Waste Solutions

Six new approaches to sustainable urban waste management in Europe

Results of the European Urban Waste Management Cluster Projects

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ICLEI Local Governments for Sustainability

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Waste Solutions

Six new approaches to sustainable urban waste management in Europe

Results of the European Urban Waste Management Cluster Projects

In the city of tomorrow, waste will be a crucial issue for achieving, or not achieving, sustainability. Pursuing sustainable waste management, in line with the Council Directive 75/442/EEC on waste, 1996, means that the actual prevention of waste generation is the first policy priority, followed by waste recovery and by the safe disposal of waste (hierarchy of principles for waste management). These principles need to be put in practice through joint waste prevention and management measures if negative impacts on the environment, public budgets and the quality of life are to be avoided. Necessary measures have to be taken mainly by local governments. Therefore, local governments also need to be involved in European research, and research needs to be measured against its use value at the local level. This insight was the driving force behind the research of six projects united in the European Urban Waste Management Cluster (EUWMC), funded under the European Union's 5th Framework Programme for Research, Technology Development and Demonstration (RTD). Between 1999-2005, the six projects, in co-operation with local authorities from a vast range of European countries, successfully developed tools, know-how and methods in response to all the steps of the waste hierarchy ladder: "AWAST" created a methodology for integrated sustainable municipal waste management; "LCA-IWM" delivered two tools for municipal waste prognosis, management system planning & assessment; "SWA-Tool" resulted in a standardised method for solid waste analyses; "PAYT" offers guidance for pay-as-you-throw policies; "ORMA" allows simulation for resource use and waste management in Eco-Industrial Parks and finally "RELIEF" kicked off the Procura+ Campaign for sustainable public procurement. Further, the six projects co-operated through the "Waste Solutions – European Urban Waste Management Cluster Project" that delivered additional results like this brochure or a database on good practice and innovative projects, all available through www.wastesolutions.org.

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Key message from the European Commission

Urban areas face many challenges both in the old and new European Union Member States. To walk the path of sustainability is difficult in the face of these challenges, but also necessary because of them. The urban policies developed to respond to these challenges are usually developed and implemented by the European Union Member States and the local authorities themselves, according to the principle of subsidiarity.

However, the urban challenge has also triggered reactions of the European Commission aimed at addressing urban sustainability from a global and integrated perspective. The European level has the capacity to act as a catalyst in supporting sustainable local development, by creating, facilitating, and promoting new policies, management and tools. The European Commission seeks to support and expand this capacity.

The role of integrating European research is essential here. Improving long-term sustainability perspectives for urban areas relies, amongst other factors, on new modelling tools and assessment methodologies that are needed to better forecast how the complex 'urban system' could evolve in the future, or piloting new ways of policy implementation in all fields of local public management.

As part of the 5th European Union Framework Programme for Research, and supported by the European Commission, the Key Action 'City of Tomorrow and Cultural Heritage' ensures the development of these practical new approaches to urban governance, planning and management that will enable truly sustainable policies to be defined and implemented. The Communication from the European Commission on "Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union" further adds a broad framework for action towards sustainability and involvement of cities and citizens in the decision making process.

The European Urban Waste Management Cluster (EUWMC) falls under the criteria of this Key Action 'City of Tomorrow and Cultural Heritage' and unites six important projects on waste management. These projects, presented here, deliver high added-value at the European and city level. They support the aim to contribute to policy and technology development on waste management and avoidance, and produce new tools and guidance successfully piloted at the urban level, under different circumstances and in a wide range of Member States.

To cluster the single projects in the "EUWMC" has a further, positive impact on improving the coordination of research, and on providing easy access for local authorities to the various tools and methodologies. The aim achieved is to integrate European research for practical measures towards sustainable waste management at the local level!

Viorel Vulturescu
European Commission
Directorate-General Research
Scientific Officer

Waste Solutions – Results of the European Urban Waste Management Cluster: An Overview

By Silvia Estermann, Waste Solutions Project Coordinator, iC Consulenten Ziviltechniker, and Stefanie Lay, Editor, ICLEI – Local Governments for Sustainability

In the city of tomorrow, waste will be a crucial issue for achieving, or not achieving, sustainability. Therefore, the European Commission Directorate-General Research funded the European Urban Waste Management Cluster (EUWMC) to bring local governments together with researchers for policy and technology development on urban waste management and avoidance. Between 1999-2005, the six EUWMC research projects have each successfully developed tools, know-how and methods in response to all the steps of the "waste hierarchy ladder", as well as co-operated on identifying research synergies between the projects and optimising information provision through the "Waste Solutions – European Urban Waste Management Cluster Project".

Context

In the city of tomorrow, waste will be a crucial issue for achieving, or not achieving, sustainability. Pursuing sustainable waste management, in line with the Council Directive 75/442/EEC on waste, 1996, means that the actual prevention of waste generation is the first policy priority, followed by waste recovery and by the safe disposal of waste (hierarchy of principles for waste management). These principles need to be put in practice though joint waste prevention and management measures if growing environmental degradation is to be avoided. For example, the use of valuable land for waste disposal, the release of harmful substances from landfills and waste transports into air, soil and water, and the use of resources that are transformed into disposed waste instead of reused or recycled will all have negative impacts on the environment, and will have a long-lasting direct and indirect influence on the quality of life.

Necessary measures have to be taken mainly by local governments. They are key actors in waste management when it comes to preserving the environment, fostering sustainable development, and complying with legislation following Council Directives. To meet the challenges at hand and come to sustainable solutions for waste, local governments need to be involved in European research, and research needs to be measured against its use value at the local level. This insight was a driving force behind the research of six research projects united in the European Urban Waste Management Cluster (EUWMC).

The European Urban Waste Management Cluster (EUWMC)

Within the European Union's 5th Framework Programme for Research, Technology Development and Demonstration (RTD), launched in 1999, six projects of the action line Sustainable City Planning and Rational

Resource Management, Key Action City of Tomorrow and Cultural Heritage, were grouped into the EUWMC. The European Commission funded this cluster to bring together decision-makers and experts from local authorities with researchers, with the aim of contributing to policy and technology development on urban waste management and avoidance.

Between 1999-2005, the six EUWMC research projects, each in co-operation with local authorities from a vast range of European countries, have successfully developed tools, know-how and methods in response to all the steps of the waste hierarchy ladder. These responses are presented in detail in this brochure (for an overview, see box).

The six European Urban Waste Management Cluster Projects

PAYT – Pay-As-You-Throw policy guidance

Variable rate pricing implemented through a pay-as-you-throw (PAYT) scheme offers an instrument of public policy to reduce residual waste and enhance recycling through the provision of financial incentives to citizens for lowering waste production and increasing waste diversion. The PAYT project offers a handbook and further guidance based on intensive research to deliver the necessary know-how for successfully employing PAYT.

LCA-IWM – Municipal waste prognosis and management

Two tools based on Life Cycle Analysis (LCA) were developed to support, in particular, local authorities in rapidly growing economies to plan waste management systems in a sustainable way. Both tools, one prognostic and one assessment aid, together with a handbook will be available free-of-charge to European municipalities in spring 2005.

AWAST, a methodology for sustainable municipal waste management

Municipal solid waste needs the development of long-term sustainable waste management systems. To respond to this need, AWAST developed a simulation system that considers environment, energetic, economic and social components of waste management and thus can serve as a contribution to sustainability.

SWA-Tool – Solid waste analyses guidance and methodology

Waste analyses serve as an effective tool for acquiring relevant information for waste management planning. However, the comparison and hence effective use of analyses has to date been difficult. The SWA-Tool now offers guidance and a user-friendly and standardised methodology for waste analyses, and allows the comparison of various waste analyses between municipalities.

ORMA – Optimisation of resource use and waste management in an Eco-Industrial Park (EIP).

The purpose of ORMA is to assist the design of environmentally and economically optimised EIPs with a simulation that uses a range of modular tools. The model is used together with individual consultancy. A handbook is also available.

RELIEF – Harnessing the power of sustainable public procurement

The RELIEF project presents the actual environmental gains possible through sustainable procurement. As a result, the Procura+ Campaign has been launched in order to build a movement of public authorities committed to implementation of sustainable procurement.

Synergies and easy access: The Waste Solutions cluster project

The six cluster projects together did not only deliver their respective results, but co-operated in the "Waste Solutions – European Urban Waste Management Cluster Project (EUWMC)". The aim was to assure that local governments obtain maximum benefit from the research undertaken by using research synergies and sharing dissemination and information. Waste Solutions served to provide the following:

Maximisation of potential synergies in research and innovation

1. Critical comparison and consolidation of the preliminary results in order to better direct future research plans and activities
2. Identification of other research and piloting projects in related areas
3. Identification of existing and envisaged innovative measures in cities and eco-industrial parks

Effective and efficient dissemination and information

4. Dissemination of the results to a wider and in particular local government audience
5. Development and maintenance of an interactive web-site: www.wastesolutions.org
6. Recommendations for future common EC waste management policy

Services and results

The Waste Solutions web centre www.wastesolutions.org not only offers access to the results of all six cluster projects, but also documentation of research on good practice cases, as well as a compilation of policy, financial and legal measures and approaches to waste applied by local governments. The cases and research helped setting the focus on measures and approaches already successfully applied by local governments. Further, a searchable online database contains both good practice cases as well as innovative research projects. The database further allows all users to add their own projects online.

At two conferences held within the cluster project, representatives from European local governments and local government networks and researchers discussed and reviewed new approaches to urban waste management in Europe. Future research requirements for local governments were defined. The results of these conferences shall provide important information for the European Commission to decide which future research topics will be needed in practice, and were also published online.

On-the-spot exchange was further accompanied by an e-forum and e-newsletters, as well as online and print information. While flyers and this brochure present the results from the cluster's research, www.wastesolutions.org further provides an interactive publications database as well as a structured links section. All users can search for, and contribute publications online, and send in their waste-related links for publication.

At the Waste Solutions workshop, Dogliani, Italy, March 2004

In conclusion

For the future, waste avoidance, at-source reduction and reuse should be a focus of research as the most favourable waste policies. Still, these options are not applicable and not effective in every field. Recycling and composting must also therefore stay on the research agenda, as preferable options for sustainable waste management. And of course, in the long run, these policies need to be backed up by decoupling economic growth and waste growth.

The research carried out within the "Waste Solutions" cluster over the past few years has responded to all these issues, and piloted solutions in real cities with real problems. This is crucial: Researchers not only worked for local governments, but with local governments. Only then can products be tailored to the needs of urban areas. Urban managers need waste management tools and policies that are not only well-done in themselves, but that are easy to apply, that are not financially overdemanding, and that, while profiting from international research and good practice can be adapted to pre-existing local circumstances: know-how of staff, geographical and natural resource situation, technological equipment, size and awareness level of local population – the number of factors that determine a solution that is viable for a specific local government is large. Further, local governments can much more easily be convinced to use scarce resources on a new approach if that approach has been tested by their peers already: "Tested by local government" is a label that signals relevance.

Both researchers and local governments profited from the united European research effort: new tools were developed making use of European-wide synergies and scope, experience from leading innovative municipalities and research was supplied beyond boarders, experts and information from many European countries was brought in easy reach. Working as a cluster proved particularly valuable. International cooperation beyond the limit of a single project is an important prerequisite to efficiently meet priorities and thus moving towards sustainable waste management all over Europe. The whole is more than the sum of its parts – Waste Solutions was no exception to this rule!

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PAYT: Guidance to establish Pay-As-You-Throw as a tool for urban waste management

By Jan Reichenbach, Intecus/Dresden University of Technology

Municipalities across Europe are under pressure to move towards sustainability and keep costs under control while lowering the individual cost burden of the citizen. Introducing variable rate pricing for municipal waste management services can be a help here, but it involves a fundamental shift away from the conventional financing mechanisms and therefore requires good knowledge, guidance, support and eventually a broad base amongst stakeholders. Important contributions in the form of a handbook and various analytical exercises have been generated by the Pay-As-You-Throw (PAYT) project. PAYT thus offers a new alternative approach to financing the "waste solutions mechanism".

Summary

Variable rate pricing implemented through PAYT offers an instrument for public policy to reduce residual waste and enhance recycling through the provision of financial incentives to citizens for lowering waste production and increasing waste diversion. Within the PAYT project, an analysis of the available knowledge and experience with PAYT in differing cultural and socio-economic settings and investigations on impacting factors and their pertinence to meet the desired targets have produced a comprehensive overview on the state-of-the-art, principal problems and potentials, regarding the realisation of PAYT in European cities. The consideration of these findings in various analytical exercises eventually helped in the identification of possible strategies to enhance the effectiveness and acceptance of waste charging as an instrument for the reduction and sustainable management of urban waste.

Partnership

The PAYT-project has been implemented by nine partners from the academic and consultancy sector in cooperation with local municipal authorities and stakeholders. Partners were IPTS Seville, INTECUS GmbH, LHTEE Aristotle University Thessaloniki, University of Economics Prague, CPPU National University Cork, Danwaste Consult A/S, University Pompeu Fabra Barcelona, IÖR Dresden, and the Dresden University of Technology.

Project team

Outcome and benefits

The practical outcome of the project's scientific research consists in a synthesis of knowledge in support of the implementation of PAYT under different settings. Furthermore, the project has supplied a survey instrument to assess the differing interests and views of stakeholders on PAYT, a methodology to identify and assess the relationships of various influencing factors and their impacts on the success of variable rate pricing

Case study: State of PAYT in 162 Czech municipalities

Within the PAYT project, a case study which aimed to find and/or to quantify the associations between factors that influence the success of a PAYT-system by using concrete data was carried out in the Czech Republic. The Czech Republic was chosen since many Czech municipalities have substantial experience with applying both PAYT and flat charge systems during recent years. This is due to the recent changes in the law concerning waste management charges. The changes first imposed an obligation on municipalities to shift from variable charges to a flat fee per capita, then it allowed them again to design their own fees for municipal waste collection.

On the basis of the statistical information obtained, in 2001 it was found that from a total of 162 municipalities, 4 of them applied "pure PAYT" to calculate payments made by citizens for operating the municipal waste management system. 94 of the 162 municipalities used a "combined system" that can be characterised as PAYT with a greater or lesser degree of solidarity among producers of waste. The absolute "non-PAYT" system was applied by 64 of the surveyed municipalities. In 2002 these figures dropped to only 1 municipality using a "pure PAYT" and 24 with a "combined system" due to the change in legislation.

The investigations confirmed that in municipalities applying PAYT there is a significant increase in the volume of separated waste. Equally significant, a decrease in the total volume of household waste in municipalities with PAYT as opposed to municipalities without PAYT was noted. With regards to the verification of influencing factors, it could be confirmed that there are five statistically significant factors that influence households in their decision to separate waste or not:

- existence of containers for source separated materials,
- citizen's perception of the usability of these containers,
- amount and quality of information obtained on waste separation,
- use of conventional, solid fuel firing in the house,
- available storage capacities particularly in the kitchen.

Furthermore, it could be concluded that in practice the costs related to municipal waste treatment are dependent on the amount of waste produced and collected. On the other hand, it was found that for PAYT areas in cases where payments were increased by one CZK per one ton of residual (mixed) waste, the production of this waste will decrease by 0.35 kg. For the non-PAYT areas it was established that if the payment per person increases by one CZK, then the annual amount of waste produced by one person will increase by 0.43 kg. Citizens in this case follow the idea "the more I have to pay, the more waste I will produce".

and a multicriteria analyses model to systemise existing experience with factor relevance for successfully introducing and operating PAYT. The latter lays the groundwork for better understanding the (initial) situation in cities and for examining possible measures and their effectiveness in creating a suitable framework for PAYT implementation.

The main instrument provided is a handbook on PAYT which offers a synthesis of the research findings in a useful and understandable format for policy makers, municipalities and other entities that consider variable rate pricing as an option for urban management and planning. Information is assembled in a way that is tailored to needs of urban decision makers and stakeholders. The information depicts the basic elements of PAYT and provides practical assistance to overcome barriers and consider critical aspects of PAYT introduction in the urban environment. The handbook is 200 pages, in English, and includes figures, annexes and pictures. Information is offered cascadingly from general to detailed in order to meet the needs of different users. Several conclusions are backed by studies on PAYT related aspects such as the current charging situations and waste separation potentials.

In addition to the handbook, there is also information available that deals with aspects related to specific local settings, feasibility, and programme design.

Application and further information

The handbook and other results are intended to assist municipalities particularly in countries, which show a strong interest to trial PAYT in the form of pilot projects, or that are otherwise working towards adopting PAYT schemes.

In addition to the handbook, information is also available that deals with aspects related to specific local settings, feasibility, and program design. Information and support can also be obtained from the dedicated PAYT website www.payt.net, which also incorporates a search tool on relevant literature. Print copies of the handbook are available and can be ordered from the project co-ordinator.

PAYT project leader: Dresden University of Technology, Institute for Waste Management and Contaminated Sites Treatment

DRESDEN UNIVERSITY OF TECHNOLOGY

The Institute for Waste Management and Contaminated Sites Treatment (IWMS), founded in 1995, is a recent addition to the 1828-founded Dresden University of Technology. The Institute approaches a wide area of problems in environmental science through the combination of research topics in waste management, environmental protection and in systems analysis. In spite of its young age the institute already has a large record of research activities performed both at national and international level and led a number of EU and governmentally supported projects covering in particular subjects related to the analysis and management of environmentally relevant risks and waste streams and their minimisation and treatment by different technical and policy measures.

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The LCA-IWM Project: Municipal waste prognosis and management system planning & assessment

By Jan den Boer, Technical University of Darmstadt

Within the LCA-IWM project (full name: 'The Use of Life Cycle Assessment Tools for the Development of Integrated Waste Management Strategies for Cities and Regions with Rapid Growing Economies') two tools have been developed: a prognostic tool and an assessment tool. These tools will support authorities in rapidly growing economies to plan waste management systems that are environmentally, economically and socially benign. The tool and an accompanying handbook will soon be available free of charge to European municipalities.

New EU Member States and many other countries with transition economies show consumption and, consequently, waste generation patterns that more and more resemble those of Western Europe. Furthermore, the waste management legislation in the new Member States is adapted to EU standards, and so, consequently, is the planning of Integrated Waste Management Systems. The translation of national and regional plans and legislation into well-developed local waste management systems is still often lacking however. In this context the LCA-IWM project was developed. The LCA-IWM project was started in September 2002 and will end in August 2005. 12 partners are involved in the project (Technische Universität Darmstadt; University Rovira i Virgili, AGA-SIMPPLE, Tarragona; University of Natural Resources and Applied Life Sciences, Vienna; Wroclaw University Of Technology; Democritus University Of Thrace, Xanthi; nova Tec s.a.r.1, Luxembourg; Syncera De Straat, Delft; Infrastruktur & Umwelt, Darmstadt; STQ, Tarragona; WAMECO S.C., Wroclaw; Kaunas University Of Technology; Slovak University Of Technology, Bratislava). The objective of the project is to develop two decision support tools for waste management planning and optimisation: a waste prognostic tool and a waste management system assessment tool.

The prognostic tool

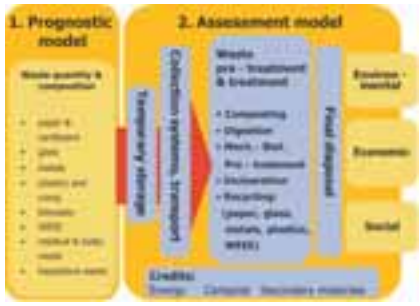
The prognostic tool enables the prediction of future amounts and composition of generated household waste based on a limited amount of input parameters. These parameters include the current amount and com-

Case studies

Both tools, the prognostic tool and the assessment tool, are currently being tested in five municipalities. As a result, the municipalities will be provided with an actual waste management plan and the project will adjust the tools according to the case study outcomes. The pilot cities are:

- **Reus, Spain**, population 98,000 inhabitants, 44,000 tons of household waste (2003)
- **Xanthi, Greece**, population 45,000, 13,700 tons of household waste (2003)
- **Nitra, Slovakia**, population 87,000, 34,000 tons of household waste (2003)
- **Wroclaw, Poland**, population 638,000, 282,000 tons of household waste (2003)
- **Kaunas, Lithuania,** population 374,000, 141,000 tons of household waste (2003)

position of household waste and predictions of some general socio-economic indicators on the one hand, and historical data on these factors on the other. Where the user has no access to current forecasts of socio-economic indicators the tool provides default numbers for different countries. The theoretical background of the tool is based on a classification of the considered city into one of four different 'prosperity levels'. For each of these levels of prosperity a different historical analogy between certain socio-economic indicators and waste generation was observed. This analogy is consequently applied to make a prediction of future waste generation trends. The implementation of one or more waste prevention measures (which can be chosen from a list) leads to alterations in the forecasted waste generation quantities. Since in most of the target cities there is little long-term experience with the separate collection of municipal waste, the tool also provides an optional forecast of the collection efficiency (the share of a generated waste flow that will be collected separately). It is assumed that over a period of 10 years following the implementation of a separate collection scheme a default value for the collection efficiency can be achieved. This default value is based on the average performance of large cities in the highest prosperity category. Alternatively, the maximum collection efficiency in this city group can be set as the default. Thus the prognostic tool provides the user with data over a period of up to 15 years on household waste quantity and composition as well as collection efficiencies. In figure 1 an overview is given of both the prognostic tool and the assessment tool.



Overview of the project results: Decision support tools for waste management

The assessment tool

The assessment tool enables the planning and assessment of waste management strategies. Up to four different scenarios can be created and compared. Each scenario consists of three basic waste management subsystems: Temporary Storage, Collection & Transport, Recycling, Treatment & Disposal.

The waste quantities and composition forecasted by the prognostic tool serve as input for the assessment tool. The user defines the collection system and decides upon the destination of the separately collected waste flows. Consequently the chosen treatment, disposal or recycling

Example: Four scenarios being assessed in Kaunas

Kaunas	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Separate collection	residual waste	glass plastics paper & cardboard metals residual waste	glass plastics paper & cardboard metals residual waste	glass plastics paper & cardboard metals residual waste
Treatment **• recyclables** **• biowaste** **• residual waste**	 none none none	 recycling none none	 recycling none MBP (aerobic)	 recycling none MBP (aerobic)
Disposal **• residual waste** **• rejects**	 landfill none	 landfill landfill	 none landfill	 none incineration/landfill

Table 1: Developed Environmental sustainability criteria for waste management systems

Criterion	Indicator
Depletion of abiotic resources	LCA-based
Climate change	LCA-based
Human toxicity	LCA-based
Photo-oxidant formation	LCA-based
Acidification	LCA-based
Eutrophication	LCA-based
Compliance with the EU Landfill directive targets	Reduction of landfilling of biodegradable waste
EU recovery and recycling targets of individual packaging materials	Recovery and recycling rates for individual materials

Table 2: Developed Economic sustainability criteria for waste management systems

Economic criteria and indicators	Indicator
Efficiency at Sub-system level	Cost per subsystem
Efficiency at System level	Total costs, revenues, costs related to GDP
Equity	Cost per inhabitant related to minimum wage and average income
Dependence on Subsidies	Subsidies or grants per inhabitant

Table 3: Developed Social sustainability criteria for waste management systems

Aspect: social acceptability		Aspect: social equity	Aspect: social function
Odour	Visual impact	Distribution and location of containers	Waste final destination
Convenience	Urban space use	Employment quality	Employment creation
Private space use	Noise		
Complexity	Traffic		
Risk perception			

LCA-IWM project leader: Technische Universität Darmstadt

Institute of Water Supply and Groundwater Protection, Wastewater Technology, Waste Management, Industrial Material Cycles, Environmental and Spatial Planning (Institut WAR). The Waste Management group covers:

- Chemical-physical, biological and thermal waste treatment technologies
- Waste management planning
- Environmental Impact Analysis
- Environmentally sound products design,
- Life Cycle Assessment for waste management
- Landfilling technologies
- Measuring techniques
- Flue gas cleaning techniques from biological waste treatment facilities

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tool can be fine-tuned. All waste management system subsystems are represented within the module by a separate module. Based on the before mentioned inputs, these modules generate output data flows about emissions and resource consumption, material flows, costs and revenues and a number of data relevant in a social context. In a next step these data flows are aggregated into environmental, economic and social indicators, thus assessing the impact on the three aspects of sustainability. The considered criteria and indicators that are used for the sustainability assessment are shown in the tables.

Based on the overall environmental, economic and social impacts a considered scenario can be compared with alternatives.

Conclusion

Following piloting in five European municipalities (see box), the resulting case studies, background information and the user manuals of both tools will be published in a handbook. The handbook and the tools are expected to be available in May 2005. Information on how to obtain a printed version or a free download will be published on the project website: www.lca-iwm.net, together with further project deliverables.

Orléans, Stuttgart and Lisbon care about tomorrow's waste: AWAST, a methodology for sustainable municipal waste management

By Jacques Villeneuve, Bureau de Recherche Géologiques et Minières

Sustainable development in the field of municipal solid waste involves two fundamental aspects: the long-term development of waste (including the uncertainty about the ultimate character of waste components) and the sustainability of the waste management system itself (including matter and energy recovery performance as well as environmental and economical performance).

The first aspect implies long-term action on process and management modes improvements. The second one obliges us, today, to define and implement waste policies that ensure the durability of the waste management system itself. Both aspects are major contributions to (or, if neglected, problems for) sustainable development of our societies. The European research project AWAST has supplied a tool to help European cities in the choice of contributions.

AWAST: Evaluate strategies and make good choices

In order to cope with the increasing quantities of waste and at the same time respect the objectives of European and national legislation and the aims of sustainable development, municipalities and other agents in the waste-treatment sector are having to permanently improve the waste-management systems. Available options are considered within a complex decision-making web. Questions concern technological choice, energy savings, costs, social and environmental impacts; answers depend on time scales. The various criteria interact strongly and are not always compatible. The need for decision-aid tools is felt acutely, whether for improving management systems, or for assessing and quantifying improvements.

The AWAST research project provided a methodology for understanding the operating mechanism of a current system of municipal solid waste (MSW) management. Such an understanding has significant advantages compared to a simple performance assessment. Concretely, AWAST provides a simulation software tool based on process analysis that includes energy and economic factors. The software integrates the aspects of collection, transport, sorting, biological treatment, thermal treatment and landfill. AWAST allows the user to:

- simulate the impact of waste composition and/or of treatment operating conditions on the total performance of a system (e.g. impact on the "quality" of the products),
- simulate, at lower cost, the effects of modifying a process (additions, plant optimization, etc.),
- determine whether a given technology can guarantee a set of objectives concerning the quantities and qualities of the different products.

The major innovation of AWAST is a modular simulator. Each "module" comprises "models" of the different processes in use. The modules can evolve as we improve our knowledge on the processes and their developments.

Figure 1a: Provisional material balance for 2003

Figure 1b: Material balance for 2003 with biowaste collection

Figure 2a: Distribution of costs for 2003, without biowaste collection

Figure 2b: Distribution of costs for 2003, with biowaste collection

Legend: 100% of collection costs, 100% of total cost of waste management

Simulation of waste management with AWAST: example of the City of Orléans

In Orléans, the first step was to set up a simulation of the waste management system in 2002. The data supplied by AGGLO (Agglomeration of Orléans: 22 communes, 280,000 inhabitants) was supplemented by data from diverse operators, validated in terms of material balance on the total flowrate, but also on the flowrate of each individual component (wood, paper, plastics, metals…).

This data allowed the project team to draw a complete "flowsheet" where all streams and processes (collection, sorting, incineration, biological treatments, transports, landfills) are defined, uniquely and according to a rigorous nomenclature adhering to European harmonisation standards. This simulator calculated all streams and their composition (components, but also chemical elements like O, C, N, H, S, heavy metals). It also calculates the energy balance including the expenses of each operation, production in incineration and biogas from the landfills.

A first scenario evaluated the balance in 2003. Using the data on the waste collected during the first six months of 2003 and the whole of 2002, total waste generation in 2003 was predicted and introduced into the simulator. The complete 2003 balance was thus obtained.

It was then used as the basis for comparison with a second scenario based on a modified waste management system with the selective collection of fermentable waste. This new collection goes hand-in-hand with the closing of the present composting plant for raw waste and the creation of a new plant for biowaste composting. In parallel, the residual stream goes to incineration.

A sample of the results obtained are presented below, showing a comparison of the global matter balance for 2003 without and with the biowaste collection (figure 1a and 1b), and a comparison of costs (figures 2a and 2b).

Identical diagrams are available for each waste category (paper for example), each chemical substance (C, H, O, N, S, Cl, heavy metals…) and for each gaseous substance (CO2, O2, HCl, SOx, NOx …), which are essential to evaluate the environmental effects.

The comparison of these two scenarios gives useful input for decision making:

Treatments: Thermal treatment: reduction of 4.4% of total waste collected, or reduction of 12% of the feed to incineration. Biological treatment: increase of 4.4% of total collected waste, or increase of 46% of the feed to composting

Material balance: matter recovery: 29.1% (+3.8%), ultimate waste to landfill: 35.9% (-2.2%)

Costs: + 3 178 600 € (+ 12%), + 11.6 € per inhabitant

Energy balance: – 1 473 332 MJ consumed (-2%), – 11 527 982 MJ produced (– 5%)

Social aspect: + 54 employees for the new collection

Help in the evaluation of waste policies

Tools such as the AWAST simulator can be of great help for the management of waste treatment and elimination systems. Their role is to supply local governments with quantified, verifiable data about different criteria for decisions: recycling rate, residual streams (emissions, storage in landfills), energy balance and service production cost.

The "benefits" of a scenario can be compared to an existing situation according to different criteria such as resources conservation or cost/performance ratio, and anticipated according to the foreseeable evolution of waste quantity and composition. Thus, the financing of options can be measured against their advantages. If used as a measurement instrument to monitor the effects of the waste policies, AWAST helps to minimise the risks of decisions in the economic as well as environmental fields.

AWAST project leader: BRGM – Bureau de Recherche Géologiques et Minières

brgm

Geoscience for a sustainable Earth

Our raison d'être is to

- understand geological phenomena
- develop new methodologies and techniques
- produce and disseminate pertinent, high-quality data

in order to provide public authorities with approaches in the context of

- sustainable development
- globalisation
- social demands: scientific ethics, safety, prevention and precaution
- new information and communication technologies (NICT)

BRGM

- is a public institution with industrial and commercial interests ("EPIC")
- is jointly supervised by the French Ministries for Research and for Industry
- has a staff of 855 and a turnover (2002) of € 74.66 million

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AWAST – Aid in the Management and European Comparison of Municipal Solid WASte Treatment methods for a Global and Sustainable Approach

http://awast.brgm.fr/

The **AWAST** project involved 11 partners : BRGM (France), Technical University of Vienna (Austria), Stuttgart University (Germany), Technical University of Trondheim (Norway), LQARS (Portugal), EDF (France), Cemagref (France), RMA (Austria), Energos (Norway), Tratolixo (Portugal), Valorsul (Portugal).

AWAST ran for 36 months and was organised into three main technical packages:

- modelling and simulation of each management and treatment model with a view to creating a library of models,
- integration of all models, development and validation of a general purpose simulator,
- real case applications for tool validation, including the definition of scenarios and the realisation of case studies.

In its modelling phase horizontal aspects such as matter description, energetic exchanges and economic models, and vertical aspects focussed on treatments were considered.
The application phase and the validation of the approach was done within a **partnership with three European cities: Orléans, Stuttgart and Lisbon**. A steering committee comprised of environmental agencies in the partners' countries, and municipalities and associations for recycling, defined test scenarios for the simulator. These tests were used to validate the technical simulation and to check the adequacy of this tool vis-à-vis the needs of local communities.

S.W.A. - Tool

How to improve and standardize solid waste analyses: The SWA-Tool

By Silvia Estermann, iC Consulenten Ziviltechniker

Waste analyses are a widely used tool for acquiring relevant information for waste management planning, and increasing the efficiency and effectiveness of planned measures. Through the SWA-Tool an improvement and comparability of waste analyses is possible.

Introduction

The quality of waste analysis data is chiefly a matter of analysis design. Recently there have been various endeavours to standardise waste analyses methods. The efforts range from regional and national standards to complete software.

The purpose of the project Solid Waste Analysis Tool (SWA-Tool) was to provide scientific clarification of standardisation and improvement of waste analyses, to develop general recommendations, and finally a standardised tool that could be employed across Europe.

Partners of the project are both municipalities and scientific institutions, namely iC consulenten, Austria; City Council Vienna, MA 48, Austria; University of Technology, Berlin, Germany; University of Northumbria, UK; Gruppo Impresa Finance srl, Italy; Fundacion Gaiker, Spain; ICIM Romania; Oil and Gas Institute, Poland; Newcastle City Council, UK; ASM Brescia spa, Italy; City of Bilbao, Spain; COMPREST, Romania; and City of Cracow, Poland.

SWA-Tool pilot municipalities

During the course of the project, the SWA-Tool method has been applied in waste analyses campaigns in five pilot municipalities: Newcastle, UK; Bilbao, Spain; Brescia, Italy; Krakow, Poland, and Brasov, Romania. The results from the pilots have been compiled as case studies that are available through www.wastesolutions.org and the project website www.swa-tool.net

Clarifications and recommendations

The following aspects were analysed during the course of the project, and addressed in the creation of the SWA-Tool.

Waste type under observation

At present there are wide variations with the use of waste terminology (for example municipal solid waste, household waste and bulky waste), as these terms are far from uniformly being applied across the EU. In order to be able to compare waste analysis data it is essential to know exactly what form of waste has been investigated.

As long as there exists no uniform application of waste terminology across the EU, the type of waste under investigation should be described as accurately as possible.

Objectives of the waste composition study

The design of a waste analysis programme mainly depends on its objectives and the information needs of the client. Typical objectives for waste analysis programmes are:

Spatial dimension

1. International level – for reporting according to international and EU law
2. National and regional levels – for strategic waste management
3. Local level – for example, in the formulation of municipal waste management strategies or assessing the feasibility of various collection, recycling and treatment options.

Accuracy

1. Snapshot without any statistical results, for a quick overview of the waste composition in a city.
2. Waste composition study with statistically valid results.
3. Waste composition study with statistically valid results, coupled with identification of waste generators, their behaviour and their spatial distribution.

Due to the variety of objectives which waste analyses must fulfil, comparing results of different waste analysis programmes is often impossible.

Level of sampling

The choice of the level of sampling is one of the most controversial issues in the design of waste analyses, concerning statistical accuracy, potential costs and comparability of waste analysis results. Choosing a different level of sampling will lead to different results. The sample may generally be taken from:

- a waste container/bag related to one individual user (household/business) or related to a residential property, or
- a collection vehicle

If it is not possible to agree on a specific level of sampling, due to different waste management systems, purposes of analyses and available data, it is recommended that the method chosen is accurately described in the analysis report.

Collecting the sample

Stratification and sorting categories

Stratification is statistically defined as a subdivision of an inhomogeneous parent population (e.g. overall waste arising in a city) into homogenous sub-populations (non overlapping groups, e.g. waste generation of inhabitants with high income versus inhabitants with low income). Stratification is not a prerequisite for the standardisation of waste analyses although it can help to achieve more precise results.

One of the most important aspects of comparability between waste analyses concerns the sorting classification employed. Waste analyses have historically employed a vast variety of first, second and third level systems depending on the country, client and/or waste analysis contractor. This makes it impossible to compare results of different waste analysis programmes, however, within the EC SWA-Tool research project a standardised sorting classification has been defined.

Sorting the sample

Sorting procedure

The sorting procedures employed can impact on the compositional results of a waste analysis. For instance, the use of trommels (devices used for waste screening) may increase the proportion of fines in the results. Sorting procedures for special cases, such as how to classify partially filled packaging, can vary.

Waste analysis results and their statistical interpretation

Reliable and comparable information about waste composition is essential for the design and operation of waste treatment plants. So far no common standard for the statistical description of waste analysis data has been developed. Research into waste analysis programmes has shown that in some instances statistical interpretation of data is not at all presented. Various confidence coefficients (90%, 95%) are being used, confidence intervals are either presented in an absolute or relative way not including an explanation of which of the two methods have been employed. This can lead to confusion in the interpretation of results.

When comparing different waste analyses it is essential that at least the following statistical parameters are presented: minimum value, maximum value, sample mean, sample standard deviation, confidence coefficient (95%), (relative) confidence interval.

The SWA-Tool

The scientific clarifications of all aspects previously mentioned lead to the development of a *"methodological tool"* for use by users of waste analyses. The outcome of the project focuses on two different levels:

- *Minimum standards* which should always be met by a waste analysis
- *Optional criteria*, in order to enable selection of the most appropriate analysis design according to the objectives and circumstances.

The results of the project were tested within waste analysis programmes in five European cities. The case studies and the tool itself can be accessed through the project website www.swa-tool.net.

SWA-Tool project leader:
iC consulenten Ziviltechniker GmbH

is one of the leading Austrian consulting firms carrying out activities in Europe, the Middle East and Asia. Following an interdisciplinary approach, iC services typically encompass engineering, contractual, economical, financial and environmental aspects. A large number of iC consulting services have been funded by the European Commission, the World Bank, Austrian national and local governments.

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ORMA – Optimisation of resource use and waste management in an Eco-Industrial Park (EIP)

A tool for more sustainable EIPs in rural Europe

By Elena Coppa, Sasso

ORMA created and implemented a model that simulated the design of an Eco-Industrial Park. The specific advantage of this model is to provide a set of tools which can be integrated or used one by one, according to requirements. The target users of the model are municipalities involved in the construction of new industrial settlements, networks of companies, existing EIPs, in particular in rural areas with low industrialisation. ORMA can become a tool for the design and improvement of production centres towards sustainability on the basis of its innovative methodologies for waste treatment which are attentive to environmental impact.

The ORMA project

The ORMA simulation model was completed in April 2004. The simulator and its single tools are available together with consulting, as it is a complex methodology that requires assistance to be applied. A handbook on the project results is also available.

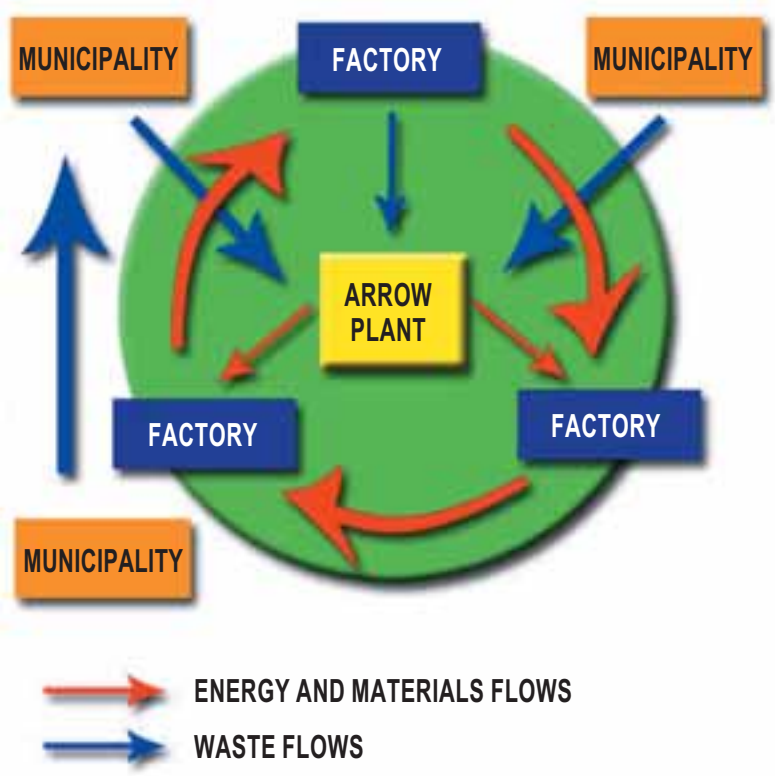
The seven project partners each contributed to the project with new applications and technologies that together design and simulate the EIP. The ORMA partners and their contributions were:

- **Città delle Langhe** (Italy) coordinated the project and was in charge of managing the publication of data obtained, information and dissemination.
- **Granta Design Limited** (UK) modified the CES (see below) software package in order to perform choice of materials within a defined set on the basis of environmental and cost performances.
- **Arrow Ltd** (Israel) designed an eco-compatible waste treatment system, which feeds on the waste generated by the activities of the EIP, producing energy and mostly reusable materials.
- **Sasso s.r.l.** (Italy) developed an integrated information system to connect all the industrial functions of the EIP for the identification and distribution of information and resources. Moreover, a CAD system was created for resource management. Sasso also developed a methodology for integrated design of the energy systems.
- **University of Torino** (Italy) delivered a study using statistic entropy measures and elaborated the relevant software.
- The main role of **Politecnico di Torino** (Italy) was an LCA study regarding the waste of the involved companies.
- **University of East Anglia** (UK) guided an LCA study concerning resources flows and energy, and collected data on different European EIPs.

The simulation model and its single tools

The principal goal of an EIP is to improve the economic performance of the participating companies and municipalities while minimising their environmental impact. Components of this approach include: green design of infrastructure and plants (new or retrofitted), cleaner production, pollution prevention, energy efficiency, and inter-company partnering. ORMA applied these principles in a low-industrialized and rural economy. It is a complete model with different tools that if used together interact at different levels:

- **Software-based Statistical Entropy Analysis:** this tool breaks down, to the level of fundamental elements, every process in the EIP and delivers indicators together with Life Cycle Analysis, to evaluate the environmental impact and to elaborate the improvements necessary.
- **LCA Analysis:** this analysis is performed to establish the overall impact of a material or process for every sub-system considered.
- **Arrow Bio-treatment Plant:** in the layout of the EIP an Arrow waste treatment plant is integrated. Arrow's technology can treat completely unsorted waste without the need for a massive work force or extensive mechanical means. Furthermore, an anaerobic conversion of biodegradable materials to biogas can give high yields of valuable fuel, in addition to a strong reduction of discard's volume and the recovering of recyclable materials.
- **Cambridge Engineering Selector (CES):** this software gives information about the structural and mechanical characteristics of a given material, and is customized in order to consider also the environmental performance. It is used to select, among a set of materials available, the best compromise for the design of all the facilities of the EIP.



- **Energetic System Study:** this study considers the potential use of renewable energy, including the exploitation of biogas from the waste treatment plant. It also evaluates the contribution that these technologies could make to fulfil the needs of an industrial settlement.
- **Integrated Information System:** this is an innovative control system, based on the technology of distributed intelligence. This system gives the possibility to develop complex applications in successive stages, adding further layers of complexity. The running of an EIP. will be possible in real time if all the components of the park/system are to be connected on the same network.

Pilote case: An Eco-Industrial Park (EIP) for the Alta Langa, Italy

The ORMA simulation was applied in the hill area known as “Alta Langa”, home of the Città delle Langhe consortium. 11 companies were included in the simulated EIP designed in the ORMA project.

The simulated EIP was designed and the lay-out conceived considering all innovative tools applied/developed in the project, with particular care to their integration.

Specifc elements of the design are eco-park infrastructure, landscaping, and buildings that could reduce greenhouse gas emissions through passive solar design, energy efficiency, use of renewable energy sources, landscaping to enhance CO_2 absorption, use of low-energy water treatment systems, materials systems to support recycling and reuse of water and materials, and transportation.

The area

The projected EIP

ORMA project leader: Città delle Langhe

Città delle Langhe, constituted in 1996, is a consortium of 39 small and medium-sized enterprises and 11 small municipalities located in Piemonte, Italy. The consortium’s aim is to cooperate to improve the quality of life through a process that entails the introduction of scientific and technological innovations, the protection and the improvement of local potentials, and exchange. Città delle Langhe promotes the philosophy of sustainable development. Its current projects are about ecology, waste management and disposal, water recovery, services for regional development, improvement of communication and transport, formation and awareness-raising about ecology and the environment.

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Harnessing the power of sustainable public procurement: Results of the RELIEF project

By Simon Clement, ICLEI – Local Governments for Sustainability

In Europe, public authorities spend over € 1,000 billion each year on buying goods and services – representing a huge potential for encouraging the market for greener products. The RELIEF project, for the first time, has put figures to the actual environmental gains possible through sustainable procurement. Building on these results the Procura+ Campaign was launched to build a movement of public authorities committed to implementation.

Summary

The RELIEF project (2001 – 2003) was aimed at calculating the environmental benefits of European public authorities "buying green". The results of these calculations very clearly showed that these benefits are potentially huge. On the basis of these results the project also developed a framework for future action to realise these benefits – Procura+, the Sustainable Procurement Campaign.

The project brought together six experienced local authorities – Hamburg, and Stuttgart in Germany, Zurich in Switzerland, Malmö in Sweden, Kolding in Denmark and Miskolc in Hungary, together with a group of scientific partners: The Interuniversitäres Forschungszentrum für Technik – Arbeit und Kultur (IFZ), Institute for Environmental Studies of the Vrije Universiteit Amsterdam (IVM), Institute for Public Finance and Infrastructure Policy of the Technische Universität Wien (IFIP), Dk-Teknik Energi & Miljo, Center for Environmental Studies (CES), and the Technische Universität Dresden (TU-Dresden).

For example: Kolding, Denmark

In 1998 the Municipality of Kolding, a city in Denmark with a population of about 60,000, approved a Green Purchasing Policy, which committed the administration to including environmental considerations into procurement actions.

By 2003 virtually 100% of purchasing activities did just that. For all product groups purchased by the municipality environmental questionnaires had been developed which potential suppliers would have to complete as part of the tendering process on different aspects of the product to be purchased or the environmental characteristics of the company.

Kolding's success is an example to any public administration in Europe in that it builds on the support and co-operation of different parts of the administration – the City Council, the Environment unit and the Purchasing unit. Through working together the required environmental expertise is combined with the procurers know-how of the market and the purchasing process – all backed up by political support at the highest level.

The cooperation with Kolding in the RELIEF project, as well as with the other RELIEF cities, Hamburg and Stuttgart, Germany, Zurich, Switzerland, Malmö, Sweden, and Miskolc, Hungary, has been documented in case reports and potential assessments available through ICLEI.

Calculating the environmental benefits

The calculations compared the key environmental impact of a "green" product with that of a "standard" product, and then multiplied the difference by the number of units of that product purchased each year by European public administrations. This provided a figure for the potential environmental benefit that could be achieved if all European public authorities were to buy green. Selected results are presented in the table below.

Product	Impact category	Environmental relief through public eco-procurement	Environmental relief through both private and public eco-procurement
Buses	Photochemical ozone formation	-3,350 tC_2H_4-equiv.	-6,980 tC_2H_4-equiv.
	Corresponding person equivalents[1]	-134,110 (European)	-279,390
Sanitary devices	Water consumption	-251,046,679 l	n/a
	Corresponding person equivalents[2]	-3,086,387	n/a
Computers	Greenhouse gas emissions	-832,320 tCO_2-equiv.	-8,049,385 tCO_2-equiv.
	Corresponding person equivalents[2]	-101,503 (Global)	-981,632
Food	Nutrification	-41,560 tPO_4-equiv.	-763,295 tPO_4-equiv.
	Corresponding person equivalents[2]	-3,676,492 (European)	-67,524,295
Electricity	Greenhouse emissions	-61,350,363 tCO_2-equiv.	-922,639,465 tCO_2-equiv.
	Corresponding person equivalents[2]	-7,481,752 (Global)	-112,517,008

European person equivalents describe the emission of an average European Union citizen. Global person equivalents describe the emission of an average person living anywhere in the world.
The measures needed to achieve these results are as follows: Buses – All new purchases comply with EURO IV emissions standards instead of EURO III; Sanitary devices – Replacement of standard 9l-flush toilets, with 6/3l-flushes, and the installation of water-saving taps; computers – All new purchases fulfil better than EnergyStar requirements with TFT monitors; Food – 100% of meat, wheat and milk produced organically; Electricity – 100% switch to renewable electricity.

Thus if public administrations would switch to renewable electricity they would reduce greenhouse emissions by an equivalent of over 7 million people. Water saving taps and toilet flushes would reduce water consumption equivalent to that of over 3 million people. Providing organic food in European public canteens would represent a relief on waters and soil equivalent to the impact of a big city like Berlin.

What the figures from the RELIEF project demonstrate is that public authorities have the potential to play a very significant role in reducing greenhouse gases, and other environmental effects through sustainable procurement – but how do you get the thousands of individual public authorities to do this?

Realising the benefits: Procura+

At the EcoProcura Conference in Göteborg, September 2003, ICLEI launched Procura+ – the Sustainable Procurement Campaign, which is aimed at achieving widespread and closely co-ordinated implementa-

tion, bringing a large number of public authorities together to achieve significant environmental gains, and send a clear and coherent signal to the market.

The Campaign is based around encouraging public authorities to apply a small set of ready prepared, and easy-to-use environmental criteria to the procurement of six high-priority product groups (electricity, building construction and renovation, IT equipment, food, cleaning products and services, buses). It was concluded during the RELIEF project that although there are a huge number of environmental impacts relating to each and every product or service purchased, there tend to be between one and three really significant product characteristics. Given the limited resources of most public authorities it makes sense to concentrate efforts here initially, hence the small number of criteria.

Guidance for Campaign participants: The Procura+ Manual

It was also concluded during the RELIEF project that without the appropriate political backing, little will be achieved on the ground. Therefore, authorities joining the Campaign will further be asked to make a political commitment to achieving self-set targets (e.g. 10% renewable electricity by 2005). Carrying out the Campaign will involve completing a Milestone Process, which follows the standard management cycle approach of planning – implementing – monitoring – evaluating – planning to ensure continuous improvement. The Campaign has been specifically designed to be easily implemented with the minimum of time and resources by public authorities of any size or experience.

ICLEI has taken the approach of working with national partners in each of the different European countries in which the Campaign is run. These national partners are able to link in more effectively with ongoing policy debates in their country, work to promote the Campaign within the national media and other stakeholder forums, and provide support and advice for Campaign participants with broader local knowledge and in the local language.

RELIEF project leader: ICLEI – Local Governments for Sustainability

ICLEI is a growing Association of Local Governments world-wide dedicated to sustainable development. In Europe, its campaigns, programmes and projects focus on urban governance & Local Agenda 21, sustainable procurement, sustainability management, and climate & air. As a sustainability agency, its products and services comprise events & networking, publications & information, tools; training & consulting; research & riloting, and advocacy. ICLEI's almost 200 European members are served by the ICLEI European Secretariat which co-ordinates all ICLEI's European activities. The ICLEI European Secretariat is situated and hosted by the ICLEI member city Freiburg, Germany, since 1992.

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Waste Solutions

Six new approaches to sustainable urban waste management in Europe

Results of the European Urban Waste Management Cluster Projects

In the city of tomorrow, waste will be a crucial issue for achieving, or not achieving, sustainability. Pursuing sustainable waste management, in line with the Council Directive 75/442/EEC on waste, 1996, means that the actual prevention of waste generation is the first policy priority, followed by waste recovery and by the safe disposal of waste (hierarchy of principles for waste management). These principles need to be put in practice though joint waste prevention and management measures if negative impacts on the environment, public budgets and the quality of life are to be avoided. Necessary measures have to be taken mainly by local governments. Therefore, local governments also need to be involved in European research, and research needs to be measured against its use value at the local level. This insight was the driving force behind the research of six projects united in the European Urban Waste Management Cluster (EUWMC), funded under the European Union's 5th Framework Programme for Research, Technology Development and Demonstration (RTD). Between 1999-2005, the six projects, in co-operation with local authorities from a vast range of European countries, successfully developed tools, know-how and methods in response to all the steps of the waste hierarchy ladder: "AWAST" created a methodology for integrated sustainable municipal waste management; "LCA-IWM" delivered two tools for municipal waste prognosis, management system planning & assessment; "SWA-Tool" resulted in a standardised method for solid waste analyses; "PAYT" offers guidance for pay-as-you-throw policies; "ORMA" allows simulation for resource use and waste management in Eco-Industrial Parks and finally "RELIEF" kicked off the Procura+ Campaign for sustainable public procurement. Further, the six projects co-operated through the "Waste Solutions – European Urban Waste Management Cluster Project" that delivered additional results like this brochure or a database on good practice and innovative projects, all available through www.wastesolutions.org.

www.wastesolutions.org