- 21 As admitted by participants at the validation meeting, January 2001.
- 22 During the Project, numbers of landfills were corrected frequently. In Slovakia for example, a number of the landfills were closed in 2001 due to non-compliance with stricter national standards.
- 23 Council Directive 91/692/EEC standardising and rationalising reports on the implementation of certain directives concerning the environment (OJ L 377, 31.12.91).
- 24 IPPC permits are issued on the basis of Directive 96/61/EEC on integrated prevention and pollution control.
- 25 See <http://www.epa.gov/region01/oeme/DVMANUAL.pdf>.
- 26 e.g. J. Friend and A. Hickling, *Planning Under Pressure*, 2nd edition, Butterworth-Heinemann, Oxford 1997.
- 27 See e.g. P. Tucker and D. Smith, "Simulating Household Waste Management Behaviour," *Journal of Artificial and Social Simulation*, 2(2), 1999.
- 28 There is a certain overlap between those two groups as the Czech Republic, Hungary, Poland and Slovakia are new members to the OECD. For the purposes of rough comparison, OECD averages are used without excluding this group of "transition economies."
- 29 *Environment in the European Union at the Turn of the Century*, Waste Generation and Management, EEA, 1999.

- 30 Inert waste was not the subject of this study. According to the Directive on Land Filling (1999/31/EC), "inert waste" means waste that does not undergo any significant physical, chemical or biological transformations.
- 31 Due to statistical outliers and "not available" data.
- 32 Total = Municipal + Non-hazardous (industrial) + Hazardous.
- 33 Grubb's statistical test for outliers (<http://www.graphpad.com/calculators/grubbs1.cfm>) was used.
- 34 Bulletin ENVIRONMENT, National Statistical Office, Sophia. Waste from exploration, mining, dressing of minerals and quarry represent about 95 percent of the total.
- 35 Average values are calculated using Table 7; average = total waste/total population where both are totals calculated over the same table rows.
- 36 According to the Directive on Landfilling (1999/31/EC), "municipal waste" means waste from households as well as other waste, which because of its nature or composition is similar to waste from households.
- 37 Estimated as total production/total municipal without Slovakia and Latvia (n.a).
- 38 Average values taken from OECD *Environmental Data Compendium*, "Waste," Paris 1999.
- 39 S. Stapel, *The GDP of the Candidate Countries, Annual data for 1999*, Statistics in Focus 27/2000, Eurostat 2000.
- 40 The value of a currency is determined by the amount of goods and services that can be purchased with a unit of the currency. This artificial purchasing power standard (PPS) is used to express GDP more meaningfully than exchange rates when a comparison between two or more countries is made, see e.g. R.M. Rodriguez, E.E. Carter, *International Financial Management*, 3rd Edition, Prentice Hall, 1984.
- 41 See e.g. ETC/W, *Baseline Projections of Selected Waste Streams* (Technical report 28), <http://etc-waste.eionet.eu.int/>.
- 42 *Environment in the European Union at the Turn of the Century*, Waste Generation and Management, EEA, 1999.
- 43 In Slovenia data for 1999 is not available, only for 1995.
- 44 *Hazardous Waste Generation in Selected European Countries, Comparability of Classification Systems and Quantities*, Topic Report 14/1999.
- 45 European Community Environment Legislation (Volumes 1-7), DG XI, 1992 and 1996, Office for the Official Publications of the EC; DG XI, *Handbook on the Implementation of EC Environment Legislation*, CD issued by MoE Prague 1999.
- 46 *Environment in the European Union at the Turn of the Century*, Waste Generation and Management, EEA, 1999.
- 47 *Environment in the European Union at the Turn of the Century*, Waste Generation and Management, EEA, 1999.
- 48 See also the new waste legislation adopted in the Czech Republic and Slovakia in June 2001.
- 49 *Environment in the European Union at the Turn of the Century*, Waste Generation and Management, EEA, 1999.
- 50 *Environment in the European Union at the Turn of the Century*, Waste Generation and Management. EEA, 1999.
- 51 AEA *Technology: Implementation/Investment Strategies for EC Air Directives*, Project no. CZ9811-02-01, Waste Incineration.
- 52 Statistical data of organisations associated in SPDS - APOREKO.
- 53 Total includes also plastics, rubber and textiles.
- 54 For details see the Case Study *Voluntary agreement on take-back and recovery of packaging: System EKO-KOM* on <www.eurowaste.org>, or its executive summary in Annex 1 of this final report.
- 55 European Commission Green paper on environmental issues of PVC, COM (2000)469.
- 56 *Environment in the European Union at the Turn of the Century*, Waste, EEA 1999.
- 57 Council Directive 91/692/EEC standardising and rationalising reports on the implementation of certain directives relating to the environment (OJ L 377, 31.12.91).
- 58 For details see the Case Study *Management System of Waste Batteries and Accumulators in Slovenia* on <www.eurowaste.org>, or its executive summary in Annex II of this final report.
- 59 Eamon Bates Issue Tracker, July-August 2001, p. 25.
- 60 Eamon Bates Issue Tracker, July-August 2001, p. 27.
- 61 Commission Green Paper on environmental issue of PVC, COM (2000)469 and Report of the European Parliament, 21 March, 2001.
- 62 Communication from the Commission, endorsed by the Council on May 7, 1990 (OJ C 122, 18.5. 1990, p.2).
- 63 ENDS Daily, No. 981, 30 April 2001.
- 64 *Handbook on the Implementation of EC Environmental Legislation*, CD issued by the MoE, Prague 2000; the Handbook is the result of collaborative efforts between the European Commission (DG ENV) and the Phare-funded DISAE programme.
- 65 Working paper by L. Stefanescu, see the Project Web site.
- 66 As Purchasing Parity Standards.
- 67 GVA - gross value added by the sector.
- 68 J. Klarer and Z. Lehocki, *Sourcebook on Economic Instruments for Environmental Policy*, REC-SIEL, Szentendre 1999.
- 69 Approved by the Parliament as Act No. 185/2001 Coll., on Waste.
- 70 43.6 million tonnes according to the Czech Statistical Office in 2000.
- 71 We expect continuation of positive trends from the 90s; hazardous waste is defined strictly in accordance with the EWC that will lead to a decrease of about 60 percent in comparison with the previous national catalogue.
- 72 According to present statistics only a minor part of hazardous waste has been land filled; as the definition of hazardous waste changes, it is difficult to estimate this share in the coming years.
- 73 J. Friend and A. Hickling, *Planning under Pressure*, 2nd edition, Butterworth-Heinemann, Oxford 1997. This book describes techniques of iterative planning under uncertainties carried out in large groups of decision-makers, stakeholders, experts, etc.
- 74 Software Prognosis was tested by DHV CR during the Project, which includes robust statistics (MAD, MAPE, etc.) and offers several models (ARIMA, ARMA, etc.), exponential smoothing, etc. See <www.profiware.com> where a free test version of PROGNOSIS can be downloaded.
- 75 *Handbook on the Implementation of EC Environmental Legislation*, CD, issued by the MoE, Prague 2000.
- 76 See methods of strategic planning recommended in J. Friend and A. Hickling, *Planning Under Pressure*, 2nd edi-

- tion, Butterworth-Heinemann, Oxford 1997.
- 77 SENTER Project (bilateral Dutch-Czech cooperation) “*Development for a National Plan for Hazardous Waste for the Czech Republic*,” January 2000 - March 2001, see website of DHV CR (www.dhv.cz).
- 78 For these reasons, an additional questionnaire was prepared (see paper by Chmelik and Geuss), but only four CEECs responded to this questionnaire.
- 79 J. Klarer and Z. Lehocki, *Sourcebook on Economic Instruments for Environmental Policy*, REC-SIEI, Szentendre 1999.
- 80 In the Czech Republic and Slovakia, for example, new Waste Acts have been approved in May 2001.
- 81 European Commission (1997): *Environmental Taxes and Charges in the Single Market*, Communication from the Commission, COM (97) 9 final, Brussels, (EC 1997).
- 82 BATNEEC means the best available technology not entailing excessive costs.
- 83 See www.oecd.org/env/policies/taxes/index.htm, and Speck and Ekins, 2000.
- 84 See www.oecd.org/env/policies/taxes/index.htm, and Speck and Ekins, 2000.
- 85 An interesting aspect of this definition is that it does not take into account the purpose of the tax. Hence, taxes which may be principally “revenue raising” taxes, are considered as environmental taxes under this definition - the intention is not regarded as important, even though it is likely to be important from the political point of view.
- 86 The definition of taxes as unrequited payments to general government attracts special attention in some of the Central and Eastern European Countries that aim to join the EU since revenue generated from emission levies is earmarked for extra-budgetary funds (Environmental Funds).
- 87 That is, a tax is clearly identified when the payment is compulsory (by law), destined to the government and unrequited (i.e. without a counterpart flow), Eurostat 1999a, p.iii.
- 88 Eurostat 1999, in: European Commission (1997): *Environmental Taxes and Charges in the Single Market*, Communication from the Commission, COM (97) 9 final, Brussels.
- 89 See www.oecd.org/env/policies/taxes/index.htm, and Speck and Ekins, 2000.
- 90 See www.oecd.org/env/policies/taxes/index.htm, and Speck and Ekins, 2000.
- 91 See www.oecd.org/env/policies/taxes/index.htm, and Speck and Ekins, 2000.
- 92 Taken from J. Klarer and Z. Lehocki, *Sourcebook on Economic Instruments for Environmental Policy*, REC-SIEI, Szentendre, 1999.
- 93 S. Speck, P. Ekins (2000): *Recent Trends in the Application of Economic Instruments in EU Member States plus Norway and Switzerland*, Forum for the Future for the European Commission, DGXI, Brussels. DG Env, 1998, 2000.
- 94 The following conversion rates EUR/local currency are used: 1.95 Bulgaria, 34.7 Czech Republic, 15.7 Estonia, 283 Hungary, 0.55 Latvia, 3.6 Lithuania, 3.6 Poland, 23,000 Romania, 41 Slovakia and 215 Slovenia (based on annual or six month averages, see www.ft.com and www.rate.co.uk/exrates.html).
- 95 Level of EUR 1.5-4 per cubic metre is found in OECD database (for 1998).
- 96 See http://www.europa.eu.int/comm/environment/enveco/env_database/database.htm.
- 97 Although ambitious targets for waste reduction, e.g. recycling, reuse, etc. have been set up by several EU candidate countries.
- 98 For more details see national questionnaires (Project Web site).
- 99 The main target is to meet rates set up on EU level for recovery (65 percent) and recycling (45 percent). Some countries decided for even higher rates e.g. Belgium (80 percent for recovery and 50 percent for recycling), Denmark (54 percent for recycling).
- 100 For more details see Ekins and Speck, 2000.
- 101 See also <http://www.oecd.org/env/efficiency/epr.htm>.
- 102 Estonia, for example, does not intend to build incinerators and the question may arise how the country wants to achieve the requirement of the Landfill Directive.
- 103 DISAE discussion paper, *Development of Implementation Strategies for Approximation in Environment Workshop*, Brussels, June 1998.
- 104 J. Jantzen, *Economic Instruments and Environmental Policy in CEE*, TME, Hague, September 1999.
- 105 Publicly available estimates in CEECs; see questionnaires at www.eurowaste.org.
- 106 Halcrow&Partners Ltd. (1999), *Provision of Technical Assistance in the Approximation of Waste Management Legislation in the Slovak Republic*, SR/104 DISAE.
- 107 Communication from the Commission, *The Challenge of Environmental Financing in the Candidate Countries*, COM(2001)304 final.
- 108 O. Linher, *The Economics of Waste Management: An EC Point of View*, Intl. Forum Osaka, September 2000.
- 109 See e.g. ECOTEC et al., *The Benefits of Compliance with the Environmental Acquis for Candidate Countries*, 2001.
- 110 Czech Implementation Plans are available on the web server of the MoE, www.env.cz.
- 111 For more details see paper by T. Kluvankova-Oravska *Economic Instruments for Waste Management in EU Member States*, available at www.eurowaste.org.
- 112 J. Jantzen, *Economic Instruments and Environmental Policy in CEE*, Institute for Applied Environmental Economics, TME, the Hague 1999.
- 113 V. Bizek, *Strategy of State Environmental Fund of the Czech Republic in Pre-accession Period*, DHV CR, Prague 1999. The main priority in the Czech Republic was air protection.
- 114 V. Bizek, *Proposal of Techno-economic Background for the Use of ISPA Funds in the Czech Republic*, DHV CR, Prague 1999.
- 115 The majority of investment projects supported by the Czech Environmental Fund are successful. The case of EKOTRON Ltd. (recycling of refrigerators with CFCs) can, however, serve as an example of support (80 millions in loans and subsidies in 1994) of a risky private sector project that ended in bankruptcy. About 20,000 household refrigerators were collected (containing about 17 tonnes of CFCs) during 1994-6 and piled near Kacov and left there following the bankruptcy. A new tender was called in 2001 to solve the situation.
- 116 Investments into environmental infrastructure in CEECs were estimated between EUR 685 (Jantzen 1999) and EUR 853 per capita (EDC 1997 in Jantzen).

- 117 There will be a wide variation between households, for several reasons. As local governments are mostly responsible for setting these prices, we can expect large differences to occur. Second, the costs of waste collection and treatment differ markedly in different parts of the country. Third, there is a difference in access to services in different areas and clearly consumers receiving services for the first time are likely to see higher prices than those whose infrastructure is being upgraded. This is particularly true for rural areas, which currently have lower service coverage, and which have far higher unit costs of extending networks.
- 118 Investments into environmental infrastructure in CEECs were estimated between EUR 685 (Jantzen 1999) and EUR 853 per capita (EDC 1997 in Jantzen).
- 119 Communication from the Commission, *The Challenge of Environmental Financing in the Candidate Countries*, COM(2001)304 final.
- 120 Full texts of the case studies are available at <www.eurowaste.org>.
- 121 Dotted band in Figure 1 has a width of three standard deviations.
- 122 ETC/W, *Household and Municipal Waste: Comparability of Data in EEA Member Countries* (Topic 3/2000), <http://etc-waste.eionet.eu.int/>. Variations in "daily household and commercial waste" between EU member countries are mainly a function of the extent to which household and similar waste from other sources is sorted and separately collected.



Illustration: Erika Varsanyi

ON THE COVER:

en•dan•gered spe•cies (en dān'jərd spē'shēz), **1.** a species at risk of extinction in Central and Eastern Europe because of human activity, changes in climate, changes in predator-prey ratios. **2. Ardeidae:** the family of long-legged, long-necked waterfowl, known as herons. **Platalea leucorodia:** a wading bird with a flat spoonlike bill, commonly called a spoonbill. **3. Croatian Ornithological Society:** an NGO working to save a mixed colony of herons and spoonbills in the Jelas fishponds of Croatia with the financial support of the Regional Environmental Center.

THE REGIONAL ENVIRONMENTAL CENTER FOR CENTRAL AND EASTERN EUROPE (REC) is a non-partisan, non-advocacy, not-for-profit organisation with a mission to assist in solving environmental problems in Central and Eastern Europe (CEE). The Center fulfils this mission by encouraging cooperation among non-governmental organisations, governments, businesses and other environmental stakeholders, by supporting the free exchange of information and by promoting public participation in environmental decision-making.

The REC was established in 1990 by the United States, the European Commission and Hungary. Today, the REC is legally based on a Charter signed by the governments of 27 countries and the European Commission, and on an International Agreement with the Government of Hungary. The REC has its headquarters in Szentendre, Hungary, and local offices in each of its 15 beneficiary CEE countries which are: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, FYR Macedonia, Poland, Romania, Slovakia, Slovenia and Yugoslavia.

Recent donors are the European Commission and the governments of the United States, Japan, Austria, Canada, Czech Republic, Croatia, Denmark, Finland, France, Germany, Hungary, Italy, the Netherlands, Norway, Slovakia, Switzerland and the United Kingdom, as well as other inter-governmental and private institutions.



Waste Management Policies in Central and Eastern European Countries: Current Policies and Trends