L-AWP 2010

Provincial Waste Management Plan Styria 2010

Styrian Provincial Government
Specialised Division 19D
Waste and Material Flow Management

Das Land Steiermark

L-AWP 2010

Provincial Waste Management Plan Styria 2010

unanimously agreed by the

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Preface


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Natural resources – notably water, food and energy – are the central issues to be dealt with in the 21st century. This means that i) we have to find more economic and more efficient ways to use our resources; ii) we have to strengthen regional economic structures and iii) we have to change our life-style. If we fail to use our resources in an efficient way, the cost of our living will literally outgrow our expectations. While natural resources are limited, the number of people is growing, and so is the consumption of nature and its resources.

The three key messages are: information – research – economising. Creating public awareness leading to changes in behaviour patterns is invaluable: we, who live in "First World Countries", have for a long time been consuming more energy, more organic surfaces, more food than we would be entitled to according to criteria of global responsibility and sustainability. Every day, we continue our life-style and the related consumption patterns at the expense of others, and at the expense of our own children's future!

Living in an ecologically truly problematic global economy, we need to propose a future-oriented regional economy to go alongside. The Provincial Waste Management Plan Styria 2010 represents a major contribution towards this goal, since it is the current basis for waste management-related planning for the next 10 years. It is aimed at minimising the effects of waste management to human health and the environment and at consequently pursuing a sustainable conservation of resources. We must not forget that waste is the most valuable raw material of the future – in this regard, Styria has acted as a role model for years.

The success of Styrian waste management shows that a major ecological problem can be turned into an economic chance. For exactly this reason, Styria has assumed a leading role in the field of resource management in Europe and all over the world.

Functioning waste treatment is characterised by true personal responsibility, strong environmental commitment and high need of information. Our measures show that environmental protection is actively pursued in Styria, including Styrian waste management. Making good things even better is the goal we want to communicate. Let us work together, and let us make active protection of the environment and enforced waste prevention and waste separation the maxim for the next years.

Johann Seitinger
Landesrat

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1 Introduction

Waste management plans are key elements of waste management-related planning. In Styria, the legal frameworks with regard to waste management were defined for the first time in 1995 in the Styrian Waste Management Concept (STAWIKO 95). As defined in the Styrian Waste Management Act (StAWG) 2004 a provincial waste management plan has to be prepared and revised every five years; accordingly, in 2005 the Provincial Waste Management Plan Styria 2005 (L-AWP 2005) was conceived as follow-up of STAWIKO 95. The ambitious goal of the L-AWP 2005 was to develop from standard waste management to sustainable waste and material flow management.

The present Provincial Waste Management Plan Styria 2010 (L-AWP 2010) is the first plan that has been conceptualized and prepared independently by the Specialised Division 19D, instead of outsourcing this process to external partners. This has been primarily done to achieve the most cost-efficient result but also in order to take advantage of the complexity of the Styrian waste management system and the abundance of existing data which are evaluated and illustrated by the Specialised Division 19D (FA19D).

According to the legal requirements laid down in the Styrian Waste Management Act 2004 (StAWG 2004, Figure 1), the L-AWP 2010 pictures current waste volumes, describes the treatment facilities, estimates the development of waste volumes and defines targets for sustainable waste and material flow management as well as strategies for waste prevention and waste treatment (waste recovery and waste disposal). Consequently, the Styrian waste management plans are not just collections of laws, regulations and definitions of standards but important strategic tools which allow meeting the goals for waste management in Styria that have been set at the national and international level.

§ 5 StAWG 2004: Provincial Waste Management Plan

(1) As laid down in the goals and principles defined in para 1, the Government of Styria shall implement a Provincial Waste Management Plan after consultations with the Styrian Union of Municipalities, the Austrian Union of Cities (group Styria), the waste management associations (para 14), the Regional Economic Chamber of Styria, the Regional Chamber of Labour of Styria, the Regional Chamber for Agriculture and Forestry, and the Chamber of Engineers of Styria and Carinthia, which shall be published in the gazette "Grazer Zeitung - Amtsblatt für die Steiermark".

(2) The Provincial Waste Management Plan shall refer to municipal waste, whereby it has to contain an analysis of waste volumes, presentations of treatment plants, forecasts on the development of waste volumes, aims for sustainable waste and material flow management as well as strategies for waste prevention and waste treatment (waste recovery and waste disposal).

(3) The Provincial Waste Management Plan shall be evaluated every five years and updated after consulting the institutions listed in para 1.

(4) After approval by the Provincial Government, the Provincial Governor has to present the Provincial Waste Management Plan to the Federal Minister for Agriculture, Forestry, Environment and Water Management according to federal legislation. [unofficial translation]

Figure 1: The Styrian Waste Management Act 2004 (StAWG 2004) provides the legal basis for the preparation of a Provincial Waste Management Plan

The L-AWP 2010 evaluates and updates the L-AWP 2005. Not only non-hazardous municipal waste, which is covered by provincial legislation defined in the StAWG 2004, is integrated into the waste management-related observations but also those waste types which are dealt with by communal collection and treatment structures together with municipal waste. This allows us to present an extensive picture of Styrian waste management, to continue the illustration of waste volumes and to recognize the most important requirements for future development. Therefore, the illustrations on other waste types than non-hazardous municipal waste are purely informative.

The evaluation and updating of the L-AWP 2005 with this present L-AWP 2010 are based on waste-related data from the years 2003 to 2008. A variety of legal and factual bases for waste management has changed during this five-year observation period. The following section will provide a brief overview on the relevant changes of federal and provincial legislative bases which have been implemented since the approval of the L-AWP 2005 in 2005:

- The Sewage Sludge Ordinance 2007 significantly reduced the maximum thresholds of heavy metals permitted for agricultural recovery of sewage sludge in Styria.
- The Landfill Ordinance 2008 reorganised classes of landfill and determined new guidelines for waste acceptance procedures.
- The amendment of the Waste Electrical and Electronic Equipment Ordinance in 2008 implementing the Battery Ordinance 2008 resulted in major changes regarding the collection of waste electrical and electronic equipment and waste batteries.
- The amendment of the List of Wastes Ordinance in 2005 integrated the additional waste type key number 92 for biologically recoverable waste into the waste inventory.

- In 2011, the Waste Inventory Ordinance 2008 will for the first time collect data regarding the production and disposal of waste in a standardised procedure all over the federal state. This will allow not only the collection of data for municipally collected household waste as currently performed on an annual basis by the Provincial Government of Styria; in the future also data on industrial waste, which are currently not being collected systematically by the Styrian Provincial Government, will be available for waste management-related planning.
- Since 1 January 2010 new threshold values have been implemented by EU legislation in addition to the Federal Procurement Act: if these limits are exceeded, EU-wide calls for tender are required for orders from public institutions or companies with public participation.

Further revisions of the legal requirements are expected for the near future: the Directive on Packaging 1996 will be amended in 2010; detailed effects of this amendment for current common practice are to date not foreseeable. Moreover, the Waste Management Act 2002 and the StAWG 2004 will have to be amended by the end of 2010 to allow for the implementation of the new EU Waste Framework Directive.

The development of communal waste collection volumes showed an increase of municipal waste by 18% in the observed period from 2003 to 2008[1] (from 430,000 tonnes (t) in 2003 to 508,000 t in 2008). The data show that in accordance with global developments the primary goal of waste management, which is waste prevention, remains to be fully implemented in Styria in terms of waste volumes (quantitative waste prevention). In the field of qualitative waste prevention, however, the decreasing concentration of heavy metals in municipal sewage sludge can be referred to as positive example.

Major successes were achieved in the field of waste recovery: the separate collection of the individual fractions is a prerequisite for comprehensive and efficient recovery of waste. Compared with total municipal waste volumes, the quantitative increase of separately collected fractions is disproportionally high (+18% in the observation period from 2003 to 2008). The amount of separately collected biogenic waste, for instance, increased by 32% (from approx. 72,000 tonnes/year (t/a) to approx. 95,000 t/a), and the amount of waste materials and packagings by a total of 24% (from roughly 169.000 t/a to approx. 209,000 t/a). During the same period, a disproportionally low increase of residual waste (community collection) by only 10% was observed. Overall, the proportion of residual waste on total municipal waste volumes was only 29% in 2008, compared with 31% in 2003.

The high waste separation quota in Styria is not least achieved thanks to the excellent infrastructure of Styrian waste management. 383 waste material collection centres (*Altstoffsammelzentrum, ASZ*) and 44 stationary collection cells for problematic substances (*Problemstoffsammelstelle, PSS*) are available in Styria for the separate collection of 40 different waste fractions. Additionally, the waste treatment plants operated in Styria comprise among others: six mechanical-biological treatment (MBT) facilities; six residual waste splitting facilities; one plant for thermal recovery of remaining materials from the recovery of municipal, commercial and industrial wastes and sewage sludge; two cement works for co-incineration of waste fractions rich in calorific value; 70 composting facilities for biogenic waste and sewage sludge; 44 plants for the production of biogas from energy crops, agricultural residues and sewage sludge; and 22 treatment plants for demolition and construction waste.

[1] Data of the L-AWP 2005 are based on the year 2003, data of the L-AWP 2010 are based on the year 2008.

The significance of the economic impact of Styrian waste management must not be neglected. The private waste disposal industry, represented by the Technical Unit Waste and Waste Water Management (*Fachgruppe Abfall- und Abwasserwirtschaft*) of the Regional Economic Chamber of Styria, counts 400 member companies with 3,000 employees and an annual turnover of 500 million Euro; 30% of the turnover is achieved by regional SMEs. Private waste disposal industry invested 150 million Euro for trend-setting technologies in the field of waste management. Research and development, resulting in innovative products in the fields of waste-separating and environmental technology, helped Styrian enterprises achieve a leading position on the global market. No data are at present available on the number of jobs created by municipal waste management.

Moreover, waste management is an essential part of the Styrian educational landscape. The University of Leoben offers a degree in Industrial Environmental Protection, Waste Disposal Technology and Recycling as Bachelor, Master and PhD programme. Research and education in the field of waste management are offered at different institutes of the University of Leoben, Graz University of Technology and the University of Graz. Moreover, waste-related topics are represented in adult education and company in-house training, e.g. trainings for waste consultants.

In 2006, an audit of Austrian waste management was performed by the Austrian Federal Audit Court (*Bundesrechnungshof*)[2]. In its 2007 report the court certified the Austrian waste management a high quality level, stressing that Styria was among those provinces which had already implemented at the provincial level the requirements of the Landfill Ordinance 1996 regarding the pre-treatment of waste to be landfilled from 01 January 2004. The legal option to continue the landfilling of waste until the end of 2008 was not applied in Styria because this is the ecologically most disadvantageous form of waste treatment. In the sense of preventive climate protection, sufficient capacities for the mechanical-biological pre-treatment of mixed municipal waste are available in Styria. In its report, the Federal Audit Court evaluated this form of waste treatment (MBT) as equal to waste incineration, provided that only state-of-the-art treatment plants are compared. For ecologic and economic reasons the court recommended to integrate industrial waste into the disposal system for municipal waste; moreover it considers the additional utilisation of the removal system and the treatment plants achieved therewith advantageous with regard to a quantitative cost degression.[3]

The Austrian Climate Protection Report (*Klimaschutzbericht*) 2009[4] highlighted that the climate protection targets for 2007 were just narrowly missed and that the pre-treatment of waste to be landfilled largely contributed that reaching the target had come so close. Even though it is expected[4] that the sectoral targets of the Austrian Climate Policy (see Chapter 2.2.5.2) will be achieved in the field of waste management, the waste management industry is also required to recognize potentials to reduce greenhouse gas (GHG) emissions and implement adequate measures. From a technical point of view these measures shall not be limited to the waste management sector but to all relevant areas

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[2] Bundesrechnungshof (Hsg.): Ausgewählte Themen der Abfallwirtschaft in Österreich. Prüfergebnis Steiermark 2007/5. Vienna, 2007; URL:http://www.rechnungshof.gv.at.

[3] Bundesrechnungshof, 2007.

[4] Anderl, M., Bednar, W., Böhmer, S., Gössl, M., Gugele, B., Ibesich, N., Jöbstl, R., Lampert, C., Lenz, K., Muik, B., Neubauer, C., Pazdernik, K., Pötscher, F., Poupa, S., Ritter, M., Schachermayer, E., Schodl, B., Schneider, J., Seuss, K., Sporer, M., Stix, S., Stoiber, H., Stranner, G., Storch, A., Wappel, D., Weiss, P., Wiesenberger, H., Winter, R., Zethner, G. & Zechmeister, A.: Klimaschutzbericht 2009. Umweltbundesamt Report Rep-0226, Vienna, 2009.

notwithstanding their formal integration into other sectors (waste collection is, for instance, integrated into the traffic sector, waste incineration into the energy supply sector, etc.). To meet this responsibility, climate protection is a vital part of the L-AWP 2010: the evaluation of the actual state will focus on the climatic relevance linked with the treatment of relevant waste fractions, and specific outlines on the potential for future optimisation will be provided wherever the current state of knowledge allows for it. Measures with regard to enhanced climate protection in the field of Styrian waste management will be part of the future planning period from 2010 to 2020.

The future organisation of waste management will be oriented towards the requirements of the new EU Waste Framework Directive, which has to be transposed into national legislation by the end of 2010. The Directive defines the major goal of waste policies: adverse effects of waste production and waste management for human health and the environment must be minimised. EU citizens shall become a “recycling society“, seeking waste prevention and a reduced consumption of resources with highest priority. For a practical implementation of this target the previous three-step waste hierarchy (prevention – recovery – disposal) is replaced by a five-step hierarchy (prevention – preparation for re-use – recycling – other recovery, notably energy recovery – disposal).

With regard to the implementation of waste management-related targets defined in the new EU Waste Framework Directive in Styria, measures for waste prevention and for further optimisation of separate collection of recoverable materials and repairable goods must be encouraged. In pursuance of the requirements set out at the European level, the conservation of resources will be the focus of the planning period from 2010 to 2020.

2 Current framework conditions

2.1 Requirements for sustainable development

The principle of sustainability in waste management is anchored in the Federal Waste Management Act 2002[5] (AWG 2002) and in the Styrian Waste Management Act 2004[6] (StAWG).

The general definition of the term "sustainability" has been coined in the Brundtland report[7]: *"Sustainable development is development which implies meeting the needs of the present without compromising the ability of future generations to meet their own needs".* Sustainable development aims at ensuring a good quality of life for everyone today and for future generations. The three target dimensions (Figure 2) illustrate that sustainable development depends on the simultaneous and equal development of the three dimensions **environment, economy and society**.

Figure 2: The three target dimensions of sustainable development

In the field of waste and material flow management, sustainability primarily refers to resource conservation and waste prevention. The **new EU Waste Framework Directive**[8], which has to be implemented as national law by the member states by 12 December 2010, underlines the necessity

[5] Federal Act on Sustainable Waste Management (Waste Management Act 2002 - AWG 2002), Federal Law Gazette I No.102/2002 as amended in Federal Law Gazette I No. 54/2008.

[6] Act of 6 July 2004 on Sustainable Waste and Material Flow Management in Styria (Styrian Waste Management Act 2004 - StAWG 2004), Provincial Law Gazette No. 65/2004, as amended in Provincial Law Gazette No. 56/2006.

[7] World Commission on Environment and Development: Our common future. United Nations, 1987. This report is also known as "Brundtland report".

[8] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain directives ("Waste Framework Directive")

for resource conservation and waste prevention. The directive aims to pave the way towards a "European Recycling Society", focusing on a highly efficient use of resources. Moreover, the new EU Waste Framework Directive provides for the application of economic instruments (e.g. supports, subsidies) and procurement guidelines to meet the goals of waste prevention and waste recovery. Furthermore, the member states have to develop **waste prevention programs** to decouple economic growth from the environmental impacts of resource exploitation.

The new EU Waste Framework Directive hence confirms that the principle of sustainability has to be consequently implemented by taking into account the three dimensions environment, society and economy. All related future actions will have to focus on waste prevention and the conservation of resources. At the same time, climate protection as one aspect of resource conservation will play a central role in the field of sustainable waste and material flow management.

For Styria, the concept for a **transition towards sustainable waste and material flow management** has already been defined in the Provincial Waste Management Plan 2005 (L-AWP 2005). To implement sustainable development at a local level, the Local Agenda 21[9] has successfully been established in Austria as action programme of the communities in collaboration with citizens, organisations and private trade and is based on a decision of the *Provincial Environment Conference* (*Landesumweltreferentenkonferenz)* 2003[10]. In Styria, the organisation "*Landentwicklung Steiermark – Rural development Styria*" is responsible for implementing the Local Agenda 21. Thanks to the high number of participating communities Styria plays the pioneering role in Austria.

Conservation of resources is the accepted guiding principle of modern waste management. Both the Federal Waste Management Act and the Styrian Waste Management Act define that, with respect to precautionary and sustainability principles, waste management is to be designed in such a way that i) waste volumes and their pollutant contents are kept as low as possible (**waste prevention**), that ii) waste is recovered if this is ecologically useful and technically feasible and if the resulting extra costs are not disproportionate (**waste recovery**), and that iii) non-recoverable waste is treated with suitable procedures and remaining residues are as non-reactive as possible (**waste disposal**).

The societal dimension of sustainability comprises the areas distributive justice, integration, creation and maintenance of jobs, quality of the working place, education, health, etc., all aiming at permanently ensuring social peace.

Under the aspect of sustainability, the satisfaction of employees, the quality of products and services and the protection of natural resources are important goals for companies. Even if the pursuit of ecological, social and quality-related goals may have inhibiting impacts on financial gains, it raises confidence from both clients and employees in the mid and long run, which may eventually assure the long-term success of a company. As regards the public sector, it will have to take responsibility regarding calls for tender to achieve sustainability in its economic dimension by applying practicable criteria for evaluation and suitability in terms of conservation of resources and reduction of greenhouse gases to determine the best bidding.

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[9] Cf.: The United Nations (UN) Conference on Environment and Development: Rio Declaration on Environment and Development. Rio de Janeiro, 1992.

[10] Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hsg.): Gemeinsame Erklärung zur Lokalen Agenda 21 in Österreich. Resolution of Provincial Environment Conference, 9 October 2003. Vienna, 2003; URL: http://www.landentwicklung.steiermark.at.

2.2 Legal and factual bases

2.2.1 Legislation of the European Community (EC) and communications from the European Commission

Since the accession of Austria to the European Union[11] (EU) in 1995, the EU directives and regulations are also relevant in Austria. EU regulations become immediately enforceable as law in all member states and must therefore not be transposed into a national law. EU directives need to be implemented as national law by means of national legislative procedures, usually leaving the member states with a certain liberty in the implementation process. Following, an overview on the main waste management-related EU regulations and directives is presented in chronological order.

Communications from the European Commission are not legally binding. Since they can, however, be considered European strategies, the following listing includes communications from the Commission in the fields of waste management, resource conservation, and sustainability.

2.2.1.1 **Directive on Sewage Sludge** (Directive 86/278/EEC)[12]

This Directive defines thresholds for the concentration of certain pollutants if sewage sludge is applied to agricultural surfaces. Moreover, it determines specific cases in which an application is prohibited as well as requirements of treatment procedures, aiming to prevent adverse affects for soils, vegetation, animals and humans.

2.2.1.2 **Directive on the Landfill of Waste** (Directive 1999/31/EC)[13]

This directive defines technical requirements for waste landfills and waste to be landfilled. It is intended to prevent or reduce adverse effects of landfilled waste on the environment, in particular on surface water, groundwater, soil, air, and human health, as far as possible.

2.2.1.3 **Waste Incineration Directive** (Directive 2000/76/EC)[14]

Directive 2000/76/EC aims to prevent or reduce the pollution of air, water and soil as well as the risks for human health connected therewith which are caused by the incineration and co-incineration of waste. Among other measures, this directive introduces thresholds for emissions

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[11] The European Community (EC) is one of the three pillars of the European Union. In common language it is often referred to as EU. The other pillars are: Common Foreign and Security Policy (CFSP) and Police and Judicial Co-operation in Criminal Matters (PJCC).

[12] Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC).

[13] Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.

[14] Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste.

into air or waters which have to be respected by waste incineration plants and co-incineration plants.

2.2.1.4 **Sixth Community Environment Action Program** [COM(2001) 31][15]

The Sixth Community Environment Action Program sets out the framework for environmental policy-making in the European Union for the period from 22 July 2002 to 21 July 2012. It focuses on the four priority areas climate change, biodiversity, environment and health as well as sustainable management of natural resources and waste. As to sustainable management of natural resources and waste, the action program aims at decoupling economic growth from the use of resources, at a more efficient use of resources and a reduction of waste volumes. In detail, the program defines the goal of a reduction of finally disposed waste volumes by 20% by 2010 and by 50% by 2050.

2.2.1.5 **Waste Statistics Regulation** (Regulation (EC) No. 2150/2002)[16]

This regulation provides a framework for the preparation of community statistics on waste management, aiming to provide regular, comparable, up-to-date and representative data on waste volumes, recycling, recovery and waste disposal in the member states.

2.2.1.6 **Directive on Packaging** (Directive 2004/12/EC)[17]

This directive applies to all types of packaging and packaging waste circulating in the community, whether they are generated by industry, trade, households or elsewhere and regardless of the materials they consist of. It determines recovery quota for packaging waste and requires EU member states to take measures to prevent the generation of packaging waste, which may include national programmes, and encourages them to develop re-use systems for packagings.

2.2.1.7 **Strategy on the Prevention and Recycling of Waste** [COM(2005)666][18]

The strategy defines targets and measures to reduce negative environmental impacts stemming from the production and management of waste.

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[15] Communication from the Commission of 24 January 2001 on the sixth environment action program of the European Union. 'Environment 2010: Our future, Our choice' [COM(2001)31].

[16] Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2002 on waste statistics.

[17] Directive 2004/12/EC of the European Parliament and of the Council of 11 February 2004 amending Directive 94/62/EC on packaging and packaging waste.

[18] Communication from the Commission of 21 December 2005 "Taking sustainable use of resources forward: a thematic strategy on the prevention and recycling of waste" [COM(2005)666].

2.2.1.8 **Thematic Strategy on the Sustainable Use of Natural Resources** [COM(2005)670][19]

The aim of the strategy is to reduce the negative environmental impact of the production and use of natural resources while still meeting economic growth and development objectives. Measures for a more efficient and sustainable use of natural resources throughout their life-cycles have been determined for the next 25 years.

2.2.1.9 **Regulation on Shipments of Waste** (Regulation (EC) No. 1013/2006/)[20]

This Regulation aims at improving environmental protection by monitoring and controlling waste shipments within the European Community as well as the import and export of waste from or into the community.

Two control procedures for waste shipments have been defined in the regulation:

- notification and written consent prior to shipments for waste intended for disposal and for certain (moderately) hazardous wastes for recovery;
- information requirements apply for shipments of non-hazardous waste intended for recovery.

Wastes subject to notification are set out in the "Amber List" (Annex IV), while wastes only subject to general information requirements are set out in the "Green List" (Annex III). Wastes for which export is prohibited are listed separately (Annex V).

2.2.1.10 **Review of the EU Sustainable Development Strategy** [10917/06][21]

Based on the European Union Strategy for Sustainable Development set out in 2001[22] and the review of this strategy in 2004/2005, the European Council under Austrian presidency adopted the renewed sustainable development strategy in 2006. It aims at meeting the negative, i.e. non sustainable, trends more efficiently than in the past. Measures and targets have been defined for the seven areas climate change, transport, consumption and production, natural resources, public health, social issues (social inclusion, demography and migration) and global poverty. Additionally, the member states are expected to merge the goals and measures of the European strategy with the national sustainable development strategies.

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[19] Communication from the Commission of 21 December 2005 - Thematic Strategy on the sustainable use of natural resources [COM(2005)670].

[20] Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.

[21] Council document 10917/06 of 26 June 2006 "Review of the EU sustainable development strategy – renewed strategy".

[22] Communication of the Commission of 24 July 2009 „Mainstreaming sustainable development into EU policies: 2009 review of the European Union Strategy for Sustainable Development" [COM(2009) 400].

The renewed strategy is reviewed every two years by means of a progress report (last review: July 2009)[23].

2.2.1.11 **Directive concerning Integrated Pollution Prevention and Control** (Directive 2008/1/EG)[24]

The IPPC directive defines the obligations with which industrial and agricultural activities with a high pollution potential must comply. It is therefore also applicable for defined waste treatment plants. The aim is to prevent or reduce emissions of pollutants and wastes into the atmosphere, water and soil.

2.2.1.12 **Waste Framework Directive** (2008/98/EC)[25]

The Waste Framework Directive entered into force on 12 December 2008 and must be transposed into national legislation by 12 December 2010, repealing the Directive on Waste (Directive 2006/12/EC)[26], the Directive on Waste Oils (Directive 75/439/EEC)[27] and the Directive on Hazardous Waste (Directive 91/689/EEC)[28].

The framework directive aims at

- creating a "European Recycling Society"
- decoupling economic growth and waste volumes
- reducing waste volumes and increasing recycling and recovery quotas
- creating a modern waste management
- simplifying and clarifying relevant legislation

A qualitative and quantitative reduction of waste volumes (waste prevention) and an increase of the recycling and recovery quotas shall be achieved by implementing measures in the fields of product development, production, distribution and adequate consumption behaviour at the end of the product life-cycle. Breaking the link between economic growth and waste generation has been defined as target.

Main changes compared with the replaced Directive on Waste are:

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[23] Communication from the Commission of 22 October 2007 „Progress Report on the European Union Sustainable Development Strategy 2007" [SEC(2007)1416].

[24] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control.

[25] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain directives.

[26] Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste.

[27] Directive 75/439/EEC of the Council of 16 June 1975 on Waste Oils

[28] Directive 91/689/EEC of the Council of 12 December 1991 on Hazardous Waste.

- Five-step waste treatment hierarchy: a new five-step waste treatment hierarchy replaces the old three-step hierarchy (prevention – recovery – disposal):

    1. **prevention**
    2. **preparation for re-use**
    3. **recycling**
    4. **other recovery, notably energy recovery**
    5. **disposal**

  With a view to implementing this waste hierarchy, the member states have to encourage the measures that allow the best outcome while maintaining the highest degree of environmental protection. "This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste."[29]

- Obligatory recycling quota: by 2020 the recycling or recovery quota of paper, metal, plastic, and glass from households and similar waste flows must amount to 50% by weight, for non-hazardous construction and demolition waste to 70% by weight. Moreover, suitable measures to guarantee the separate collection of biogenic waste for composting or fermentation have to be implemented.
- Waste prevention programs and waste management plans: by the end of 2011, the EU commission will present a report on the possibilities of waste prevention (product eco design policy) and an action plan formulating measures that encourage a change in consumption patterns. By 2014 targets for waste prevention and decoupling of waste generation and economic growth will be defined and are expected to be achieved by 2020. To prepare for this, the member states have to formulate waste prevention programmes by 12 December 2013 and are required to draw up nationwide waste management plans.
- Cooperation network among waste disposal facilities: establishing a cooperation network among waste disposal facilities and facilities for the recovery of mixed municipal waste from private households shall enable the member states to become self-sufficient in the field of waste disposal and recovery. Thereby, the best available technology (BAT) documents have to be taken into account.
- Shipments of waste: other than defined in Regulation (EC) No. 1013/2006 on shipments of waste, the member states can limit incoming waste shipments to incineration plants which are classified as recovery plants if this would demonstrably require national waste disposal or treatment which is not in accordance with the respective waste management plans.
- Extended producer responsibility: member states can define legislative measures to support the design and production of products which fully take into account and encourage an efficient use of resources during their life-cycles.
- Improved definitions: based on current judicature of the European Court of Justice, a more accurate definition of the term "waste" is provided and separated more carefully from the terms

[29] Art 4 para 2 of Directive 2008/98/EC.

"product" and "by-product". It is precisely defined when the incineration of solid municipal waste can be considered energy efficient and hence classified as recovery, etc.

- Waste management planning: scope and content of the requirements of waste management planning are defined. Waste management planning must illustrate the current situation and contain measures for the improvement of waste treatment as well as strategies for the implementation of the goals preventing waste and breaking the link between waste generation and economic growth. Possibilities for the "broad public" to participate in the establishment of waste management plans and waste prevention programmes are ensured.

Generally, the **applicability** of the directive covers all types of **wastes**.

The **exceptions** are:

- gaseous effluents emitted into the atmosphere
- land (*in situ*, i.e. before excavation) including unexcavated contaminated soil
- soil excavated in the course of construction works (not contaminated), if the material is used on the excavation site for construction purposes;
- radioactive waste
- decommissioned explosives
- faecal matter (if not covered by Regulation (EC) No. 1774/2002[30]), straw and other natural agricultural or forestry materials used in farming, forestry or for the production of energy from such biomass through processes or methods which do not harm the environment or endanger human health.

Among the **exceptions** from the scope of applicability are, with the **restriction** "already covered by other Community legislation":

- waste waters
- animal by-products (counter-exceptions: those which are intended for incineration, landfilling, or use in biogas or composting plants)
- carcasses of animals disposed of pursuant to Regulation (EC) No 1774/2002[16]
- wastes from extractive industries if subject to Directive 2006/21/EC[31]

[30] Regulation (EC) No. 1774/2002 of the European Parliament and of the Council of 3 October 2002 laying down health rules concerning animal by-products not intended for human consumption.

[31] Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC – Statement by the European Parliament, the Council, and the Commission.

2.2.1.13 **Renewable Energy Directive** (Directive 2009/28/EC)[32]

This directive establishes a common framework and binding targets for member states, defining the share of energy from renewable sources in the gross final consumption and in the transport sector.

Achieving the following requirements by the year 2020 at the European level has been defined as overall goal:

- 20% reduction of greenhouse gas emissions
- 20% share of energy from renewable sources
- 20% more energy efficiency

For Austria, the defined target to be reached by 2020 for the share of energy from renewable sources in the gross final energy consumption amounts to 34%. In comparison, the share of energy from renewable sources in the gross final consumption of energy in 2005 amounted to only 23.3%. The burden to reduce greenhouse gas emissions is shared among the member states according to their wealth. **By 2020 Austria** has to **reduce** its **greenhouse gas emissions by 16%** compared with the year 2005. This target value refers to all emission sources which are not covered by the scope of the emission trading system according to Directive 2003/87/EC[33].

2.2.2 Legislation at the national level

2.2.2.1 **Waste Management Act 2002**[34]

With the Federal Waste Management Act 2002 (AWG 2002) the targets of sustainable development were legally anchored in the field of waste management. While the L-AWP was effective, the AWG 2002 has been amended six times. The definition of the waste management-related targets[35], which is still effective, states: “Based on the precautionary principle and on sustainability, waste management is organised to:

1. prevent harmful or detrimental effects on humans, animals and plants and on their bases of life and their natural environment, and to reduce other adverse effects on the general human well-being to a minimum,
2. minimise the emissions of air pollutants and climate-relevant gases,
3. conserve resources (raw materials, water, energy, landscape, space, landfill volumes),

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[32] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

[33] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC of the Council.

[34] Federal Act on Sustainable Waste Management (Waste Management Act 2002), Federal Law Gazette I 102/2002 as amended in Federal Law Gazette I No. 115/20

[35] Art 1 para 1 AWG 2002.

4. in the case of recycling, ensure that the waste or the materials reclaimed thereof do not represent a greater risk than do the comparable primary raw materials or products made from primary raw materials, and
5. guarantee that only such waste remains as can be deposited without danger for future generations.

The following principles[36] for a successful implementation of these targets are to be respected:

1. The quantities of waste and their pollutant contents shall be minimised (waste prevention).
2. Waste shall be recovered to the extent that is ecologically useful and technically feasible and if the resulting extra costs are not disproportionate to other waste treatment processes, and if a market for the reclaimed substances or energy does already exist or can be created (waste recovery).
3. Non-recoverable waste shall be treated according to its composition through biological, thermal, chemical or physical processes. Solid residues shall be as non-reactive as possible and properly disposed of (waste disposal).

Pursuant to the effective EU Waste Framework Directive, **the new five-step waste hierarchy has to be transposed into national waste legislation (AWG 2002) by the end of 2010**. The corresponding amendment of the AWG 2002 was still being discussed while the L-AWP 2010 was prepared.

Based on European legal requirements[37], the Federal Waste Management Act defines the concept of waste. The term waste[38] in the sense of the AWG 2002 refers to all movables the owner wants to dispose of or has disposed of (so-called subjective definition of waste).

Moreover the collection, storage, transport, and treatment of movables as waste may be required (so-called objective definition of waste) for reasons of public interest[39] if otherwise

- human health could be at risk or exposed to unacceptable disturbances,
- natural living conditions of animals or plants and soil quality could be in danger,
- a sustainable use of water and soil could be impaired,
- the environment could be polluted beyond the inevitable degree,
- there could be a risk of fire or explosion,
- sounds or noise could be created in excessive dimensions,
- the occurrence or growth of pathogenic agents could be favoured,
- public order and safety could be disturbed, or
- natural scenery or the appearance of settlements could be seriously damaged."

[36] Art 1 para 2 AWG 2002.

[37] Directive on Waste (2006/12/EC) and Waste Framework Directive (2008/98/EC).

[38] cf. Art 2 para 1 to 3 AWG 2002.

[39] Art 1 para 3 AWG 2002.

Together with the definition of waste, the above-mentioned requirements for a protection of public interests are the central principle for the implementation of waste-related legal measures taken by the authorities.

Moreover, the AWG 2002 defines the obligation to obtain a permit and the duty of disclosure for waste treatment plants[40], assigning different procedures according to type and size of the plant.

The definition of the general treatment obligations for waste holders[41] provides the framework for the collection, storage, transport and treatment of waste. In particular, all waste holders have to transfer these tasks in an appropriate manner to authorised parties regardless of type and quantity of the waste.

The goals to be achieved for a sustainable reduction of waste volumes throughout the whole product life-cycle are specified as follows[42]:

- Products shall be manufactured, treated, processed or otherwise designed to make them long-lasting and easy to repair so that they can be recycled or recovered to a large extent after the end of their intended usage.
- Distribution forms shall be organised in such a way that the waste volumes generated are as low as possible (e.g. by take-back systems or collection and recovery systems involving deposits).
- Products shall be designed in such a way that their production, use and consumption do not harm public interest (Art 1 para 3 AWG 2002) and that waste volumes and the pollutant levels in waste are as low as possible.
- Products shall be consumed in such a way that the environmental impact is minimised, in particular in terms of waste generation.

A number of national regulations have been passed based on the targets defined in the AWG 2002. Therewith and taking into account the legislative competence of the Federal constitution, the Federal Minister for Agriculture, Forestry, Environment and Water Management has found a consistent solution for large areas of Austrian waste management at a national level, including the area of non-hazardous waste (e.g. packing waste, biogenic waste, demolition and construction waste, end-of-life vehicles, and waste electrical and electronic equipment). The competence of the Federal Provinces is in principle limited to the organisation and execution of the collection and treatment of non-hazardous municipal waste.

[40] Art 37 AWG 2002.

[41] Art 15 AWG 2002.

[42] Art 9 AWG 2002.

2.2.2.2 Packaging Ordinance 1996[43]

The Packaging Ordinance (*VerpackVO*) 1996 regulates the requirements of taking back and recycling packagings. The planned amendment of the Packaging Ordinance 1996 is among others expected to contribute to meeting the EU requirements in terms of i) recycling quota of household waste; ii) increased cost efficiency and controllability; and iii) the preservation of waste management-related services and increasing competition. In particular the organisational flexibility shall be increased by introducing new system and collection requirements.[44]

2.2.2.3 Compost Ordinance[45]

The Compost Ordinance defines the quality standards of composts from waste for organic recycling. Its central elements are type and provenance of source materials, quality requirements of the end product, as well as labelling of composts and putting them into circulation. The Compost Ordinance is an "end of waste ordinance". If the requirements laid down in the ordinance are met, the compost loses the characteristics of waste and becomes a product.

2.2.2.4 List of Wastes Ordinance[46]

The List of Wastes Ordinance provides uniform standards for hazardous and non-hazardous waste. In the course of its amendment[47] in 2005, the waste type key number 92 "Waste for biological recovery" has been integrated into the waste directory. It contains all waste types which are, due to their material composition, suitable as source material for composting in pursuance with the Compost Ordinance or for material recovery in biogas facilities. Since then, separately collected biogenic municipal waste ("organic waste container") has been classified as waste key number 92401 ("Mixed waste of groups 924 and 921, containing animal substances, for composting") in Styria. The 2008 amendment[48] of the List of Wastes Ordinance focuses on the omission to adopt a European waste list and on a consolidated waste inventory which is published online via the EDM (electronic data management)

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[43] Order of the Federal Minister for Environment, Youth and Family Affairs on the Prevention and Recovery of Packaging Waste and Specific Waste Goods, and for the Establishment of Collection and Recovery Systems (*VerpackVO*), Federal Law Gazette No. 648/1996 as amended in Federal Law Gazette II No. 364/2006

[44] Keri, C.: Packaging Ordinance 2010. Basis Begutachtungsentwurf. Vortrag zur ÖWAV-Veranstaltung „Abfallrecht für die Praxis", Vienna, 26 November 2009; http://www.oewav.at/upload/medialibrary/Keri.pdf.

[45] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on Quality Requirements for Composts Made from Waste (Compost Ordinance 2001), Federal Law Gazette II No. 292/2001.

[46] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on a Waste List (List of Wastes Ordinance), Federal Law Gazette II No. 570/2003 as amended in Federal Law Gazette II No. 498/2008.

[47] Federal Law Gazette II No.89/2005.

[48] Federal Law Gazette II No.498/2008.

portal[49] of the Federal Ministry for Agriculture, Forestry, Environment and Water Management (*BMLFUW*).

2.2.2.5 Treatment Obligations Ordinance[50]

The Treatment Obligations Ordinance entered into force on 1 January 2005, the regulations for waste electrical and electronic equipment became effective on 13 August 2005.

The Treatment Obligations Ordinance defines minimum requirements with regard to the collection, storage and treatment of the following waste flows:

- waste electrical and electronic equipment
- batteries and accumulators
- solvents and solvent-containing waste, paint and varnish waste
- hazardous medical waste
- waste amalgam
- electrical equipment containing polychlorinated biphenyl (PCB) and other PCB-containing waste

These minimum obligations apply for waste holders (original waste producers, waste collectors and those responsible for waste treatment). In case a waste holder is not authorised or capable to guarantee appropriate waste treatment, Art 15 para 5 AWG 2002 states that the collection or treatment has to be transferred to authorised persons or institutions so that adverse effects on public interest in the sense of the AWG 2002[51] can be avoided.

2.2.2.6 Waste Electrical and Electronic Equipment Ordinance[52]

The Waste Electrical and Electronic Equipment Ordinance (*EAG-VO*) came into effect on 30 April 2005. It requires retailers of electrical and electronic equipment to take back old appliances and to cover the related costs, all of which has been effective since 13 August 2005. Aiming to implement the so-called RoHS (Restriction of Hazardous Substances) Directive (Directive 2002/95/EC)[53], the 2006

[49] http://www.edm.gv.at.

[50] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on waste treatment obligations (Treatment Obligations Ordinance), Federal Law Gazette II No. 459/2004 as amended in Federal Law Gazette II No. 363/2006.

[51] cf. Art 1 para 3 AWG 2002.

[52] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management Waste Prevention, Collection and Treatment of Waste Electrical and Electronic Equipment (Waste Electrical and Electronic Equipment Ordinance, *EAG-VO*), Federal Law Gazette II No. 121/2005 as amended by Federal Law Gazette II No. 496/2008.

[53] Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

amendment of the *EAG-VO* requires limitations of pollutants also in new appliances to decrease the use of specific hazardous waste in waste electrical and electronic equipment (WEEE). The 2007 amendment contains adjustments for collection and recovery systems and defines exceptions regarding the RoHS regulations. The main contents of the hitherto last amendment to the *EAG-VO* in 2008 are changes in the use of hazardous substances (RoHS Directive), regulations for ending collection and recovery systems, credits for over-compliances and the cancellation of an automatic generation of consignment notes in the electronic data management system (EDM).

2.2.2.7 Battery Ordinance[54]

The Battery Ordinance entered into force in 2008 and provides new guidelines for the collection and recovery of all used batteries. It contains provisions for the take-back and collection of different types of batteries and accumulators, i.e. for devices, vehicles, and industry appliances. Collection and recovery systems requiring approval of the Federal Ministry for Agriculture, Forestry, Environment and Water Management take over the coordinated collection of all waste batteries and accumulators from commerce and the communities.

2.2.2.8 Landfill Ordinance 2008[55]

With the implementation of the Landfill Ordinance (*DepVO*) 2008 on 1 March 2008 the corresponding contents of the **EU Directives Landfill Ordinance** (Directive 1999/31/EC) and **Waste Directive** (Directive 2006/12/EC) as well as **Council Decision establishing criteria and procedures for the acceptance of waste at landfills** (2003/33/EC)[56] were transposed into national legislation. The new landfill ordinance consequently pursues the prohibition for landfilling of untreated waste, which has been introduced for the first time in the Landfill Ordinance 1996. The main improvement of the present landfill ordinance are the **comprehensive waste acceptance procedure**; specific requirements with regard to sampling, waste examination, retain samples, documentation etc. within the acceptance of waste by the landfill operators are defined in detail in Annex 4 of the ordinance. Further changes apply e.g. to the **new classification of landfill classes** and the integration of regulations implementing **reporting duties via the electronic data management system** (EDM). Until full implementation of the extensive regulations (by 1 January 2012 at the latest) different transitional stages have been defined for existing landfills. The new landfill ordinance particularly affects the subcategory of landfills for demolition and construction waste: landfills of this group are classified as IPPC plants for which any deviation from state-of-the- art technologies has been

[54] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on Waste Prevention, Collection and Treatment of waste batteries and accumulators (Battery Ordinance), Federal Law Gazette II No. 159/2008.

[55] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on landfills (Landfill Ordinance 2008), Federal Law Gazette II No. 39/2008, as amended by Federal Law Gazette II No. 185/2009.

[56] Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II to Directive 1999/31/EC (2003/33/EC).

prohibited since 1 July 2009[57].

2.2.2.9 Waste Inventory Ordinance[58]

The Waste Inventory Ordinance has been implemented on 1 January 2009. At the federal level, it defines the annual waste inventories which must be reported by waste collectors and those responsible for waste treatment[59], containing information on type, quantity, origin, and whereabouts of waste. This ordinance aims at improving the waste management-related planning data, supporting the authorities in their executive function (control activities), reducing the administrative burden by introduction of an electronic data management system (EDM), creating synergies with other report duties and collecting the required data to meet the EU report duties. The annual waste inventories have to be reported for the first time by 15 March 2011 for the preceding calendar year.

2.2.3 Legislation at the provincial level

2.2.3.1 Styrian Waste Management Act 2004[60]

As provincial law, the Styrian Waste Management Act 2004 (StAWG 2004) defines the management of waste which is covered by the competence of the provinces, i.e. non-hazardous municipal waste[61].

The StAWG 2004 is also oriented towards precautionary and sustainability principles. The sustainable goals and principles of the Federal Waste Management Act 2002 have been taken over into the StAWG 2004 without any change. In its general regulations, the StAWG 2004 defines specific measures set by the Province of Styria for a sustainable acquisition of working materials and consumer goods. To implement the waste management-related goals and principles, a Provincial Waste Management Plan has to be prepared, which is to be evaluated and updated every 5 years[62].

It is laid down that **the community has to organise public removal structures** for the **collection and removal of municipal waste**[63]. Further provisions are made for the organisation of waste removal by the communities, the number and size of collection containers, the distribution and use of

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[57] IPPC ("integrated pollution prevention and control") plants are all industrial and agricultural installations with a high pollution potential (cf. IVU Council Directive 96/61/EC concerning integrated pollution prevention and control, Chapter 2.1.1).

[58] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on Annual Waste Inventories (*AbfallbilanzV*), Federal Law Gazette II No. 497/2008.

[59] cf. Art 17 AWG 2002.

[60] Provincial Law of 6 July 2004 on Sustainable Waste and Material Flow Management in Styria (Styrian Waste Management Act 2004 - StAWG 2004), Provincial Law Gazette No. 65/2004, as amended by Provincial Law Gazette No. 56/2006.

[61] Art 4 para 4 StAWG 2004.

[62] Art 5 StAWG 2004.

[63] Art 7 - 12 StAWG 2004.

waste collection containers, the implementation of a waste removal order, and the levy of fees and reimbursement of costs by municipalities. As soon as the municipal waste is loaded onto a vehicle of the public waste removal fleet, the responsible waste management association becomes the holder of the waste. Land owners within the removal area are entitled and obliged to have all municipal wastes produced on their land collected and removed by public removal structures and to dispose of municipal waste which is produced on areas beyond the removal area at defined collection sites.

Waste management associations[64] are responsible for **the treatment, i.e. the recycling and/or removal of municipal waste**. The StAWG 2004 as well as the Styrian Law on the Organisation of Associations of Municipalities (*Steiermärkisches Gemeindeverbandsorganisationsgesetz*) 1997[65] define the organisation of the waste management associations as associations of municipalities.

Details regarding the execution of the StAWG include authority competences, sanctions, etc. [66]

The waste management acts of the provinces and the AWG 2002 have to be harmonised with the new Waste Framework Directive.

2.2.3.2 Sewage Sludge Ordinance 2007[67]

To implement the EU Sewage Sludge Directive (Directive 86/278/EEC), the use of sewage sludge in agriculture has been defined in the Styrian Soil Conversation Act[68] and the Styrian Sewage Sludge Ordinance 2007.

Only if the legal requirements laid down therein are complied with, sewage sludge may be applied to agriculturally used or usable areas, i.e. in particular on the basis of and within the scope of a certificate for its application. The Sewage Sludge Ordinance 2007 defines the requirements for sewage sludge and soils and the execution and documentation of its application. Compared with the previous Sewage Sludge Ordinance[69], the Sewage Sludge Ordinance 2007 decreased the applicable threshold values for heavy metal concentrations in sewage sludge by 14% to 60%, according o the heavy metal in question. Therefore, the threshold values for heavy metal concentrations in sewage sludge according to the Sewage Sludge Ordinance 2007 correspond exactly to the limits which are defined in the Compost Ordinance for “Sludge as raw material for quality sewage sludge compost”.

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[64] Art 14 and 15 StAWG 2004.

[65] Provincial law of 1 July 1997, implementing the Styrian Law on the Organisation of Associations of Municipalities (*GVOG* 1997), Provincial Law Gazette No. 66/1997 as amended in Provincial Law Gazette No. 92/2008.

[66] Art 16 - 24 StAWG 2004.

[67] Ordinance of the Provincial Government of Styria of 8 October 2007 on the application of sewage sludge to agriculatural soils (Styrian Sewage Sludge Ordinance), Provincial Law Gazette No. 89/2007 as amended in Provincial Law Gazette No. 94/2007.

[68] Provincial law of 2 June 1987 on the Conversation of Soils (Styrian Soil Conversation Act), Provincial Law Gazette No. 66/1987 as amended in Provincial Law Gazette No. 8/2004.

[69] Sewage Sludge Ordinance, Provincial Law Gazette No. 89/1987 as amended in Provincial Law Gazette No.73/2003.

2.2.4 Federal Waste Management Plan 2006[70]

The Federal Minister for Agriculture, Forestry, Environment and Water Management has to prepare a Federal Waste Management Plan (B-AWP) at least every five years. The B-AWP is considered as "White Book" of Austrian waste management and has to comprise the following[71]:

- an analysis of the waste management situation
- regional distribution of plants for waste disposal
- concrete measures derived from the targets and principles of the AWG 2002 for
    - a reduction of waste volumes and pollutant contents
    - an environmentally friendly and economically sound recovery of waste
    - the disposal of inevitable and non-recoverable waste
    - the transport of waste from or to Austria for recovery or disposal and
    - the promotion of waste recovery, in particular with regard to protection of resources
- measures planned by the federal state in order to reach these targets
- special regulations for specific waste types, in particular treatment obligations and programmes

The currently valid Federal Waste Management Plan 2006 will be updated in 2011. With the L-AWP 2010, the Province of Styria contributes to the updating of the Federal Waste Management Plan 2011.

2.2.5 Strategies for sustainable development and climate protection

2.2.5.1 Austrian Strategy for Sustainable Development (NSTRAT, ÖSTRAT)

The **"Austrian Strategy for Sustainable Development" (NSTRAT)[72]** was adopted in April 2002 by the Austrian government as federal strategy for sustainable development, implementing the Austrian strategy pertaining to the resolutions of the UN World Summit in Johannesburg 2002 ("Rio+10 Conference")[73]. As such, it defines the concept for a sustainable Austria and assigns indicators to the four fields of action.

On 30 October 2006, the Conference of Provincial Governors agreed on the further development of NSTRAT towards an **Austrian Sustainability Strategy of the Federal State and the Provinces**

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[70] Federal Ministry for Agriculture, Forestry, Environment and Water Management (ed.): Federal Waste Management Plan 2006. Vienna, 2006; URL: http://www.bundesabfallwirtschaftsplan.at.

[71] acc. to Art 8 para 2 AWG.

[72] Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hsg.): Die österreichische Strategie zur Nachhaltigen Entwicklung. Eine Initiative der Bundesregierung. Zukunft bauen. Österreichs Zukunft nachhaltig gestalten. Vienna, 2002; http://www.lebensministerium.at.

[73] United Nations (ed.): Report of the World Summit on Sustainable Development. Johannesburg, South Africa, 26 August - 4 September 2002. New York, 2002; http://www.nachhaltigkeit.at.

(ÖSTRAT)[74]. Simultaneously, an order to prepare a corresponding proposal for implementation was given to the sustainability coordinators. This proposal serves as common framework for the federal state and the provinces for the implementation and the orientation towards a sustainable Austria and is based on the following principles:

- Rio Declaration of the World Summit dating back to 1992, pointing out the responsibility of the communities and regions regarding sustainable development.
- resolutions of the UN World Summit in 2002 ("Rio+10 Conference")
- results of the European Sustainable Cities Report, in particular the Charta of Aalborg[75] and the Aalborg Commitments[76], indicating the leading political principles in European cities and municipalities and defining 10 fields of action to be implemented for sustainable development at the communal level
- EU Strategy for Sustainable Development[77], which has been adopted by the EU heads of state and governments under Austrian presidency in June 2006 and contains legally binding frameworks and targets also valid for Austria.

ÖSTRAT is composed of a **strategic part**, describing the four main fields of action (Quality of Life in Austria, Austria as a dynamic business location, Austria as a Living Space, and Austria's responsibility). The common activities are listed in the **work programmes**, taking into account established activities and measures of the provinces and the federal state. The first work programme[78] for the period 2009-2010 can be divided into the following key topics:

- global responsibility
- solidarity of the societies and social capital
- sustainability at the regional and local level
- eco-efficiency and resource management by sustainable production and consumption patterns
- corporate social responsibility as success factor for Austria as an attractive business and employment location
- education and research as motor of innovation for sustainable development
- good governance – high quality cooperation between the federal state and civil society

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[74] ExpertInnenkonferenz der NachhaltigkeitskoordinatorInnen der Länder und des Bundes: Österreichische Strategie Nachhaltige Entwicklung (ÖSTRAT) – eine Handlungsrahmen für Länder und Bund. 2009.

[75] Charta of European Cities and Towns Towards Sustainability (Aalborg Charta). Aalborg 1994; http://www.nachhaltigkeit.at.

[76] Federal Ministry for Agriculture, Forestry, Environment and Water Management: Aalborg+10 – Inspiring Futures (Austrian version). 2005; http://www.nachhaltigkeit.at.

[77] see also Chapter 2.2.1

[78] ExpertInnenkonferenz der NachhaltigkeitskoordinatorInnen der Länder und des Bundes: Arbeitsprogramm 2009 – 2010 zur Umsetzung der ÖSTRAT (gemeinsames Arbeitsprogramm des Bundes und der Länder). 2009.

To implement the sustainability strategy at the provincial level, qualified bodies within each Provincial Government must be entrusted with the coordination of environmental policy aimed at sustainable development, guaranteeing to meet the organisational requirements for this purpose.

2.2.5.2 **Austrian Climate Strategy 2007**[79]

With regard to the targets defined in the Kyoto Protocol, Austria has committed itself to reduce its emissions of greenhouse gases (CO_2, CH_4, N_2O, HFC, PFC and SF_6) within the Kyoto period from 2008 to 2012by 13% compared with the levels of 1990. In 2002, the Federal government and the Conference of Provincial Governors adopted the "Austrian Strategy to Reach the Kyoto Target" (Climate Strategy 2002)[80]. In 2005, the climate strategy was evaluated and the results stated that, regardless of numerous measures for climate protection having been implemented, Austria has not yet succeeded in approaching the Kyoto target, even though the defined emission targets will for instance be reached in the **waste management sector**. Since the targeted reductions will at the whole not be sufficient to reach the Kyoto target 2012, further measures are required. Based on the evaluation and the results of public consultation (ministries, provinces, interest representatives, NGOs) the Climate Strategy 2007 was prepared. The most significant changes of the Climate Strategy 2007 compared to the Climate Strategy 2002 are:

- re-evaluation of the sectoral target scenarios 2010 based on the development of emissions to date (until 2004), the business-as-usual expectation and actual reduction potentials
- re-definition of measures in the fields energy and transport
- adjustment of the Austrian allocation plan for emission trading (2nd National Allocation Plan – NAP 2) for the sectors affected by emission trading (energy and industry)
- new definition of the JI-CDM-programme[81]

With regard to the waste management sector, the Climate Strategy 2007 does not include any amendments of the measures adopted in the Climate Strategy 2002.

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[79] Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hsg.): Anpassung der Klimatrategie Österreichs zur Erreichung des Kyoto-Ziels 2008-2013. Adopted by the Council of Ministers on 21 March 2007. Vienna, 2007; http://www.klimastrategie.at.

[80] Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hsg.): Strategie Österreichs zur Erreichung des Kyoto-Ziels. Klimastrategie 2008/2012. Adopted by the Council of Ministers on 18 June 2002. Vienna, 2002; http://www.klimastrategie.at.

[81] The Austrian JI/CDM programme aims at actively contributing to the commitment to reach the Austrian Kyoto target by buying emission reductions from joint implementation (JI) and clean development mechanism (CDM) projects. (http://www.ji-cdm-austria.at.)

2.2.5.3 Climate Protection Report 2009[82]

The Climate Protection Report 2009 illustrates the emission trends of greenhouse gases in Austria from 1990 to 2007, divided according to sectors and main polluters, and compares them with the targets defined in the Climate Strategy 2007.

The report gives an estimate of the development of Austrian GHG according to the individual sectors until 2020, subsequently providing an evaluation of the attainability of the legal obligations laid down in the climate and energy package of the European Union.

In 2007, the waste management sector was responsible for emissions of 2.2 million tonnes of CO_2 equivalents, i.e. approx. 2.5% of the overall Austrian GHG emissions. In the year 2007 the emissions in this sector experienced a decline by 40.4% when compared to 1990. The target value set out in the climate strategy for the period 2008 to 2012 was missed by only 0.08 million tons in 2007. Therefore, reaching the sectoral target as defined in the climate strategy can be considered very realistic.

2.2.5.4 Austrian Energy Strategy[83]

The Austrian energy strategy presents the strategic key issues of future energy and climate policies in Austria. The strategy focuses on the three areas: increased energy efficiency, saving energy and enforced use of renewable energy sources. Implementing the proposed measures shall help achieve the Austrian climate targets, drastically reduce the dependence on energy imports and boost economy and employment.

2.2.5.5 Austrian Resource Plan[84]

The Austrian Resource Plan can be considered as federal master plan for the protection of resources. It identifies areas where resources are found and which are not defined as other protected areas (e.g. national parks, water management priority areas, landscape protection areas, Natura 2000 areas). In the next step, these areas are classified as “Resource protection areas” in spatial planning legislation, which is performed in two stages: In Stage 1 (completed) data on resource deposits were systematically collected and evaluated with regard to the extent the resources require protection. In Stage 2 (in progress) the identified resource areas are legally defined as protected areas in collaboration with the federal provinces.

2.2.5.6 Styrian Energy Strategy 2025[85]

The Styrian Energy Strategy 2025 is the basis for the energy policy of the Province of Styria and contains all energy concepts and related resolutions of the Styrian Provincial parliament.

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[82] Anderl et al., 2009.

[83] Bundesministerium für Wirtschaft, Familie und Jugend & BMLFUW (Hrsg.): EnergieStrategie Österreich. Maßnahmenvorschläge Vienna, 2010; http://www.energiestrategie.at.

[84] The preparation of the *"Österreichischer Rohstoffplan"* has not yet been completed. Information is available via http://www.bmwfj.at, section *Energie & Bergbau*.

[85] Landesenergiebeauftragter der Steiermark: Energiestrategie Steiermark 2025. 8.6.2009.

It aims at the best reduction of energy resources used while taking into account social-political and economic aspects and covering the remaining needs with the highest possible share of renewable energy sources.

2.2.5.7 Styrian Climate Protection Plan

The Styrian Climate Protection Plan is currently being prepared and will be presented in June 2010 to the Provincial Government and the Styrian Provincial Parliament for adoption. With regard to the implementation of the European energy and climate package the Styrian Climate Protection Plan shall reach consensus and identify the required measures for a climate-friendly and sustainable system of society, economy and energy in the Province Styria. Seven climate-relevant areas are explicitly mentioned: energy production, buildings, mobility, production, agriculture and forestry, waste management and climate style.

2.3 Organisational framework conditions

2.3.1 Departments of the Styrian Provincial Government and District Administration Offices

The waste management-related tasks for the execution of regulations at the national and provincial level are distributed among the organisational units of the Styrian Provincial Government as listed below. Most tasks stem from federal legislation whose execution has been transferred to the province in the context of indirect federal administration (AWG 2002 with relevant ordinances), while a minor part can be related to provincial legislation (StAWG 2004).

2.3.1.1 Organisational units with legal tasks

- **Specialised Division 7A - *Gemeinden und Wahlen*** *(Municipalities and Elections)*

  supervision of municipalities - organisation of fees and tariffs determined by municipalities

- **Specialised Division 10A - *Agrarrecht und ländliche Entwicklung*** *(Agricultural Law and Rural Development)*

  responsible e.g. for legal aspects of forestry, such as soil protection. Aspects of water protection, however, such as application of manure or fertilisation with fermentation residues, are covered by FA13A.

- **Specialised Division 13A - *Umweltrecht und Energiewesen*** *(Environmental Law and Energy)*

  Waste authority at first or second instance for all matters pertaining to the AWG; waste authority for all materials pertaining to StAWG (Provincial waste management plan, regional waste management plants, organisation of associations, legislation related to organisation of municipal waste fees and tariffs, organisation of collection and treatment of municipal waste).

  Interactions between FA13A (in its function as water rights authority) and waste management are e.g. fertilisation of agricultural areas with nitrogenous fertilisers (e.g. manure, compost,

fermentation residue): if water rights consider an application as unacceptable (e.g. exceeding quantities or during periods when it is prohibited), it is considered as waste disposal.

- ***Bezirkshauptmannschaften*** *(District Commissions)*

  District Administration Offices at first instance

2.3.1.2 Organisational units with factual tasks

- **Division 2 -** ***Zentrale Dienste*** *(Central Administration)*

  responsible for purchasing management, management of the vehicle fleet, facility management of the Government of the Province of Styria

- **Specialised Division 10B –** ***Landwirtschaftliches Versuchszentrum*** *(Agricultural Research Centre)*

  experimental and investigation activities in service of Styrian agriculture and environmental protection

- **Specialised Division 10C -** ***Forstwesen (Forstdirektion)*** *(Forestry)*

  responsible for forestry and environmental protection

- **Specialised Division 17B -** ***Technik und Sachverständigendienst*** *(Engineering and Expert Witnesses)*

  official expert witness service in the field of waste technology (waste management expert witnesses, ASV) in plant-related corporate procedures and for inspections

- **Specialised Division 17C -** ***Technische Umweltkontrolle*** *(Technical Environmental Inspections)*

  execution of environment-related plant inspections (environmental inspections) in compliance with the EU recommendation 2001/331/EC on providing for minimum criteria for environmental inspections in the member states, inspection of equipment plants in the context of the expert witness service.

- **Specialised Division 19A -** ***Wasserwirtschaftliche Planung und Siedlungswasserwirtschaft*** *(Water Management Planning in Household Water Management)*

  Points of interaction between water management and waste management mainly apply for generation and treatment of sewage sludge and with regard to potential effects of waste treatment for surface and ground water.

- **Specialised Division 19D -** ***Abfall- und Stoffflusswirtschaft*** *(Waste and Material Flow Management)*

  official expert witness service in the field of waste management (waste management expert witnesses, ASV) in plant-related corporate procedures and for inspections, planning activities (Provincial Waste Management Plan), funding matters, information and training activities, measures to create public awareness to support sustainable development towards material flow management, supervision of municipalities and regions.

- ***Baubezirksleitungen*** (*District Administration Offices For Construction)*

They assist the district administration and the Specialised Divisions in the implementation of the assigned tasks (official expert service, etc.)

- ***Landesabfallbeauftragte für die Dienststellen des Landes Steiermark – Provincial waste officers for the agencies of the Province of Styria***

  The responsibilities of the waste consultants are defined in the AWG 2002[86]. For all agencies of the Province of Styria (such as administrative offices, schools, senior citizen homes etc.) the following tasks are currently being assumed by a member of FA19D and a member of Division 2 (deputy):

  - preparing and updating a waste management concept for the agencies of the Province of Styria
  - monitoring if waste management-related regulations are respected and signalling of detected deficiencies to the head of the specialised division and other responsible persons
  - supporting the individual agencies in the organisation of legally conforming collection and disposal of waste
  - organising and performing the training of employees responsible for waste-related matters in the respective agencies
  - coordinating the acquisition of waste collection containers, separation systems, etc. in collaboration with the agencies responsible for purchasing management
  - giving advice on ecological purchasing of office furniture and office materials as well as cleaning agents etc. (CHECK IT project)

2.3.2 The waste management associations

17 waste management associations (*AWVs*) (www.awv.steiermark.at) are responsible for the following tasks all over Styria[87]:

- supporting the municipalities in waste management-related problems
- giving sustainable advice in environment and waste-related matters
- planning waste management within the associations: for this purpose, regional waste management plans are established which are oriented towards the L-AWPL-Stmk.
- recovery and disposal of municipal waste

The waste management organisations are associations of municipalities, their organizational structures are laid down in StAWG 2004[88] and in the Styrian *Gemeindeverbandsorganisationsgesetz* (Law on the organisation of associations of municipalities). One association generally consists of the municipalities of one political district. The City of Graz independently performs the tasks of a waste

[86] Art 11 AWG 2002.

[87] Art 6, 14 15 StAWG 2004.

[88] Art 14 StAWG 2004.

management association. Moreover, the municipalities Radmer and Hieflau, which are part of the political district Leoben, and the municipality Hohentauern (political district Judenburg), joined the waste management association Liezen. The municipality Niederöblarn (political district Liezen) joined the waste management association Schladming, and the two political districts Mürzzuschlag and Bruck form the "Waste management association Mürzverband". The geographic areas of responsibility of the Styrian waste management associations are illustrated in Figure 3.

The municipalities within one waste management association are represented in the respective association meeting, and the members of the association meeting elect the Executive Board.

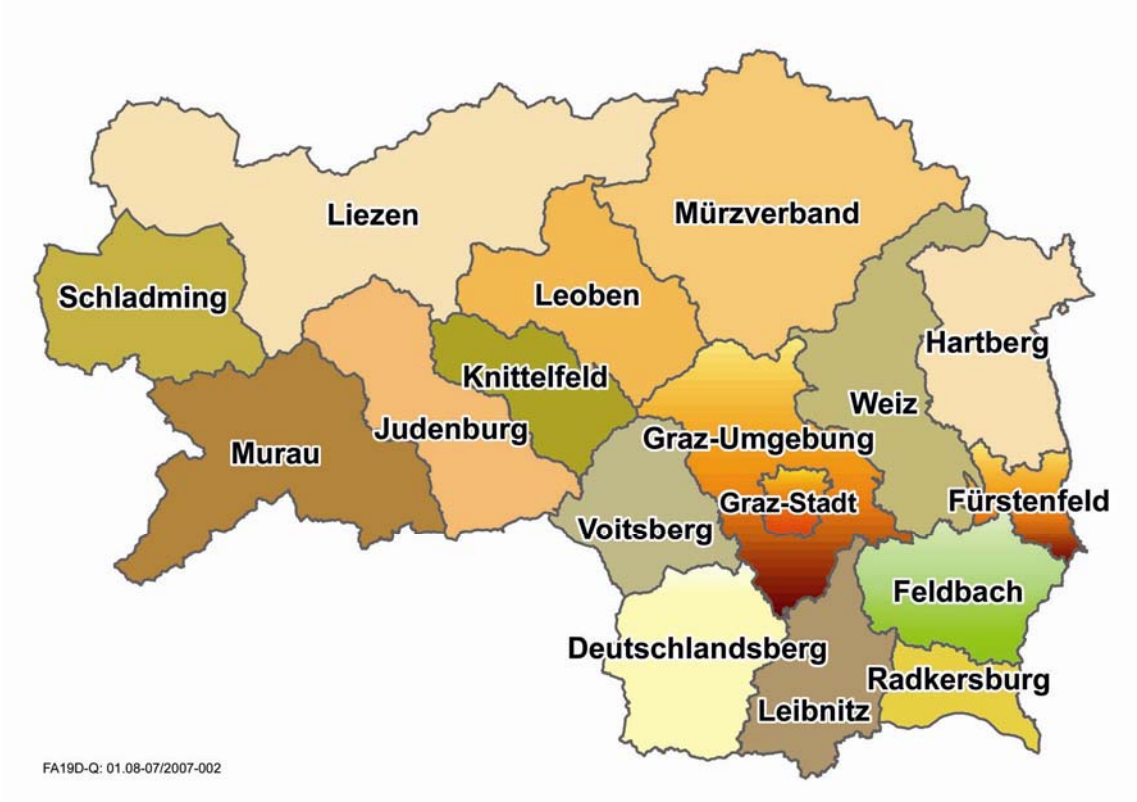

Figure 3: The 17 Styrian waste management associations

To perform the defined counselling activities, the waste management associations employ qualified environment and waste consultants who are organised in the Union of Styrian Environment and Waste Consultants (*Verein der Steirischen Abfall- und UmweltberaterInnen, VStAB*).

At present, 39 environment and waste consultants support the work of the Styrian waste management associations, partly supported by the managers of the waste management associations and by consultants employed by municipalities. Their main task is to support the municipalities in the separate collection of waste materials and in public relations activities for qualitative and quantitative waste prevention. They are the first regional contacts for citizens, educational institutions, companies and other institutions in all questions related to the collection, treatment and disposal of waste as well as general environmental issues. Moreover, they are partners in the implementation of a series of projects in the field of sustainable waste and material flow management (e.g. *G'scheit Feiern* initiative, sustainable school trips, Green Procurement Styria, *S.P.A.S.S. Box – Schul.Paket.Abfall.Spiele.Sammlung*).

In 1999, the waste management associations founded their umbrella association (www.awv.steiermark.at) as a voluntary cooperation, which has had the legal status of a voluntary association (*Verein*) since 1 January 2005. All 17 Styrian waste management associations are members of the umbrella association which acts as a bridge between the Province of Styria and the waste management associations. As a communication and information platform it represents the interests of the Styrian waste management associations at the provincial, federal and European level, but also towards the private disposal industry. Moreover, it acts in close collaboration with FA 19D to implement joint targets.

2.3.3 The municipalities

The primary waste management-related task of the municipalities is the collection and transport of municipal waste generated in the municipal area by public removal. The municipality defines the organisation of public removal in the waste removal order. Public removal can be organised as pick-up collection system for specific waste types (e.g. waste materials) or as bring-it-yourself system by operation of waste material collection centres (*Altstoffsammelzentrum, ASZ*) and stationary collection cells for problematic substances (*Problemstoffsammelstelle, PSS*). As at 1 January 2009, **383 waste material collection centres** were available in Styria for the collection of municipal waste (waste materials), packagings and other waste types.

The following concrete obligations for municipalities can be drawn from the AWG 2002 and the StAWG 2004:

- collecting and removing non-hazardous municipal waste[89]. For this purpose, a public removal service has to be introduced which must be performed in regular intervals.[90]
- organising and performing a bulky waste collection or a controlled transfer of bulky waste by operating a waste material collection centre
- providing suitable waste collection containers as well as holding responsibility for their cleaning and maintenance[91]
- performing or initiating upon requirement, but at least twice a year, a separate collection (possibility for disposal) of problematic substances if the municipality does not provide other means for their collection[92]. This obligation within the municipal collection of problematic substances ("controlled transfer") includes waste cooking oils and fats, notwithstanding the fact that they are not classified as problematic substances[93].
- implementing a removal order defining removal area, type and frequency of public removal with regard to municipal waste[94]; type and frequency of problematic substance collection, determining access to public collection centres, type of collection containers or

[89] Art 4 para 4 StAWG 2004.

[90] Art 7 StAWG 2004.

[91] Art 9 StAWG 2004.

[92] Art 28 AWG 2002.

[93] Art 16 AWG 2002.

[94] Art 11 StAWG 2004.

collection bags used, type of tariffs and fees, basic principles of the organisation of tariffs related to individual waste fractions and the treatment plants used for the recovery and disposal of municipal waste.

- establishing a collection centre for waste electrical and electronic equipment from private households[95]

In 16 of the 542 Styrian municipalities, the collection of mixed municipal waste (residual waste) is performed by communal enterprises or so-called private-public-partnership-models (PPP)[96] (Figure 4).

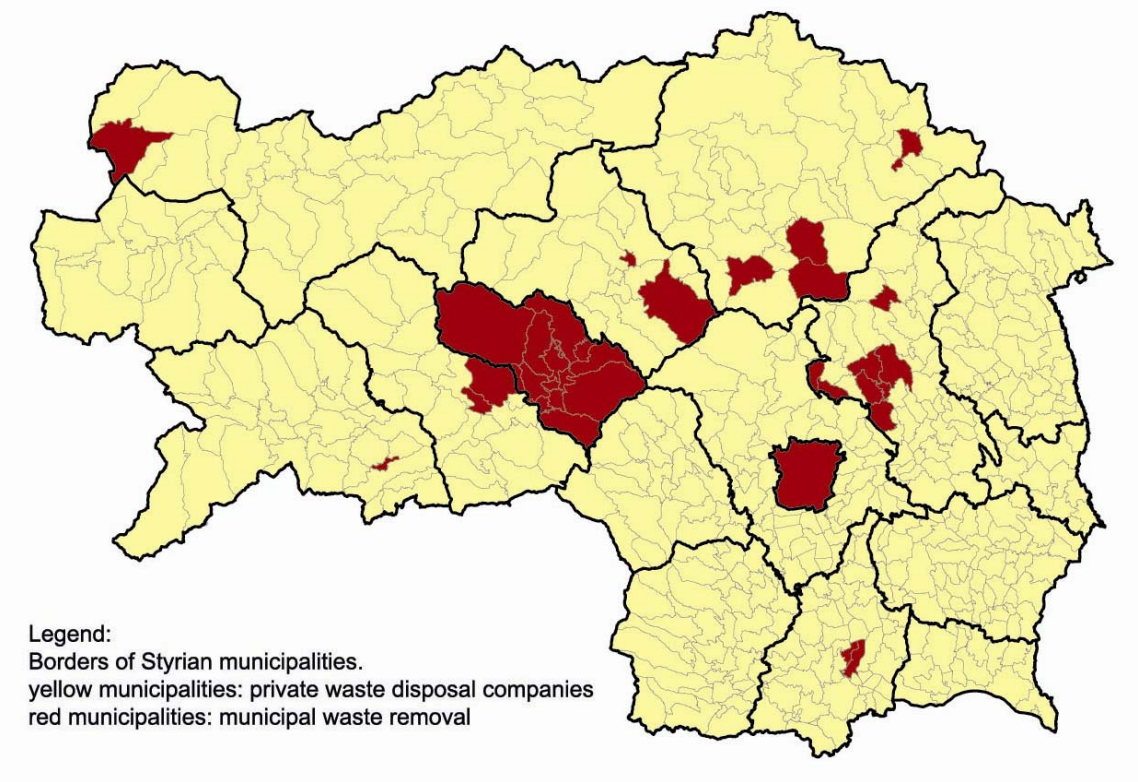

Figure 4: Waste collection in Styrian municipalities by private waste disposal companies (yellow) and municipality-owned waste removal companies (red) (Source: umbrella organisation of Styrian waste management associations)

For public procurements, municipalities are subject to the regulations defined in the Federal Law on Public Procurement 2006[97]. In May 2006, the handbook ***Vergaberecht im Bereich der Abfallwirtschaft – Procurement legislation in the field of waste management*** was published in collaboration with FA1F (*Verfassungsdienst und Zentrale Rechtsdienste*) as volume 15 of the publication series of FA19D, providing detailed answers to practical questions regarding the awarding of contracts for waste disposal services. The brochure (Figure 5) can be downloaded via the waste management information system (*abfallwirtschaftliches Informationssystem, AWIS*) at www.abfallwirtschaft.steiermark.at > Publikationen.

[95] Art 28a AWG 2002.

[96] see also Chapter 2.3.5.

[97] Federal Law on Public Procurement (*BVergG* 2006), Federal Law Gazette I No. 17/2006, Federal Law Gazette II No. 125/2009.

Figure 5: *Vergaberecht im Bereich der Abfallwirtschaft*, volume 15 of the publication series issued by FA19D

The umbrella association of Styrian waste management associations and the Technical Unit Waste and Waste Water Management within the regional Economic Chamber of Styria prepared a draft for waste management-related calls for tenders (available for download via www.abfallwirtschaft.steiermark.at > Grundlagen > rechtliche Vorschriften). Taking into account free and fair competition, this draft provides practically oriented help for calls for tenders and legally conforming contract award procedures for waste disposal-related services. In the sense of sustainable waste management, application of the **"best tenderer principle"** is recommended, whereby specific award criteria (such as ecological evaluation of transport routes, emissions of transport vehicles) must be defined. Awarding contracts purely according to cost-related aspects (**"cheapest tenderer principle"**) cannot be considered satisfactory in view of the goals of sustainable waste management.

Regulation (EC) No. 1177/2009[98] of the European Commission introduced reduced thresholds for the procedures for the award of public contracts, which will replace the previously applicable thresholds defined in the Federal Law on Public Procurement 2006 as of 1 January 2010. If the estimated contract value exceeds this threshold, a Europe-wide call for tenders is required.

2.3.3.1 The communal collection infrastructure - waste material collection centres

In Styria, the infrastructure for the separate collection of waste has been systematically improved and extended. As at February 2009, a total of 383 waste material collection centres (ASZ) with joint collection cells for problematic substances were operated in Styria. Additionally, stationary collection cells for problematic substances are available in 44 Styrian municipalities (Figure 6).

[98] Commission Regulation (EC) No 1177/2009 of 30 November 2009 amending Directives 2004/17/EC, 2004/18/EC and 2009/81/EC of the European Parliament and of the Council in respect of their application thresholds for the procedures for the award of contracts.

The Province of Styria has financially supported the municipalities within the last 15 years, granting subventions amounting to a total of **21.2 million Euro** for the improvement of collection infrastructures. This triggered an investment volume of **43 million Euro**. On average, the waste material collection centres accept 40 different waste types (separate collection), which are to a large part recovered. The specific disposal costs for waste which is recovered via the ASZ amount to a mean value of 125 Euro per tonne and are therefore significantly below the costs for the treatment of residual waste.

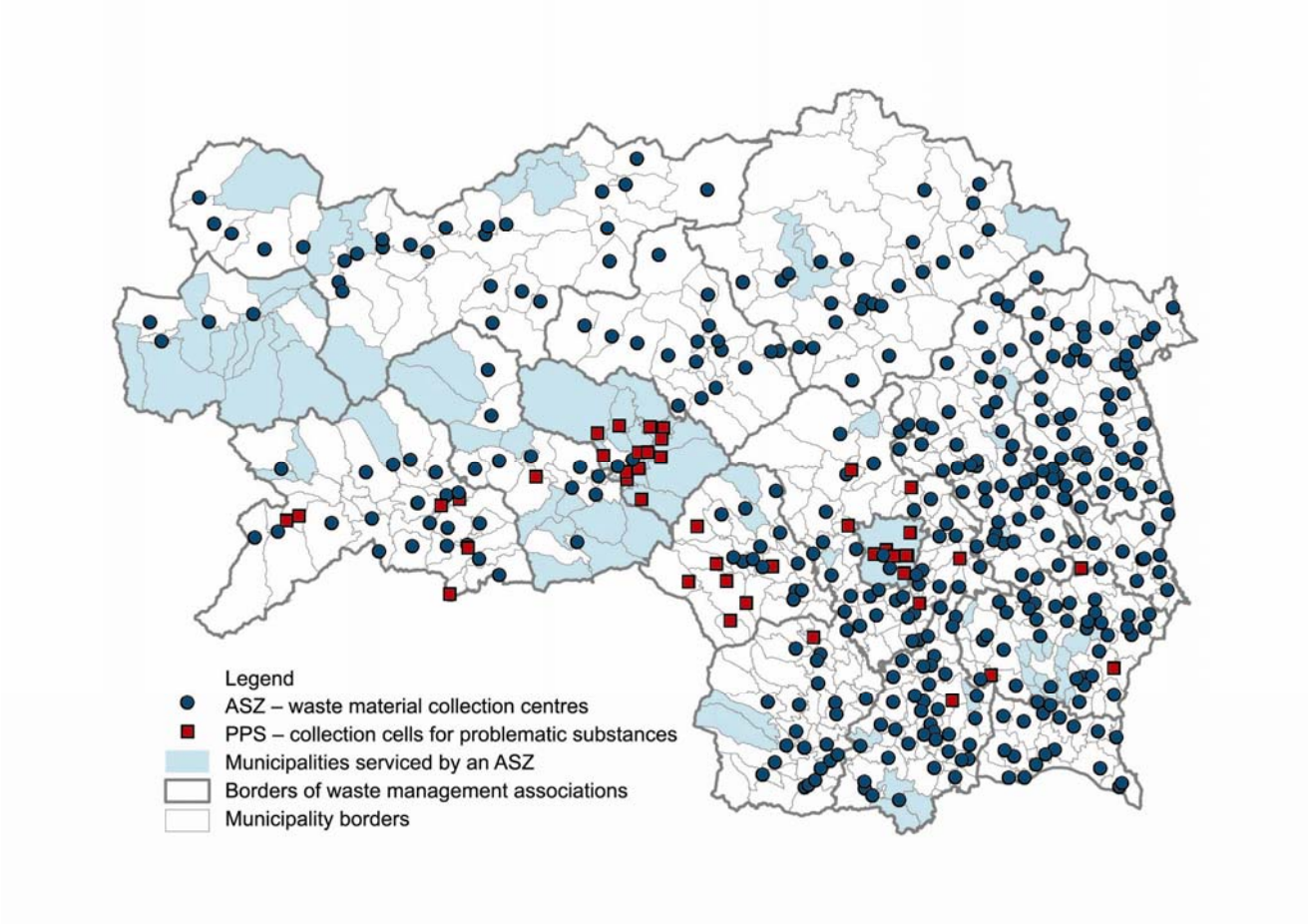

Figure 6: Waste material collection centres (*Altstoffsammelzentrum, ASZ*) and collection cells for problematic substances *(Problemstoffsammelstellen, PSS)* in Styrian municipalities

In recent years, increased interest was accorded to the operation of ASZ in the context of community cooperations. Of the overall 383 Styrian ASZ, 30 are currently operated as **community cooperation**, involving **a total of 108 municipalities**. The forms of cooperation vary from small units with at least two communities to units with more than 10 affiliated municipalities (e.g. ASZ Spielberg-Pausendorf with 14 municipalities, ASZ Gnas with 11 municipalities). In general, the larger cooperations have longer opening hours and are therefore well accepted among the population. The **maximum catchment area** of the joint ASZ varies between **3 and 25 km**, the **opening hours** range from **36 to 2,070 hours per year**, and the total specific waste quantity collected in ASZ amounts to between **20 and 69 kg/inhab/year.** The representative evaluation of the results collected for 80 municipalities

presented in the pilot project *Steirischer Abfallspiegel 2009*[99] shows that the **ASZ opening hours** are between 0.8 and 10.4 hours per week (**median[100]: 2.0 hours per week**), whereby the ASZ is usually open for several hours on 1 or 2 days per month. The mean service input of the ASZ staff is approx. 10 minutes per inhab/year. The **frequentation** lies between 3.6 and 25.4 disposals per hour (**median: 11.4 disposals per hour**). The throughput numbers range from 447 kg to 6,588 kg per hour (median: 1,756 kg/h), the **specific throughput numbers** from 49 to 239 kg/inhab/year (**median: 98 kg/inhab/year**).

Due to the requirements defined in federal legislation, municipalities have to take back waste electrical and electronic equipment (*EAG-VO*), batteries (*Batterien VO*), packagings (*VerpackVO* 1996), waste cooking oils and fats as well as problematic substances (AWG 2002) from the households. With regard to the reimbursement of infrastructure fees, Styria disposes of 24 fully equipped and 328 partly equipped WEEE collection centres (as at 31 December 2008, Figure 7 and Figure 8).[101]

COLLECTION CENTRE, FULLY EQUIPPED			
Category	**Required containers**	**Space requirements**	**Cost financing: pick-up coordination via coordination agency**
Large electrical and electronic appliances	2 mobile containers 12 m² or 1 mobile containers 24 m²	35 m²	€ 710,47
Refrigeration equipment	1 Wechselcontainer 24 m²	35 m²	€ 711,60
Screen appliances	6 grid boxes, approx 3 m³ and 7 Euro pallets	66 m²	€ 823,41
Small electrical and electronic appliances	3 grid boxes	18 m²	€ 422,07
Gas discharge lamps	5 post pallets	30 m²	€ 433,51
Waste equipment batteries	3 containers 120 liter barrel with lid, with locking ring; or 2 containers 220 liter barrel with lid, with locking ring	3 m²	€ 105,91

Figure 7: Requirements of fully equipped WEEE collection centres

[99] INFA Institut für Abfall, Abwasser und Infrastruktur-Management GmbH: Steirischer Abfallspiegel 2009. Abfallwirtschaftlicher Strukturvergleich steirischer Gemeinden. Amt der Steiermärkischen Landesregierung – FA19D (Hsg.), Graz, 2009.

[100] The median is the central value of a data distribution and is useful in cases where the distribution has very large extreme values, which would otherwise skew the data. The median is calculated by arranging the values in ascending order. If the total number of values in the sample is uneven, the median is the middle number, if the total number of values in the sample is uneven, the median is the mean of the two middle numbers.

[101] Data from: EDM of the *BMLFUW*, 31.12.2009.

COLLECTION CENTRE, PARTLY EQUIPPED			
Category	**Required containers**	**Space requirements**	**Cost financing: pick-up coordination via coordination agency**
Large electrical and electronic appliances	2 Euro pallets	12 m²	€ 157,46
Refrigeration equipment	2 Euro paletts	12 m²	€ 157,46
Screen appliances	2 grid boxes	12 m²	€ 311,62
Small electrical and electronic appliances	1 grid box	6 m²	€ 180,11
Gas discharge lamps	1 post pallet	6 m²	€ 172,56
Waste equipment batteries	1 container 120 liters barrel with lid, with locking ring	2m²	€ 67,53

Figure 8: Requirements for partly equipped WEEE collection centres

To optimise the ASZ management in Styria at all levels and to determine uniform safety-related ASZ standards, an ASZ consortium was established in which the Styrian waste management associations and FA19D are represented. Meanwhile, the efforts of this ASZ consortium resulted in the creation of uniform ASZ signposts (Figure 9) and a uniform definition of collection fractions all over Styria.

Figure 9: Examples for the new uniform ASZ signposts

To make use of the optimisation potentials regarding the operation of waste material collection centres, an *ASZ Handbuch (ASZ Handbook)* was prepared in collaboration between FA19D and the umbrella organisation of the Styrian waste management associations. It will be presented to the municipalities within the year 2010. In the face of the implementation of the new waste hierarchy pursuant to the EU Waste Framework Directive, the ASZ consortium and handbook will also provide information on the collection, treatment and transfer of recoverable waste, basing on the handbook

Re-Use Leitfaden EAG - Re-Use Guidelines WEEE of the *BMLFUW*[102] and other related manuals which are currently still in preparation. Communal services are not only vital for their communal socio-economic employment potential but will in particular help meet the future challenges in the field of WEEE recovery and maintenance.

2.3.3.2 Regional cooperations of muncipalities (RegioNext)

RegioNext (www.regionext.steiermark.at) is a comprehensive initiative of the Province of Styria to strengthen regional areas. RegioNext defines increased regional independence as a main target for future regional development and aims to establish a framework for cooperation between individual communities by creating around 80 small regions (*Kleinregionen*).

The increased cost pressure among public households, the raising complexity of planning and development tasks, the augmenting connection of intra- and international relations with reported globalisation trends and demographic development as indicated by the latest estimates show that actions need to be taken. Municipalities reach the limits of their financial and personal performance capacities. **Intercommunal collaborations are appropriate organisation forms** to manage the complex tasks mentioned above.

These ***development concepts at small regional levels (kleinregionale Entwicklungskonzepte, KEK)*** aim at defining the communal tasks which the integrated municipalities shall perform together. Synergic effects increasing the communal performances, relieving the budgets of the individual municipalities and extending the scope of action of joint projects are expected. For instance, the **Quick Check *"Klima und Umwelt - Climate and Environment"*** for the small regional level is planned to be implemented as one part of the comprehensive concept within the *KEK* development. Thereby the following fields of action will be analysed:

- strategic development of municipalities
- community buildings/plants
- energy and heating
- water/waste water
- waste
- mobility
- actors of implementation at the small regional level
- public relations

Beside the small regional level, aiming to initiate an increased number of cooporations among municipalities, the RegioNext process also focuses on the regional level. Based on decisions of the regional planning advisory board, Styria has been divided into the following seven regions:

- Liezen (political district Liezen)

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[102] ReUse Plattform des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft: Leitfaden für die Wiederverwendung von Elektroaltgeräten in Österreich. KERP Kompetenzzentrum Elektronik & Umwelt im Auftrag des BMLFUW, Vienna, 2009; http://www.kerp.at.

- Obersteiermark Ost (political districts Bruck an der Mur, Leoben and Mürzzuschlag)
- Obersteiermark West (political districts Judenburg, Knittelfeld and Murau)
- Oststeiermark (political districts Weiz, Hartberg and Fürstenfeld)
- Südoststeiermark (political districts Feldbach and Radkersburg)
- Südweststeiermark (political districts Leibnitz and Deutschlandsberg)
- Steirischer Zentralraum (City of Graz and political districts Voitsberg and Graz-Umgebung)

Each region focuses on the development of regional political projects and targets. For this purpose, regional mission statements are elaborated, containing the common strategic orientation with regional guidelines.

2.3.4 The private waste disposal industry

The **Technical Unit 701 "Waste and Waste Water Management"** (www.wko.at/stmk), established in 2000 within the **Austrian Federal Economic Chamber (*WKÖ*)**, registers 400 members from waste industry companies, employing approximately 3,000 persons in the fields of traditional waste management, waste water treatment, recovery of parts of end-of-life vehicles and street cleaning. With an annual turnover of 500 million Euro (30% of which are contributed by regional small-sized enterprises) and a total investment volume of 150 million Euro in innovative technologies, the Styrian waste disposal industry is one of the most important economic factors in Styria.

The vast majority of Styrian municipalities meet the obligation of providing public waste removal services insofar as this task has been transferred to authorised private waste disposal companies[103]. Likewise, waste management associations use the services of authorised private disposal companies to varying degrees to meet their responsibilities with regard to treatment of municipal waste (recovery and disposal)[104].

Since 1982, the private disposal companies have been organised in the independent interest representation *Association of Austrian Waste Disposal Companies* (*Verband Österreichischer Entsorgungsbetriebe, VÖEB*). In 1999, the *VÖEB* and the ***Austrian Water and Waste Management Association (Österreichischer Wasser- und Abfallwirtschaftsverband, ÖWAV*, www.oewav.at)** founded the Voluntary Association for Awarding the Certificate of a ***Specialised Waste Disposal Company (V.EFB,*** **www.vefb.at**). The certificate of quality "EFB" (*Entsorgungsfachbetrieb)* is awarded to make reliability of the waste disposal service, comprehensive technical training of staff as well as guaranteed respect of all relevant legal regulations visible to the clients. The number of Styrian *EFB* has increased from 14 (2005) to 29 (2009) and comprises approx. 10% of the members of the Technical Unit Waste Management.

The comprehensive collection and recovery system for all packaging wastes in Austria is performed by the ***Altstoff Recycling Austria AG* (*Waste Material Recycling Austria, ARA*, www.ara.at)**. On initiative of the Austrian economy ARA was founded in 1993 as non-profit organisation and was

[103] Art 7 para 5 StAWG 2004.

[104] Art 14 para 6 StAWG 2004.

restructured in 2008 within the integration of the hitherto independent sectoral recycling companies (*Branchenrecyclinggesellschaften, BRGs*). An amendment of the Austrian Packaging Ordinance is being prepared, following the call for competition regarding dispensation from obligations and operative implementation of measures for collection and recovery of household-related packaging waste.

2.3.5 Private Public Partnership (PPP)

PPP is the term for partnerships between the public authorities and private third parties. Unlike full privatisation, PPP models do not include complete transfer of public responsibilities (including transfer of ownership) to private parties. PPP cooperation models aim at collaborating with private parties if specific tasks are more likely to be solved together than alone. PPP can also be an alternative solution for shortages in fulfilling public services.

PPP models differ according to their distribution of responsibilities, the degree to which private partners take an operational risk and the remaining possibilities for public authorities to control processes. The municipalities Graz, Hartberg, Kapfenberg, Voitsberg, Köflach, Bärnbach, Rosental, Maria Lankowitz and Bad Gleichenberg run PPP cooperation forms. In each case, the community and a private waste disposal company formed a company taking over the tasks of communal waste disposal services.

Various PPP cooperation forms are currently discussed for the construction and operation of waste material collection centres. Questions and details to be taken into account when preparing a PPP contract include in particular the transfer of ownership, the risk of revenues for waste materials depending on raw material prices, price indices, considerations pertaining to the Federal Procurement Act, employment status of staff, etc. In collaboration with the *Infora Consulting Group GmbH (ICG)*, the Styrian Union of Municipalities and the Styrian waste management associations, FA19D prepared a ***practical guide on cooperation forms of waste material collection centres*** (Figure 10), which was published in 2009 as volume 16 of the publication series of FA19D (www.abfallwirtschaft.steiermark.at > Publikationen).

Figure 10: *Praxisleitfaden zu Kooperationsformen von Altstoffsammelzentren* (ASZ), publication series issued by FA19D, volume 16

2.3.6 Agriculture

Agriculture and forestry play central roles in the treatment of biogenic waste, sewage sludge, fermentation residues from biogas plants and plant ashes from biomass combustion plants in Styria. **63 composting facilities** associated with an agricultural or forestry enterprise and authorised according to the AWG 2002 were operated in 2009. The same association with agricultural or forestry enterprises applies for the operation of **15 biogas plants** in Styria.

Since Styria was successful in implementing a **decentralised treatment of separately collected biogenic household waste,** in particular in composting plants, the required **transport ways can be reduced to a minimum** and the regional added value is strengthened by the production of compost.

Beyond household waste, other materials are also applied for direct agricultural recovery: approx. **300,000 m^3 of fermentation residues from biogas plants, approx. 114,000 m^3 of sewage sludge** (quantity indicated as wet sludge and assuming approx. 5% of dry matter (DM) without compostable sewage sludge), **plant ashes from biomass heating plants** and other waste and residual materials derived from agricultural products (e.g. residues from processing or pressing procedures, etc.) are applied as manure to agricultural (and in the case of plant ashes also forestry) surfaces. The substitution of mineral fertilisers by material recovery of adequate waste is an important contribution to a functioning closed-loop system, but also to a sustainable use of resources.

While the Compost Ordinance[105] provides the legal framework for composting and the Styrian Soil Conversation Act[106] as well as the Styrian Sewage Sludge Ordinance 2007[107] determine regulations for the application of sewage sludge, the recovery of further waste types on soils is only regulated by a legal requirement according to AWG 2002: By "application to the soil **for the benefits of agriculture and ecology"**[108] the waste is materially recovered. Despite numerous expert recommendations for state-of-the-art technologies, the legitimacy of applying these wastes must be determined individually.

The **Styrian Provincial Chamber of Agriculture and Forestry (www.lk-stmk.at)** is the legal representation of the agricultural and forestry enterprises. As to waste treatment in composting and biogas plants, the ***ARGE Kompost & Biogas*** *(Consortium for Composting and Biogas*, www.kompost-biogas.info) represents the interests of operators and contributes to the implementation of quality assurance programmes in collaboration with public administration.

2.3.7 Other partners in implementation

Waste management associations and municipalities are responsible for the implementation of sustainable strategies for waste and material flow management in the field of household waste, involving private waste disposal companies as well as agriculture as actors regarding the collection and treatment of household waste. Moreover, various NGOs, initiatives and institutions help

[105] see Chapter 2.2.2.3

[106] see Chapter 2.2.3.2

[107] see Chapter 2.2.3.2

[108] Recovery procedure R 10 according to Annex 2 AWG 2002

implementing measures for sustainable waste and material flow management as cooperation partners at the provincial level.

- ***ARGE Abfallvermeidung*** (*Consortium Waste Prevention*, www.arge.at - organised as benevolent voluntary association, founded in 1982) is responsible for the training of most Styrian environment and waste consultants and supports pilot projects in the fields of waste prevention, PR and community waste management. Currently, they focus on the promotion of reusable packagings in Austria (www.mehrweg.at). The consortium develops new environment-related business fields, in particular for socio-economic companies (e.g. the non-profit company *ÖKO Service GmbH* in Graz). Within EU projects, the ***Repair network Austria*** (*Reparaturnetzwerk Österreich*) was initiated, which was e.g. the beginning of the Repair network Liezen and the organisation RepaNet. Based on the waste hierarchy of the new EU Waste Framework Directive[109] the consortium develops and implements projects in the fields of waste prevention and preparation for recovery.
- The Federal Ministry for Agriculture, Forestry, Environment and Water Management (*BMLFUW*) is also referred to as ***Lebensministerium*** *("Ministry of Life"*, www.lebensministerium.at). The Federal Minister for Agriculture, Forestry, Environment and Water Management is the last instance regarding the execution of the AWG 2002 and the regulations derived from it. **Department VI Material Flow Management, Environmental Engineering and Waste Management** is the contact for FA19D for all questions related to waste and material flow management, and **Division II/3 Sustainable development and environmental subsidization policy** for the fields of sustainable development and sustainability coordination.
- The **Coordination Office for Waste Electrical and Electronical Equipment** Austria GmbH (*EAK Austria*, www.eak-austria.at) has been responsible since July 2005 per notification of the *BMLFUW* for specific tasks defined in the AWG 2002 and the *EAG-VO*. Since the Battery Ordinance has come into effect in September 2008, the *EAK* is also responsible for waste device batteries.

  In particular, the *EAK's* responsibilities include PR, coordinating removal activities, covering the infrastructure flat rates and reporting to the *BMLFUW* and the European Commission.
- **ECO WORLD STYRIA** *Umwelttechnik-Netzwerkbetriebs GmbH (Environmental Technology Network Operations Ltd*, www.eco.at) is a vital collaboration partner for FA19D. Technology companies with key importance for Styrian waste management are members of this network, some of which are international leaders in the fields of biomass, solar energy and waste/waste water. ECO WORLD STYRIA supports Styrian companies with innovative impulses when it comes to the opening of new markets and international marketing strategies. Moreover the network assumes operative tasks in the framework of the *Business Initiative Sustainability (Wirtschaftsinitiative Nachhaltigkeit, WIN*).
- The ***Styrian Internationalization Centre*** (*ICS*, www.ic-steiermark.eu) was founded in 2005 by the Chamber of Commerce of Styria, the Federal Province of Styria/Styrian Business Promotion Agency and the Industrialist's Association to establish Styrian companies worldwide and to facilitate their market entry into new target markets. The export orientation of Styrian

[109] see Chapter 2.2.1.12

companies as suppliers of solutions for disposal and technology in the field of waste management frequently requires participation of FA19D to present the disposal and technology competences in the field of waste and material flow management.

- The ***International Solid Waste Association (ISWA)*** (www.iswa.org) plays a key role in the global development and implementation of technologies and measures for sustainable waste management. Since 1 January 2009 the ISWA, a worldwide association of waste management experts, has been based in Vienna and counts more than 1,200 members in 83 states. The national member organisation is **ISWA Austria** (www.iswa.at).
- The ***LandesEnergieVerein Steiermark*** (*LEV*, "*Provincial Energy Agency*", www.lev.at) was founded in 1981, with the task to support local renewable sources of energy as well as measures for energy savings and to develop corresponding projects. Every year, the *Network Eco-Energy Styria*, *LEV* and the *Styrian Business Initiative Sustainability* award the sustainability award "*Energy Globe STYRIA AWARD*" (a regional counterpart of the (inter)national Energy Globe Award) to projects and initiatives related to the topics energy supply and efficient use of resources (energy, water, waste water, waste) as well as clean air, air quality, climate protection and CO_2 reduction and finally to good practice youth projects related to sustainability.
- ***Landentwicklung Steiermark*** ("*Rural Development Styria*", www.landentwicklung.com) is the follow-up project of *Ökologischen Landentwicklung* ("*Ecological Rural Development*") and is responsible for the execution of the Local Agenda 21 processes in Styria. Agenda 21 has proved to be an efficient model for the creation of awareness and participation of citizens. Additonally, *Landentwicklung Steiermark* supports the implemenation of the RegioNext projects in Styrian municipalities.
- The ***Network Eco-Energy Styria*** (*Netzwerk Ökoenergie Steiermark*, *NOEST*, www.noest.or.at) was founded in 2002 by the Province of Styria as part of Specialised Division 17A for Energy. It works in close collaboration with the Provincial Energy Agency. It is the one-stop-shop and knowledge hub for all energy innovations in the field of renewable energy sources and energy efficiency in Styria. In collaboration with *ECO World Styria*, the *NÖST-ECO-WIN* newsletter on energy and environment technologies is distributed 12 times a year to 6,000 readers.
- ***Ökoprofit®Graz*** (www.oekoprofit.at) is a programme of the City of Graz for corporate environment protection, aiming to reduce the corporate costs by reducing corporate emissions and protecting natural resources (benefits for environment and economy). It is operated as cooperation project between regional businesses, administration and external experts (Private Public Partnership).
- The ***Austrian Association for Recycling of Demolition and Construction Waste*** *(Österreichische Baustoffrecyclingverband*, *BRV*, www.brv.or.at) was founded in 1990. It is a voluntary union of recycling companies and represents the interests of the demolition and construction waste recycling industry. Together with FA19D the *BRV* runs the **internet platform *Recyclingbörse Bau*** (*Recycling Platform Construction*, www.recycling.or.at).
- At the national level, the ***Austrian Water and Waste Management Association*** (*ÖWAV*, www.oewav.at) is an independent platform of highly qualified experts, seeking a balance of interests among the Austrian water, waste water and waste management industry. In numerous working groups and consortia, the *ÖWAV* prepares technical guidelines and

statements to legal drafts and enables the exchange of experiences between decision makers from economy, administration and science.

- ***respACT*** (www.respact.at) is a platform for corporate social responsibility (CSR) and sustainable development in Austria, which was founded in October 2007 from a fusion of the two organisations *Austrian Business Council for Sustainable Development* (ABCSD) and *respACT Austria*. It supports Austrian companies to achieve ecological and social targets in an economical and independent manner. Via the Business Initiative Sustainability (*WIN*) there is cooperation with FA19D regarding the annual call, application, evaluation of submitted projects and organisation of the CSR Award Presentation (TRIGOS-gala).

- The **Styrian *Berg- und Naturwacht*** (www.bergundnaturwacht.at) was founded as public corporation with the goal to support municipalities and provincial authorities in monitoring provincial legislation related to environmental protection. The *Steiermärkisches Berg- und Naturwachtgesetz* 1977[110] defines specific targets and responsibilities for the cooperation's scope of action. Around 2,250 volunteers actively work as mountain and nature guards and enjoy the status of "official supervisory bodies".

  Waste management-related activities of the *Berg- und Naturwacht* include landscape cleaning with schools and NGOs (e.g. provincial "*Frühjahrsputz* – Spring-cleaning" initiative 2008, 2009, 2010) or the detection of environmental violations in the context of the initiative "*Saubere Steiermark - Clean Styria*". Since the *Saubere Steiermark* initiative has been launched in 1976, around 125,000 "forgotten" waste vehicles were correctly disposed of.

- ***Styrian Business Promotion Agency*** (*Steirische Wirtschaftsförderungsgesellschaft mbH*, *SFG* (www.sfg.at) was founded in 1991 and "outsourced" business promotion to date performed by the Province of Styria. *SFG* and the Regional Economic Chamber of Styria are partners of FA19D in matters of the *WIN* platform. Moreover, *SFG* is – together with FA19D and the City of Graz – proprietor of *Eco World Styria.*

- The ***Umwelt-Bildungs-Zentrum Steiermark*** (*Environment Training Centre Styria, UBZ,* www.ubz-stmk.at) was founded in 2001 on initiative of the Styrian Provincial Government and is a non-governmental, non-commercial, cultural and non-profit educational institution. Children and teenagers are encouraged to actively participate in building a liveable environment and future in the framework of environmental training. To reach this goal, playing and teaching materials for children, teenagers and teachers which allow for target-oriented presentation of information and the conception and execution of projects are prepared. In the field of waste and material flow management, seminars for teachers are offered, centering around topics such as the ecological footprint, ecolabel, separation of waste and waste management concepts for schools.

- **Federal Environment Agency** (www.umweltbundesamt.at) carries out research and collects data for preparing the Federal Waste Management Plan. To evaluate the current situation of

[110] Law of 7 June 1977 on Berg- und Naturwacht in Styria (Steiermärkisches Berg- und Naturwachtgesetz 1977), Provincial Law Gazette No. 49/1977 as amended in Provincial Law Gazette No. 69/2003.

Austrian waste management, FA19D provides data on Styrian waste management and collaborates with the Federal Environment Agency in EDM-related matters.

- The Styrian **universities**, **universities of applied sciences** and **non-university research institutions** are important partners for projects and questions to be addressed in the fields of waste and material flow management and sustainable development. Specific cooperations with FA19D are for instance: the Institute for Sustainable Waste Management and Technology and the Institute for Economic and Business Management at the **University of Leoben** (www.unileoben.ac.at), the Institute of Process and Particle Engineering, the Institute of Technology and Testing of Building Materials and the Institute of Industrial Management and Innovation Research at **Graz University of Technology** (www.tu-graz.ac.at), the Institute for Systems Science, Innovation & Sustainability Research at **University of Graz** (www.uni-graz.at), the Institute of Hygiene, Microbiology and Environmental Medicine at the **Medical University of Graz** and, on the non-university sector, the **Joanneum Research** (www.joanneum.at). Cooperations outside the Province of Styria are established at: the Institute for Water Quality, Resource and Waste Management at **Vienna University of Technology** (www.tu-wien.ac.at), the Institute of Waste Management at the University of Natural Resources and Life Sciences, Vienna (*BOKU*, www.boku.ac.at) as well as the Institute for Technology and Sustainable Product Management and the Research Institute for Managing Sustainability at the **Vienna University of Economics and Business** (www.wu.ac.at).
- The ***Voluntary Association for Awarding the Certificate of a Waste Disposal Company*** (*V.EFB*, *Verein zur Verleihung des Zertifikates eines Entsorgungsfachbetriebes*, www.vefb.at) was founded in 1999 from its two member associations ***ÖWAV*** and ***VÖEB***; since April 2002 ***ISWA* Austria** has been the third member of this association.
- The ***Association of Austrian Waste Disposal Companies*** (*VÖEB*, www.voeb.at) was founded in 1982 and is the independent representation of interest of the Austrian commercial disposal companies. It is organised as social partnership representation and specifically oriented towards the waste management industry.
- The ***Business Initiative Sustainability*** (*Wirtschaftsinitiative Nachhaltigkeit*, *WIN*, www.win.steiermark.at) constitutes a pool of more than 130 consultants, offering their expertise in the field of preventive environment and climate protection and sustainable business to small and medium-sized enterprises. It allows the SMEs to acquire external know-how for specific environmental issues.
- For specific programmes and projects, FA19D collaborates with independent planners **(civil engineers)** represented by the *Kammer der Architekten und Ingenieurskonsulenten für Steiermark und Kärnten* (*Chamber of Architects and Engineer consultants for Styria and Carinthia*, www.aikammer.org), with **engineering offices** and with **corporate consultants** represented by the Regional Economic Chamber of Styria (www.wko.at/stmk).

3 Generation, collection and treatment of waste

3.1 Definition of terms and collection of data

The data on waste production in Styria are based on the annual compilation of waste volumes which are collected by community services (public waste removal, waste material collection centres, problematic substance collection centres).

The following **waste types** are collected:

- wastes covered by the legislative and executive competence of the province, i.e. **non-hazardous municipal waste**[111]
- other wastes which have to be collected by municipalities and waste management associations according to federal legislation, i.e. problematic substances, waste electrical and electronic equipment and batteries
- wastes which must partly be accepted by municipal collection centres although they are not covered by the collection obligation for communities, such as packagings, demolition and construction waste, excavated soil, waste tyres, etc.

Municipal waste is defined as waste from private households and "other waste types which are similar to waste from private households due to their nature and composition".[112]

Non-hazardous municipal waste is divided into[113]

1. separately collected recoverable municipal waste (**"waste materials"** such as textiles, paper, metals, glass - without packaging waste).
2. separately collected **biogenic municipal waste** (compostable municipal waste, such as waste from kitchens, gardens, markets or cemeteries)
3. bulky municipal waste **("bulky waste"** that by nature can neither be collected in the provided collection containers nor by municipal waste collection)
4. municipal waste generated on public streets, squares and parks (**street sweepings** that are by nature subject to residual waste treatment)
5. mixed municipal waste (**"residual waste"**, i.e. all the non-hazardous municipal waste that cannot be assigned to numbers 1 to 4).

Problematic substances are **"hazardous wastes** which are usually generated in private households. Moreover, the definition 'problematic substances' includes hazardous waste from all other waste producers that is by nature and quantity comparable with hazardous waste usually generated in private households. In both cases, the waste is considered problematic as long as it is taken care of by waste producers."[114] (unofficial translation)

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[111] according to Art 10 para 1 N 12 *Bundes-Verfassungsgesetz*; for definitions see Chapter 3.1.1.

[112] Art 2 para 4 N 2 AWG 2002 and Art 4 para 4 StAWG 2004.

[113] Art 4 para 4 StAWG 2004.

[114] Art 2 para 4 N 4 AWG 2002.

According to the Packaging Ordinance 1996[115] **packagings** consisting of paper, plastic, glass, metals, etc. are "packaging materials, auxiliary packaging materials, pallets or products designed for the direct manufacture of packaging materials or auxiliary packaging materials. Packaging materials are products intended to cover or seal goods or products for the purposes of transport, storage, shipping or selling. Auxiliary packaging materials are products used for packing purposes together with packing materials, in particular for packaging, sealing, preparing for shipping and labelling of products or goods."[116] (unofficial translation)

Any packagings which are subject to the Packaging Ordinance and licensed accordingly are collected and recovered via the *ARA* (Waste Material Recycling Austria) system in cooperation with regional waste disposal industries, waste management associations and municipalities. Packagings are not classified as municipal waste and are therefore no waste materials. Since they are, however, taken over by municipalities and waste management associations and hence partly integrated into the same collection systems as waste materials, the present Provincial Waste Management Plan provides an overall evaluation of collection volumes and treatment methods for waste materials and packagings.

Table 1 provides an overview of the collected waste types.

[115] Order of the Federal Minister for Agriculture, Forestry, Environment and Water Management Verordnung on the prevention and recycling of packaging waste and certain waste goods and the installation of collection and recovery systems (*VerpackVO* 1996), Federal Law Gazette I No. 648/1996 as amended in Federal Law Gazette I No 364/2006.

[116] Art 2 para 1 *VerpackVO* 1996.

Fractions/waste types	
Mixed municipal waste (residual waste) **Street sweepings** **Bulky municipal waste (bulky waste)** **Biogenic municipal waste (organic waste)** ▪ separately collected organic waste (organic waste container) ▪ municipal garden and park waste ▪ cemetery waste **Recoverable municipal waste (waste materials)** ▪ non-ferrous metals ▪ metals/ferrous scrap (without vehicles) ▪ waste paper, paperboard, and cardboard ▪ flat glass ▪ glass ▪ waste wood ▪ clothes ▪ textiles ▪ cooking oils and fats ▪ plastic ▪ styro-foam **Demolition and construction waste** ▪ concrete waste ▪ construction waste ▪ excavated materials ▪ construction site waste ▪ demolition and construction waste **Municipal sewage sludge**	**Problematic substances** ▪ waste mineral oils ▪ problematic substances – not specified ▪ waste medicinal products ▪ equipment batteries ▪ car batteries **Packing waste** ▪ paper and cardboard packagings, printed forms ▪ lightweight fraction (packagings) ▪ metal packagings ▪ glass packagings **Waste electrical and electronic equipment** ▪ small appliances ▪ large appliances, excluding refrigeration equipment ▪ gas discharge lamps (fluorescent lamps) ▪ screen appliances, incl. cathode ray tubes ▪ refrigeration equipment **End-of-life vehicles (scrap vehicles)** **Other waste types** ▪ waste windows ▪ ash ▪ rakings ▪ silage films ▪ other waste – not specified ▪ bulky waste (recoverable) ▪ diapers ▪ waste tyres

Table 1: Waste types of community collections, terms according to Styrian Waste Investigation 2009

Data on the collection volumes are gathered by the municipalities in collaboration with the waste consultants of the relevant waste management associations and updated in the web-based database of FA19D ("*AEH-Online*"); they are also available at community level via the website *Abfallwirtschaftliches Informationssystem, AWIS* (*Waste management-related information system*)[117] run by the Province of Styria. The waste management associations and FA19D check the data for completeness and plausibility. The Provincial Waste Management Plan 2010 illustrates the municipal collection volumes in Styria from 1990 to 2008. Data on specific waste flows are collected within projects, summer traineeships, etc. Numbers related to the generation and treatment of municipal sewage sludge until 2007 are based on the annual data collections performed by FA19A.

To allow for comparisons of specific waste quantities (collection quantities) at the federal level, the terms for collected waste types according to the Federal Waste Management Plan 2006 were used (Appendix 9.5: Classification of waste).

For calculations of specific waste volumes in kilogramme per inhabitant and year (kg/inhab/year), the reported population numbers according to the census of the years 1981, 1991 and 2001 were taken as references, respectively. Due to the fact that censuses are no longer being performed in 10-year intervals since 2001, the population numbers as published by **Statistics Austria** (www.statistik.at,

[117] www.abfallwirtschaft.steiermark.at >> Zahlen, Daten & Fakten

"Average annual population numbers since 1981 by Federal Provinces") are taken as references for the calculations in accordance with the procedures applied by the Federal Environment Agency. This retrospective adjustment of the data basis implies changes in specific waste quantities since the year 2002 compared with earlier calculations on the specific waste volumes in Styria; the changes until 2001 are, however, negligibly small.

3.2 Total municipal waste volumes in Styria

3.2.1 Development of municipal waste volumes

In November 2009, the European Environment Agency (EEA) published data on the waste volumes generated in European municipalities. According to this report, the specific waste volume **amounted to 522 kg/inhab in the EU27 in 2007**, to **568 kg/inhab** in the **EU15+EFTA** (Iceland, Norway and Switzerland) **and to 597 kg/inhab in Austria**.[118]

In Austria, the volumes of "wastes generated in households and similar institutions" increased by almost 14% in the observed period (2003 to 2008) from 3,327,700 t[119] to 3,786,000 t.[120] This corresponds to a share of approx. 7%[120] of total primary waste volumes in Austria in 2008.

3.2.1.1 Volume trends of all wastes collected via community structures

In 2008, the total waste volume **collected via** community structures **in** Styria **amounted to 548,155 t (i.e. a specific quantity of** 455 **kg/inhab). This quantity is increased to 581,896 t if sewage sludge from community treatment plants is added (33,741 t of dry matter (DM) in 2007[121]). In comparison, the total volumes of collected waste in** 2003 **(reference year for the L-AWP 2005) amounted to** 454,348 t **(382 kg/inhab) and an additional 22,569 t of DM sewage sludge; in 1990 the total quantity of collected municipal waste amounted to** 311,179 t **(266 kg/inhab). illustrates the development of individual waste fractions in these years[122]; overviews with tables of waste volumes can be found in Appendices 9.6 and 9.7.**

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[118] European Environment Agency, www.eea.europa.eu

[119] Neubauer, C. & Walter, B.: Behandlung von gemischten Siedlungs- und Gewerbeabfällen in Österreich. Betrachtungszeitraum 2003-2007. Umweltbundesamt Report Rep-0225, Wien, 2008.

[120] Umweltbundesamt GmbH: Die Bestandsaufnahme der Abfallwirtschaft in Österreich. Statusbericht 2009. BMLFUW (Hsg.), 2010; URL: http://www.bundesabfallwirtschaftsplan.at.

[121] Annual data collection of FA19A on sewage sludge volumes since 1996; in 2008 the data collection was not performed due to IT changeovers.

[122] According to the systematics applied at the Austrian level, the fraction "Paper, packagings, printed forms" is fully added to packagings in the overview.

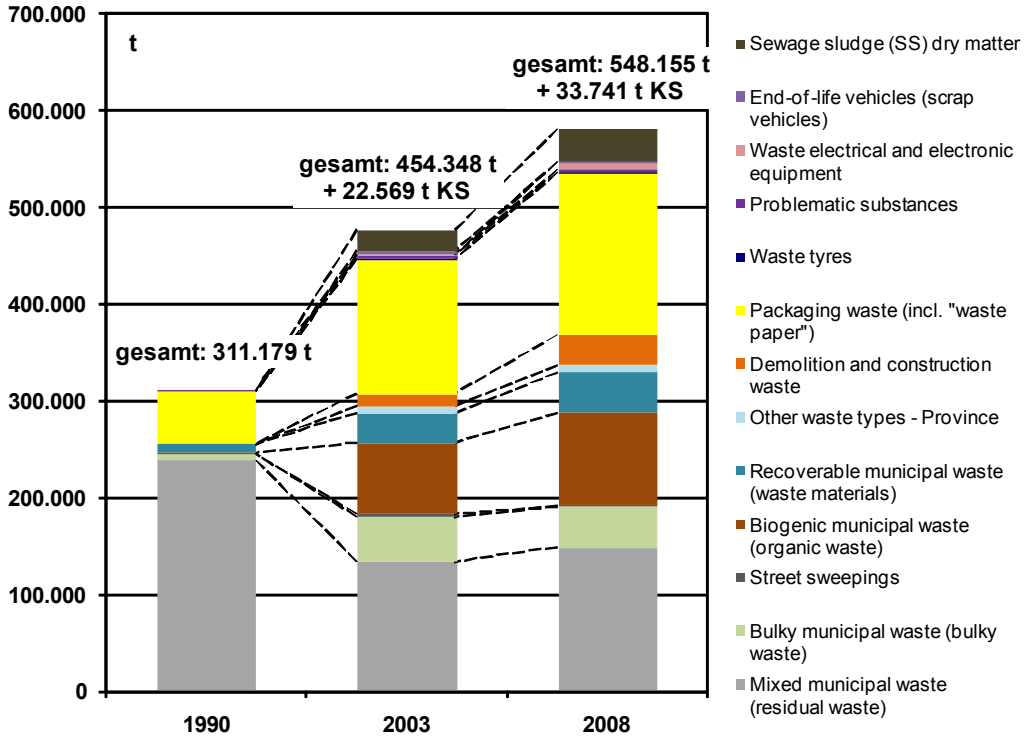

Figure 11: Total volumes of waste collected via municipal structures, years 1990, 2003 and 2008. For 1990 and 2008 data on sewage sludge volumes from municipal sewage treatment plants are not available; as at 2008 the 2007 sewage sludge (SS) volumes are indicated.

3.2.1.2 Municipal waste volumes

To allow for comparability of data at the national level, the **terms according to the Federal Waste Management Plan pertaining to municipal waste** are used in the following sections, not including the fractions waste tyres, ashes, waste windows, diapers, silage foils, rakings etc. (see Table 1: other waste types), end-of-life vehicles and communal sewage sludge. The total municipal waste volumes in Styria according to this system are illustrated in Table 2, indicating that the **municipal waste volumes** increased from 311,179 t (266 kg/inhab) in 1990 to 430,413 t (362 kg/inhab) in 2003 to **508,035 t (421 kg/inhab)** in the year **2008**.

Year	Municipal waste volumes[123] in t/year	Municipal waste volumes [123] in kg/inhab/year
1990	311,179	266
2003	430,413	362
2008	508,035	421

Table 2: Total municipal waste volumes, terms according to the Styrian Waste Investigation 2009

[123] Total municipal waste volumes according to systematics of the Federal Waste Management Plan.

Figure 12 shows the mass fractions of individual waste types compared to total waste volumes in the year 2008. With approx. 41%, i.e. 209,000 t, packagings and municipal waste materials (which are collected together, such as paper) hold the highest shares of total waste volumes in this year, followed by residual waste and bulky waste with a rate of 38% (191,000 t) taken together, followed by biogenic waste with approx. 19% (95,000 t). The remainder (approx 2% or 13,000 t) is shared among waste electrical and electronic equipment, problematic substances and street sweepings.

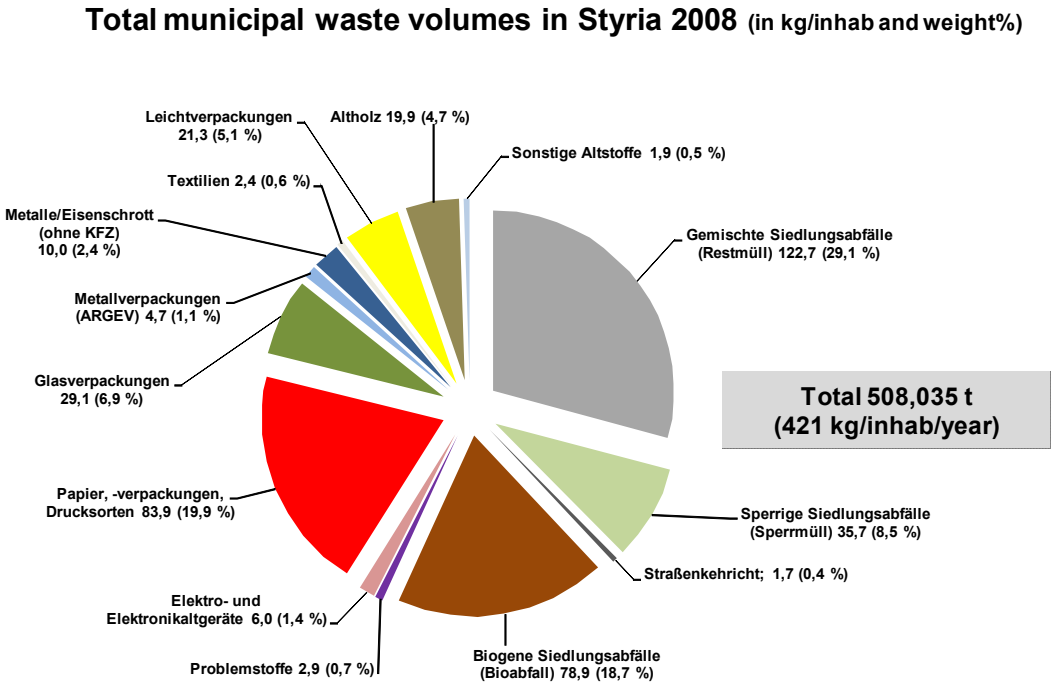

Figure 12: Shares of individual waste fractions on total waste volumes 2008 in %

The development of volume trends of the individual fractions residual waste, bulky waste, biogenic waste, problematic substances as well as the fractions waste materials and packagings taken together between 1990 and 2008 is illustrated in **Figure 13**. The data show that, despite an increase in total waste volumes, the quantities of residual waste and bulky waste were successfully reduced significantly between 1990 and 1994 due to the introduction of separate collection. After 1994 the waste volumes were maintained at a relatively constant level. The years from 1990 to 1994 experienced a massive expansion of available collection infrastructure for separate collection by implementing waste material collection centres, collection bays for recoverables and facilities for decentralised composting (home or community composting). Moreover, the collection of waste electrical and electronic equipment started as early as 1995 in the framework of scientifically monitored pilot projects. Since 2005, the obligatory take-back of waste electrical and electronic equipment free of charge for recovery has been in force as defined in the Waste Electrical and Electronic Equipment Ordinance.

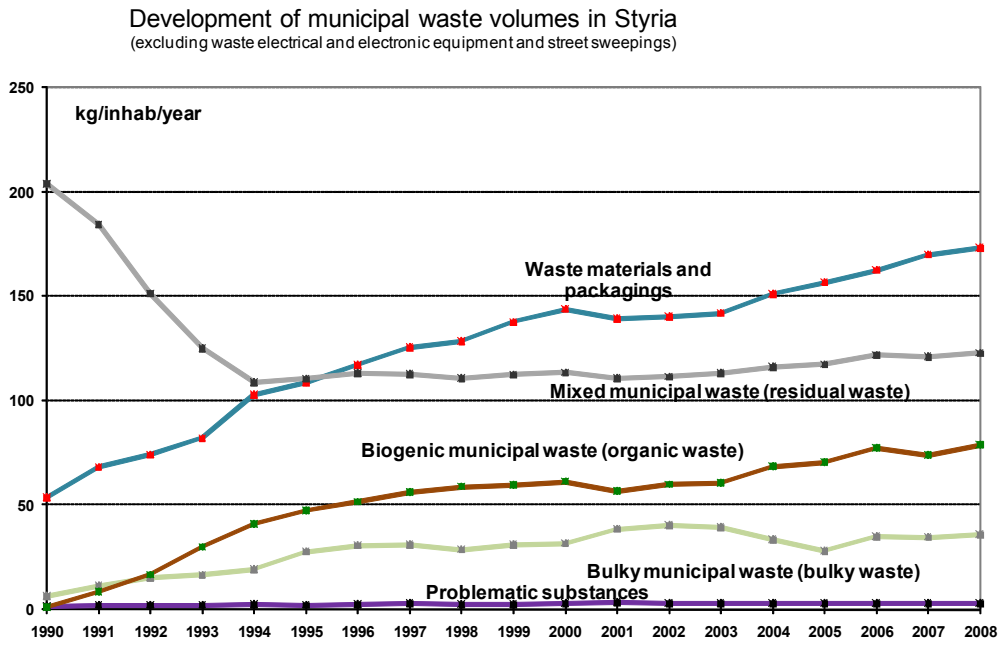

Figure 13: Comparison of specific collection volumes of residual waste, bulky waste, biogenic waste, problematic substances and the summarised fractions waste materials and packagings in Styria, 1990 - 2008, in kg/inhab/year

A comparison of municipal waste volumes from 2003 and 2008 (Table 3) shows that absolute collection volumes increased by 18% in this period. The most significant increase was recorded for waste electrical and electronic equipment, whereas collection volumes of bulky waste and street sweepings declined in the same period. The increase of residual waste volumes in this period (10%) was more moderate and can be attributed to the extensive offers for separate waste collection and to the joint PR activities of FA19D, waste management associations and waste consultants.

Waste fraction	2003		2008		Changes 2003-2008 in %	
	Quantity in t	Quantity in kg/inhab	Quantity in t	Quantity kg/inhab	of quantity	of quantity per inhab
Mixed municipal waste (residual waste)	134,588.8	113	148,052.6	123	+10	+9
Bulky municipal waste (bulky waste)	46,606.6	39	43,058.6	36	-7	-9
Street sweepings	3,274.8	3	2.014.0	2	-39	-39
Biogenic municipal waste (organic waste)	72,215.2	61	95,136.2	79	+32	+30
Problematic substances	3,261.4	3	3.530.2	3	+8	+7
Waste electrical and electronic equipment	1.652,7	1	7,290.0	6	+341	+335
Waste materials and packagings	168,813.4	142	208,953.2	173	+24	+22
Total	**430,412.9**	**362**	**508,034.8**	**421**	**+18**	**+17**

Table 3: Total municipal waste volumes in 2003 and 2008: absolute waste volumes in t, specific waste volumes in kg/inhab and changes of waste volumes in % (waste fractions according to systematics of the Federal Waste Management Plan; waste materials and packagings are taken together)

3.2.2 Summary 2009

The Provincial Waste Management Plan 2005 estimated an increase in total waste volumes of 7.8% or 464,000 t for the year 2008. The current waste volumes, amounting to 508,000 t, exceed the estimated number by 44,000 t. In total, waste volumes have gone up by 18% since 2003 (Table 3). This development can mainly be attributed to separately collected waste materials, packagings and biogenic waste, which can only be materially recovered if collected separately. From a qualitative point of view, this increase can be regarded as success of Styrian waste management, taking into account that the simultaneous increase of mixed – and therefore hardly materially recoverable – municipal waste (residual waste) was below average.

The volumes of separately collected waste materials and packagings grew disproportionately high (by 24%) in the observation period from 2003 to 2008, those of separately collected biogenic waste by 32%. The obligation to separately collect waste electrical and electronic equipment pursuant to the Waste Electrical and Electronic Equipment Ordinance came into effect in 2005, resulting in an increase in collection volumes by 341% since 2003. Efficient waste separation not only requires well-functioning collection infrastructure; notably, citizens must be aware of the need for separate collection of the different fractions. Therefore, separate collection of individual waste fractions on the site of production is the prerequisite for efficient recycling and represents an important goal for the future. In particular, measures to encourage separate collection of recoverable or repairable wastes will have to be taken in view of the implementation of the new waste hierarchy as defined in the EU Waste Framework Directive.

To manage the constant increase in waste volumes, it is necessary to analyse their influence factors. The following factors influencing total municipal collection volumes were identified within the evaluation of collection quantities[124] (Figure 14):

- **Home and community composting**, i.e. the composting of biogenic municipal waste in private gardens, can contribute to reduce municipal collection volumes of up to 60 kg/inhab/year; the extent varies according to the development structure of the residential area in question.
- The illegal **disposal via household combustion** (domestic fuels) is connected with a decrease of municipal collection volumes of up to 120 kg/inhab/year; the extent varies according to the number of buildings with heatings for solid fuels.
- Small **household sizes** are related to higher waste volumes. On average, the *per capita* waste volume generated in a two-person household surpasses that of a three person household by 130 to 300 kg/inhab/year.
- 100 - 120 kg of municipal waste are produced per **job** and year. The numbers of jobs and commuters and tax capacity are the most important factors influencing municipal waste volumes.
- In **tourist municipalities** the **number of overnight stays** significantly influences waste volumes: additional 0.5 - 1.2 kg of waste are generated per overnight stay.

[124] Beigl, P. & Lebersorger, S.: Abfallmengenprognose für den Steiermärkischen Landesabfallwirtschaftsplan 2010. Zwischenbericht, Universität für Bodenkultur, Wien, 2009.

From the point of view of sustainable waste and material flow management, measures against the illegal disposal of waste as domestic fuels are required regardless of the increase in municipal waste volumes that are expected as a result thereof. The incineration of waste in inadequate combustion plants may have adverse effects on the environment due to the emission of air pollutants (e.g. nitrogen oxides, dioxins, particulate matter, hydrocarbons etc.)

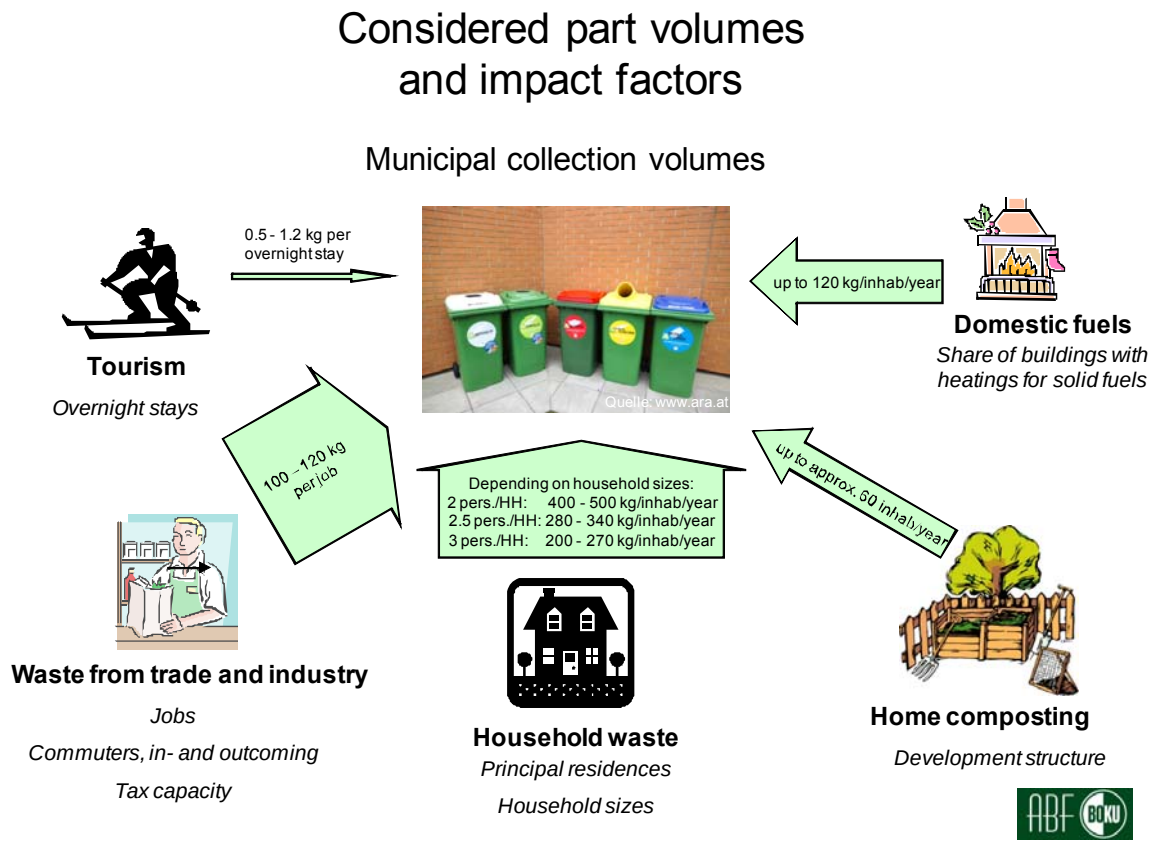

Figure 14: Factors influencing collection volumes of municipal waste (Source: Beigl & Lebersorger, 2010)

3.3 Mixed municipal waste (residual waste)

3.3.1 Waste volumes

In **Austria**, **residual waste volumes** generated in households and similar institutions increased from 1,339,000 t in 2003[125] by 3% and amounted to **1,379,000 t (165 kg/inhab)**[126] in 2008.

In **Styria,** the **residual waste volume** was 128,887 t (109 kg/inhab) in 1994. By **2008**, an increase to **148,053 t** or **123 kg/inhab** was recorded (Figure 15); the increase since the year 2003 (134,589 t) amounted to 10% (Table 3).

[125] Neubauer & Walter, 2008.

[126] Umweltbundesamt GmbH, 2009.

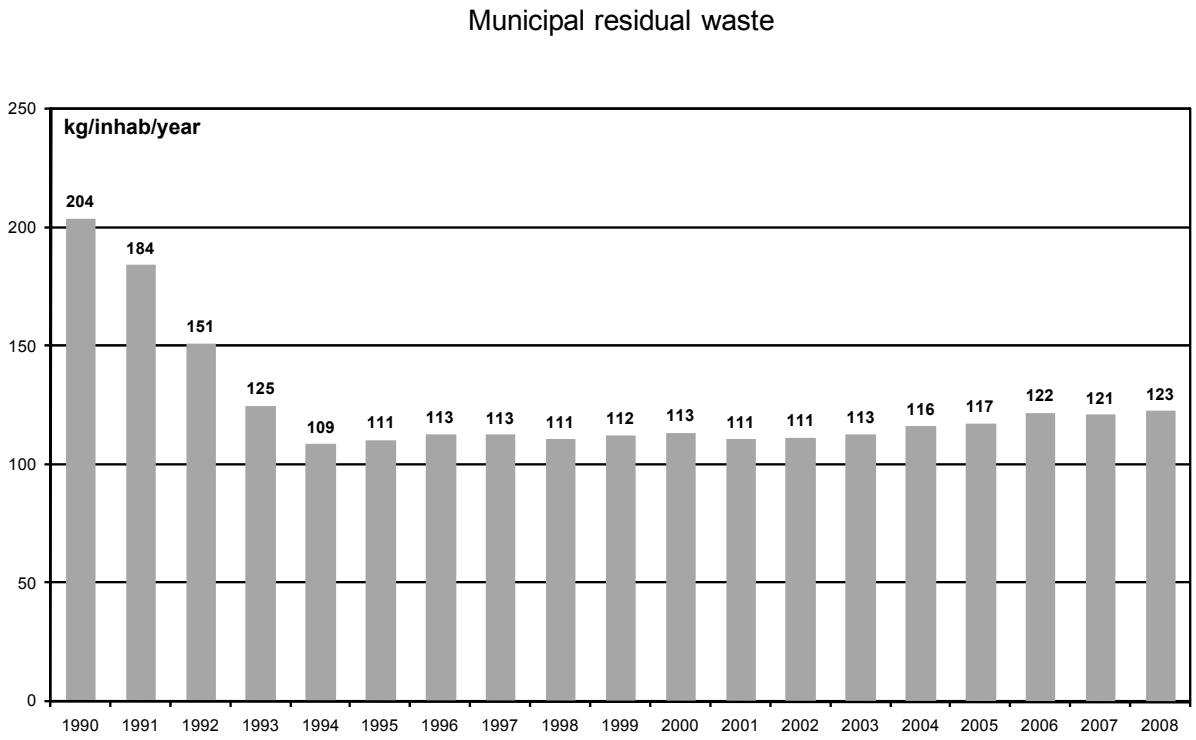

Figure 15: Development of municipal collection volumes of mixed municipal waste per inhabitant, Styria, from 1990 - 2008. The significant decrease of collection volumes between 1990 and 1994 is related to the extensive implementation of the separate collection of biogenic waste, waste materials and packagings.

In Styria, mixed municipal waste is mainly collected via the pick-up system with containers or collection bags. In Styrian communities, residual waste containers are picked up in intervals of one, two, four, six or eight weeks, whereby most removals are performed every four weeks (Figure 16). Organising the collection of residual waste as bring-it-yourself system, e.g. via waste material collection centres, is not permitted according to the StAWG 2004.

The benchmark pilot project *Steirischer Abfallspiegel* was initiated to study waste-related structures in Styrian municipalities from 2008 to 2009 by FA19D and performed in collaboration with INFA (Institute for Waste, Waste Water and Infrastructure Management GmbH in Ahlen, Germany). In 2008, 67 municipalities participated on a voluntary basis, in 2009 this number had already increased to 117. The results from 2009 show that the **volumes of containers provided** by Styrian municipalities **for the removal of residual waste** range from 335 l/inhab/year to 1,253 l/inhab/year, with a median of 615 l/inhab/year. Most collection containers hold 120 litres (Figure 17).

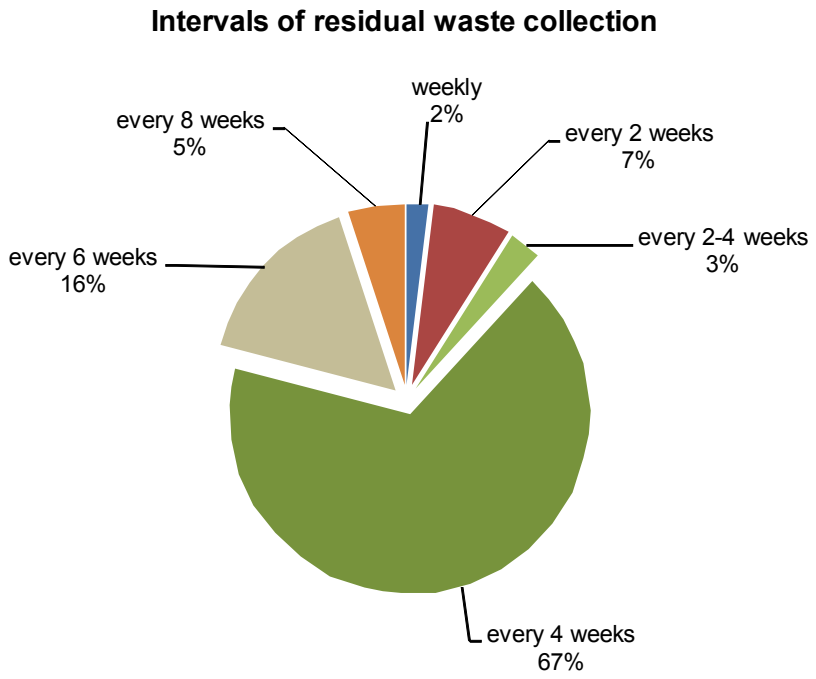

Figure 16: Intervals of residual waste collection in Styrian municipalities (data collected from 117 municipalities)

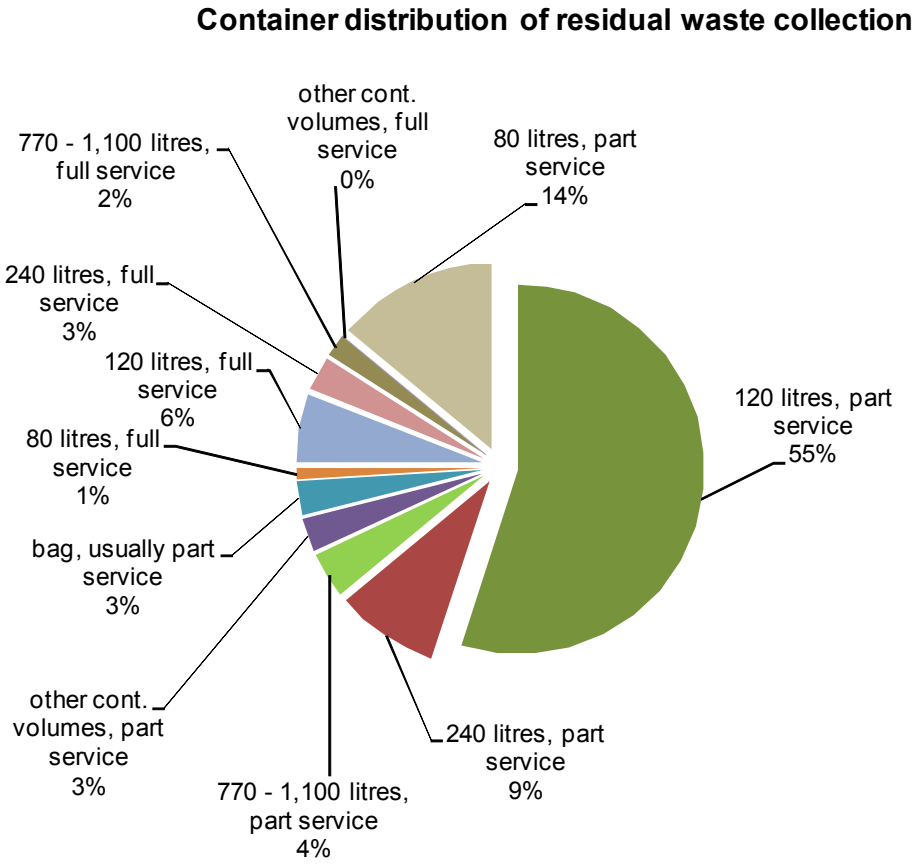

Figure 17: Distribution of containers for residual waste collection in Styrian municipalities (data collected from 117 municipalities)

3.3.2 Composition of residual waste

In the years 1998, 2003 and 2008 FA19D initiated a province-wide analysis of residual waste[127] in Styria, which was performed by TBU GmbH. A total of approx. 15 t of residual waste from 104 sections with a sample volume of approx. 108 m^3 were thoroughly sorted and analysed within three campaigns (heating period, non-heating period, pre-heating period).

The composition of waste originating in rural areas differs significantly from residual waste generated in urban areas. Moreover, major seasonal differences were observed according to the respective heating, non-heating, or pre-heating period. In general, residual waste volumes in rural areas were clearly lower (median: 79.4 kg/inhab/year) than those in urban areas (median: 174.2 kg/inhab/year). Notably, less paper was found in residual waste during the heating period (median: 6.2 kg/inhab/year) than in the other seasons (median: 7.2 kg/inhab/year).

The following description of the composition of residual waste refers to average values (medians) from all areas throughout the year.

The residual waste components were divided into the following fractions according to their material properties: organic waste, paper, carton, composite materials, plastic, metal, glass, hygiene articles, inert materials, textiles, problematic substances, others, and a fraction with a particle size of <20mm. The latter is mainly composed of organic materials; due to the size of particles it contains this fraction is biologically treated in MBT plants before it is landfilled. The percentages of the individual fractions in the analysed residual waste samples are illustrated in Figure 18, showing that the fraction organic waste holds the largest share with an average of 20.5%, i.e. a quantity of approx. 25 kg/inhab/year. This fraction mainly consists of biogenic municipal waste, which should either be disposed of in home or community composting or separate collection (“organic waste container”). Hence, residual waste volumes might be drastically reduced by a more consequent separate collection of biogenic municipal waste. The fraction “organic waste” also includes originally sealed food and food in opened packagings, amounting to approx. 4 kg/inhab/year (Figure 20). This waste might be avoided by conscious consumption behaviour. Analyses of volume shares of residual waste (Figure 19) show that plastic (38%) clearly represents the most important waste fraction in residual waste.

[127] Vogel, E., Steiner, M. & Quickert A.: Siebgestützte Restmüllanalyse im Land Steiermark. Endbericht, TBU GmbH, Innsbruck, 2009.

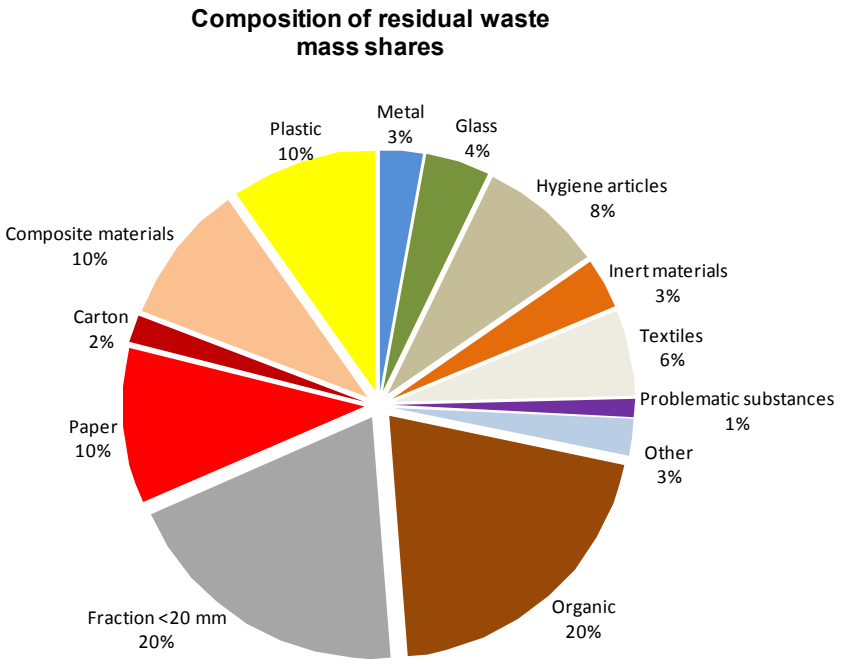

Figure 18: Composition of residual waste (mass %) in 2008[128]

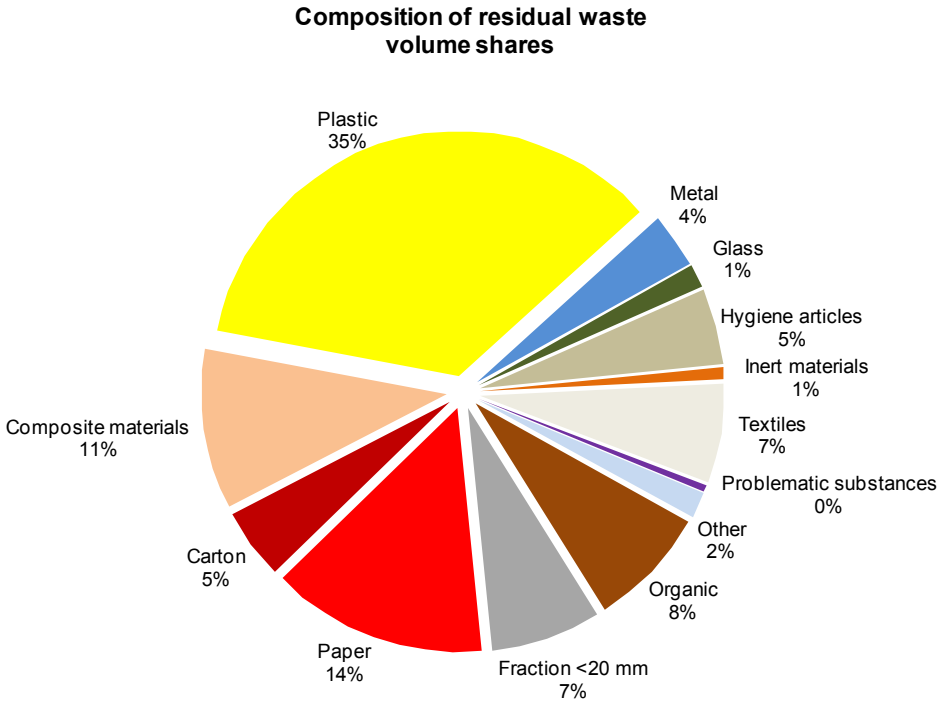

Figure 19: Composition of residual waste (volume %) in 2008[128]

[128]Vogel et al., 2009.

Figure 20: Food in residual waste (Municipal Solid Waste Analysis 2008).

A comparison of residual waste analyses from the years 1998, 2003 and 2008 (Figure 21) shows that the most significant increases can be observed for the waste fractions plastic and composite materials, paper and organic waste.

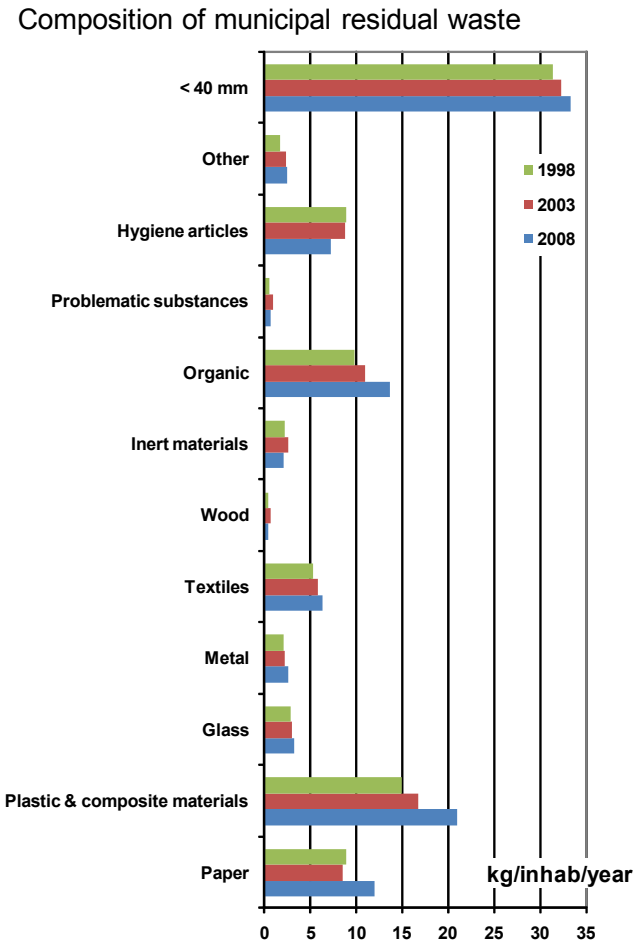

Figure 21: Comparison of results of residual waste analyses 1998, 2003 and 2008[129]

[129] Vogel et al., 2009.

3.3.3 Waste treatment and climatic relevance

3.3.3.1 Mechanical-biological treatment of waste and residual waste splitting

Since the prohibition of landfilling came into force on 1 January 2004, mixed municipal waste has been treated mechanically-biologically all over Styria. Mechanical treatment can either be performed in residual waste splitting plants or in plants for mechanical-biological waste treatment (MBT). In the first, mechanical step of the process high calorific fractions, recoverable waste materials (metals) and contaminants are separated (overflow from screening process). In the second, biological step organic materials contained in the low calorific fractions (screening pass flow) are decomposed, resulting in a fraction suitable for landfilling and corresponding to the criteria defined in the Landfill Ordinance 2008 (<5% content of organic carbons in DM or higher calorific value <6,600 kilojoules per kilogramme (kJ/kg DM), aerobic activity after 4 days (AA_4) <7 mg O2/g DM, gas formation rate (GB_{21}) after 21 days < 20 Nl/kg DM). In the MBT Directive[130] the *BMLFUW* defined requirements for state-of-the-art MBT plants with regard to suitability of incoming materials, technical equipment and trapping of exhaust air.

The main process steps of purely mechanical waste treatment in residual waste splitting plants and mechanical-biological treatment plants (MBT) can be described as follows:

- **mechanical or manual pre-separation**: necessary to separate impurities (bulky parts, waste wood, stones), but also potential recoverables (e.g. waste metals, plastic) already before start of the first process step.
- **shredding**: intended to reduce the size and decomposition of materials to prepare them for subsequent process steps. Size reduction can be achieved by pressing, cutting, crushing and shredding. Shearing units are either fast running (hammermills or impact mills, two-shaft shredders) or slow running (one- or two-shaft shredders); moreover robust pre-shredders and post-shredders prone to damage by contaminants are distinguished.
- **separation of metals**: Ferrous (Fe) and non-ferrous (NF) scrap disposed of as residual waste are potential recoverables; on the other hand, they may have adverse effects on the treatment process due to heavy wear on various machines. Therefore, magnetic and eddy current separators are used to sort out metals.
- **screening**: is mainly performed to sort the waste into a coarse fraction and a fine fraction, which are composed of different materials. The material intended for biological treatment is mainly contained in the fine fraction, whereas the high calorific materials are held in the coarse fraction.
- **sighting**: Air classifiers are used to separate the lightweight fraction from the waste mixture by means of air to improve the composition of high calorific fractions.
- **further mechanical treatment units:** Before reaching the biological treatment step in an MBT plant, mixing units can be used to blend different material flows.

After completion of the mechanical treatment steps the materials undergo a two-step **biological treatment,** which includes an intensive rotting process (2 to 8 weeks, Figure 22) and a post-rotting

[130] *BMLFUW* (Hsg.): Richtlinie für die mechanisch-biologische Behandlung von Abfällen. Vienna, 2002.

period (6 to 12 weeks, Figure 23). Therein, microorganisms and specific active aeration processes cause the degradation of the biologically available organic substance, which is converted into stable organic components (humic substances). The intensive rotting process is performed in encapsulated systems (tunnels with exhaust air ventilation). In an “open” post-rotting process the waste is arranged in heaps and covered.

Figure 22: Intensive rotting tunnel, MBT Frohnleiten

Figure 23: Post-rotting, MBT Liezen

Treatment of residual waste in MBTs has developed historically in Styria: between 1975 and 1980, so-called waste sanitation facilities and waste splitting plants were established, which provided infrastructure that was successfully integrated into the planned MBTs. In time before the prohibition of landfilling of untreated wastes[131], state-of-the-art MBTs were opened in **Halbenrain**, **Frohnleiten** and **Liezen;** in **Allerheiligen im Mürztal** the rotting tunnel constructed in 1996 was operated as MBT after completion of adaptation works. In Graz, residual waste from the city and some neighbouring municipalities is mechanically pre-treated at the Sturzgasse site; further biological treatment is

[131] cf. Landfill Ordinance 1996.

performed in Frohnleiten. In total four state-of-the-art MBT plants are operated in the Province of Styria. Together with the mechanical-biological treatment plants in Aich-Assach and Frojach-Katsch, which do not completely meet the technical requirements for MBTs defined in the MBT Directive, a total capacity for mechanical-biological treatment of 212,000 t/a was available in Styria in 2008 (Table 4, Figure 24). In 2009, another biological waste treatment plant situated in St. Johann/Haide was approved by the authorities. The facility planned by the *AWV Hartberg* will be available for treatment of biologically recoverable wastes from the splitting plant already operated at the same site.

Site	Capacity in t/a	Operator
Graz/Frohnleiten	76,000	*AEVG/Servus Abfall (biological step)*
Halbenrain	70,000	*A.S.A. Halbenrain*
Liezen	25,000	*AWV Liezen*
Allerheiligen im Mürztal	17,000	*AWV Mürzverband*
Frojach-Katsch	14,000	*AWV Murau*
Aich-Assach	10,000	*AWV Schladming*
Total capacity:	**212,000**	

Table 4: Mechanical-biological treatment plants in Styria (data from licensing notices, as at 1 January 2009)

Moreover, 6 residual waste splitting plants are available in Styria for the mechanical treatment of mixed municipal waste, covering for a total capacity of 269,900 t/year (Table 5, Figure 24).

Site	Capacity in t/a	Operator
St. Johann in der Haide	10,000	*AWV Hartberg*
St. Michael	65,000	*Fa. Mayer/Säumel*
Graz	75,000	*AEVG*
St. Margareten an der Raab	45,000	*Fa. Müllex*
Peggau	40,000	*Fa. Zuser*
Fisching	34,900	*Fa. Trügler*
Total capacity:	**269,900**	

Table 5: Residual waste splitting plants for mixed municipal waste (data from licensing notices, as at 1 January 2009)

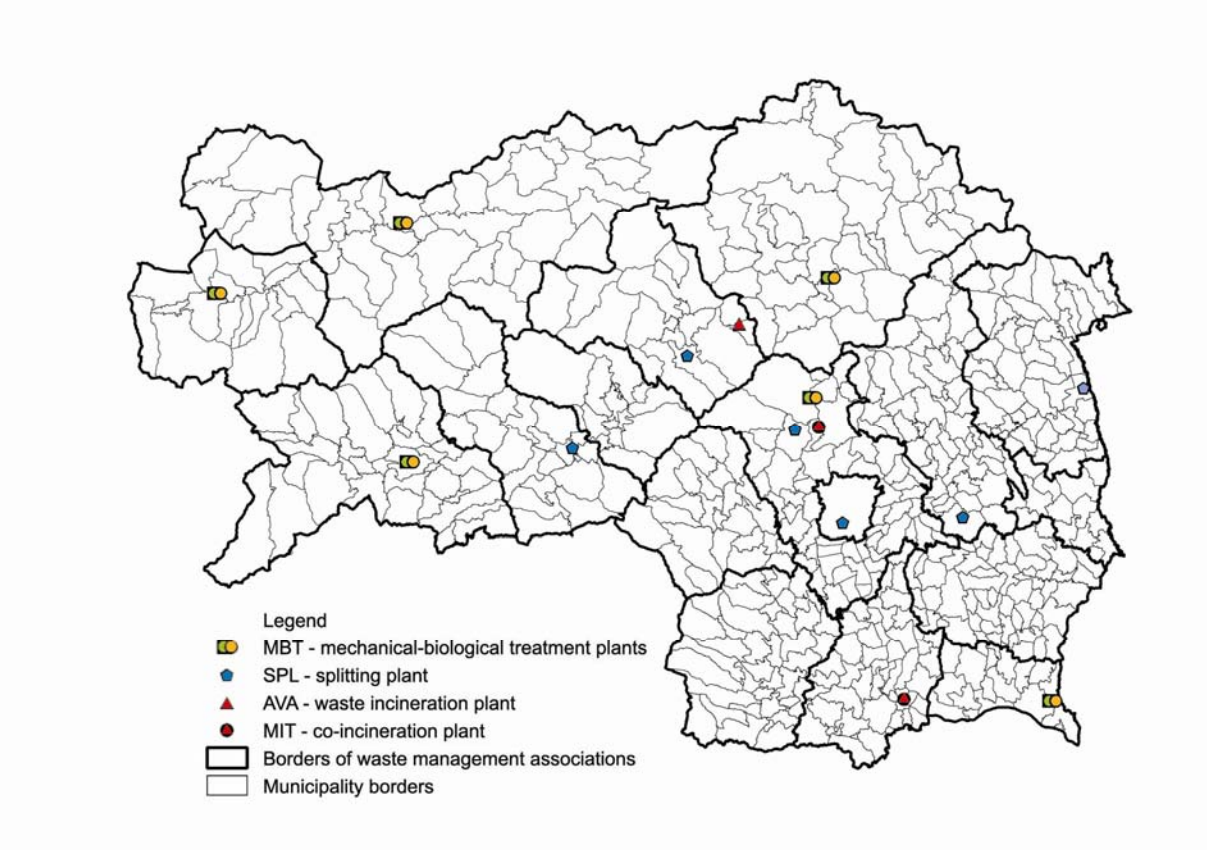

Figure 24: Treatment sites for mixed municipal waste (residual waste) and other waste types in Styria: mechanical-biological treatment plants (MBT), residual waste splitting plants, incineration and co-incineration plants

The Sankey diagram shown in Figure 25 illustrates the material flows of residual waste treatment with MBT and residual waste splitting in Styria in 2008, including **total residual waste volumes (municipal waste and other commercial wastes** of waste type key number SN 91101 according to the List of Wastes Ordinance). Thus, the graph not only contains the approx. **148,000 t of residual waste from community collection**, but also the approx. **106,000 t of residual waste from businesses** collected by private waste disposal companies. Overall, 254,000 t of residual waste were delivered to Styrian residual waste splitting plants and MBTs in 2008.

In 2008, 153,000 t (**60%**) of residual waste were taken over by **residual waste splitting plants;** thereof approx. 44% were thermally recovered **as fractions rich in calorific value** and approx. 5% (primary metals) were materially recovered. The low calorific fraction was treated biologically in MBTs.

Of the approx. 100,000 t of residual waste treated in MBTs in 2008, approx. 10% of the input were separated as high calorific fraction before the actual biological treatment for **thermal recovery**. The remaining part was biologically treated together with the low calorific value from the splitting plants (76,000 t), whereby this number was reduced by approx. 37% due to rotting losses. 107,000 t remained after biological treatment, whereof approx. 40% were separated as high calorific fraction and thermally recovered.

This combination of treatment in splitting plants and MBTs allowed for **thermal recovery** of approx. 117,000 t or **46%** of total volumes of mixed residual waste; approx. 66,000 t or **26%** were landfilled on **mass waste landfills.** Around 9,000 t or **4%** of the input in splitting plants and MBTs were identified

as potential recoverables (metals, plastic, waste wood, glass packagings), separated during mechanical treatment, and **materially recovered** (recycling).

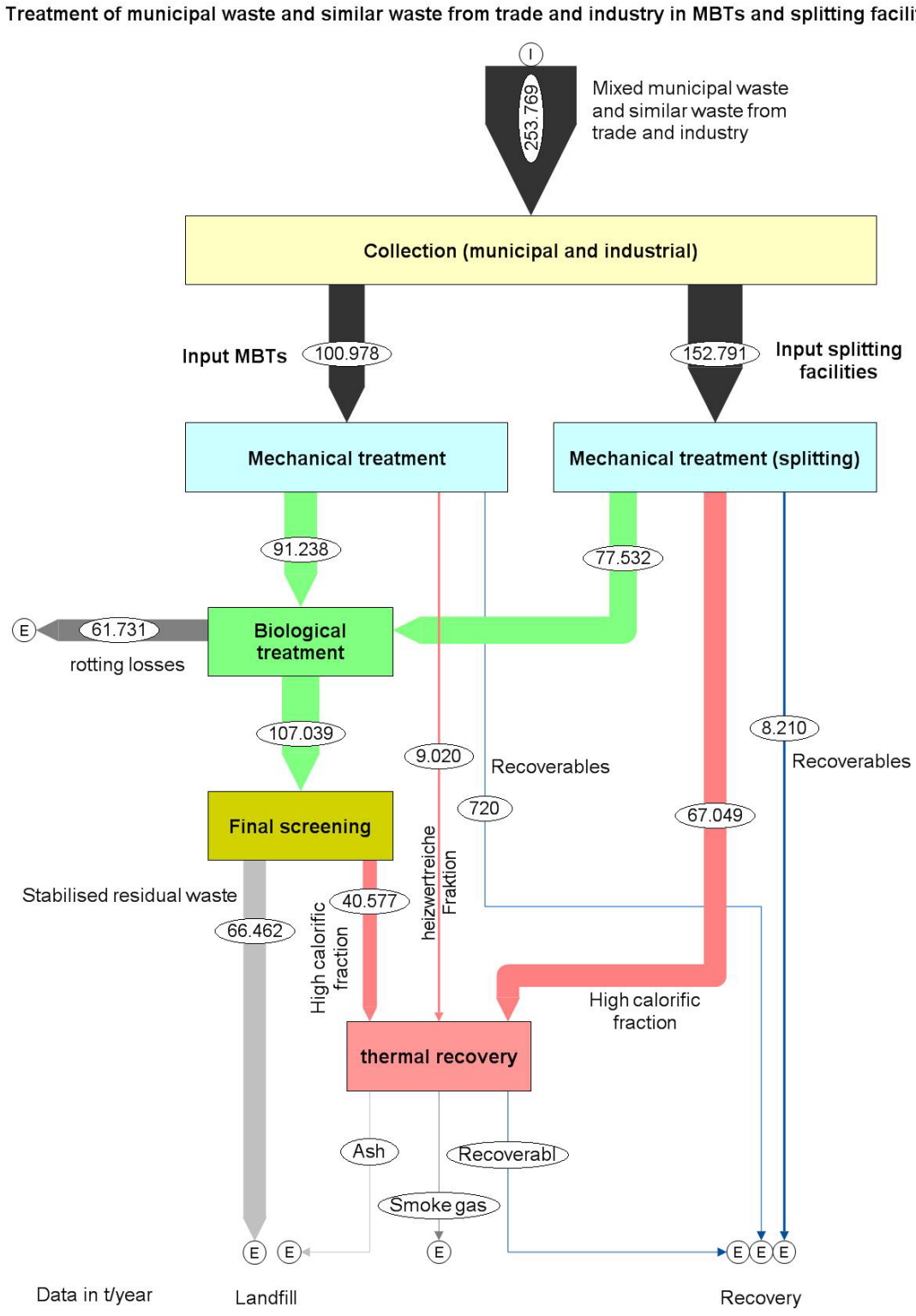

Figure 25: Material flows in splitting plants and mechanical-biological treatment (MBT) facilities, residual waste treatment 2008

3.3.3.2 Thermal treatment

The high calorific fractions separated in the splitting plants and MBTs are either passed on directly to waste incineration plants (*MVAs*, e.g. fluidized bed firing plants) or to co-incineration plants (e.g. in cement industry) after adequate pre-treatment. Additionally, several pryolysis and incineration plants are available exclusively for the treatment of commercial and industrial company wastes.

Since January 1 2004, ***TRV* Niklasdorf (*Thermal residual waste recovery*,** Figure 24 and Figure 26), run by *Energie- und Abfallverwertungsgesellschaft m.b.H* (*ENAGES*), has been operating in Styria as 40 megawatt (MW) fluidized bed firing plant with an annual capacity of 100,000 t (Table 6). In this plant, residual materials generated during the treatment of municipal, commercial and industrial waste and sewage sludge are thermally recovered. After minor technical adjustment works of current waste treatment processes, the Niklasdorf facility would in principle also be suitable for thermal recovery of untreated residual waste. By generation of electricity and release of process heat to the directly connected paper mill *Brigl & Bergmeister GmbH*, the incineration plant achieves efficiency factors between 75% and 80%. The plant corresponds to the requirements for thermal treatment plants according to Annex II of the new EU Waste Framework Directive[132] and is therefore a **thermal recovery plant**.

Figure 26: Thermal residual waste recovery of *ENAGES* in Niklasdorf

According to the Waste Incineration Ordinance[133], co-incineration plants are defined as plants whose main purpose is the generation of energy or production of material products and

[132] Recovery plants according to the Waste Framework Directive (Directive 2008/98/EC) include incineration facilities dedicated to the processing of municipal solid waste only where their energy efficiency is equal to or above 0.60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009 or 0.65 for installations permitted after 31 December 2008.

[133] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on the incineration of waste (Waste Incineration Ordinance - *AVV*), Federal Law Gazette I No. 389/2002 as amended in Federal Law Gazette I No 296/2007.

- which use **waste as a regular or auxiliary fuel**; or
- in which **waste is thermally treated for the purpose of disposal**.

If co-incineration takes place in such a way that the main purpose of the plant is not the generation of energy or production of material products but thermal treatment of waste, the plant is regarded as an incineration plant.

In Styria, **two cement works** (*Lafarge-Perlmooser* in Retznei and *Wietersdorfer & Peggauer Zementwerke GmbH* in Peggau, see also Figure 24) serve as **waste co-incineration plants**, providing a total capacity of approx. 119,900 t/year. This includes thermal recovery of certain high calorific fractions with low contents of humidity or heavy metals from community collection of mixed municipal waste (high calorific values from residual waste splitting or from MBT). The use of untreated mixed municipal waste (residual waste) is, however, not allowed in these plants.

To **produce quality-defined waste fuels** from **pre-treated** municipal waste and commercial waste, a fuel processing plant was built at the Retznei site in immediate vicinity of the cement work of *Lafarge Perlmooser GmbH.* This plant has been planned, constructed and operated *by ThermoTeam.* It is Austria's most modern fuel processing plant for the production of waste fuels from pre-treated plastic and residual waste and has an input capacity of around 100,000 t/year.

The above-mentioned facts prove that Styria is committed to consequently pursue the production of different thermal waste fractions (according to plant-specific requirements). With regard to different energetic efficiency factors of incineration plants (ranging from approx. 25% using a “grate boiler“ without district heating, to approx. 70% with district heating, to up to 80% using fluidized bed firing plants with steam utilisation in industry, to a maximum of 90% in cement production), the energy contents of waste can be used to the optimum. To minimise adverse effects on the environment (e.g. pollutants) Styrian thresholds applicable to co-incineration plants for auxiliary raw materials and waste fuels, which have been defined in the licensing notices, are below the limits recommended by the *BMLFUW*[134].

Site	Capacity in t/a	Operator
TRV Niklasdorf	100,000	*ENAGES mbH*
Cement work Peggau	39,900	*Wietersdorfer & Peggauer GmbH*
Cement work Retznei	80,000	*Lafarge Perlmooser GmbH*
Total capacity	**219,900**	

Table 6: Thermal waste treatment plants (data from licensing notices, as at 1 January 2009)

In 2007, ***Mayr Melnhof Karton GmbH*** **in Frohnleiten** submitted a project application for approval of a new energy plant based on waste fuels. It aims to **build a fuel treatment facility and an energy plant** with two fluidized bed firing plants with a heat output of 80 MW, respectively, achieving a recovery capacity of 270,000 t to 450,000 t per year according to the calorific value of the used waste fuels. This is intended to reduce the dependency of fossil fuels and enable the use of waste materials from waste paper recovery as well as from externally treated waste fuels with a high biogenic fraction.

[134] Federal Ministry of Agriculture, Forestry, Environment and Water Management. (ed.): Guideline for Waste Fuels. Vienna, 2008; http://www.lebensministerium.at.

Meanwhile, the approval procedure has been completed and an **EIA approval has been issued and entered into force 5 August 2008.** Construction works have not yet been started (January 2010).

3.3.3.3 Landfilling (mass waste landfill, residual waste landfill)

As at **1 January 2009, nine mass landfills** (Table 7,Figure 27) were available in Styria for the disposal of materials from the mechanical-biological waste treatment plants that are suitable for landfilling. As at **1 January 2009,** the free landfill volume of Styrian mass waste landfills amounted to **approx. 3.7 million m^3** (Figure 28). Since 2004, the annual consumption of landfill volumes has been around 200,000 m^3 due to the integration of around 250,000 tonnes of mass waste (i.e. residues from MBT and other residual materials such as ashes, slag, etc.)[135].

Since 1 July 2009, the landfilling of residual materials from waste incineration plants on mass landfills has been prohibited according to the Landfill Ordinance 2008; only disposal on residual waste landfills has been permitted (Table 8, Figure 27). Since this date the waste volumes to be landfilled on residual waste landfills (approx. 100,000 t/year), which had been used almost exclusively for wastes generated by the iron and steel industry until 1 July 2009, have increased significantly. Thus, separated compartments for residual waste have been created at sites previously operated as mass landfills (Frohnleiten, Halbenrain, Bad Aussee and Köflach) to provide space for the residual materials generated during waste incineration, which have until now been disposed of on mass landfills. As a result, the available mass landfill volume was reduced by approx. 500,000 m^3 in 2009 and has amounted to approx. **3.0 million m^3 since 1 January 2010** taking into account the annual consumption of landfill volumes in 2009. With a continuing average landfill volume consumption of 200,000 m^3 per year the **remaining mass landfill capacity** would be sufficient for **approx. 15 more years**, calculated **from 1 January 2010 onwards**. Estimations of the actually remaining time are hardly feasible because many approval procedures have not yet been completed and details on the quantities intended for future landfilling are currently unknown. It can be expected, however, that the capacities available in 2010 will be sufficient until 2025.

[135] Estimated volume, assuming an average density of 1.25 t/m^3 according to annual reports of landfill operators

Site	Remaining capacities in m^3	Operator of landfill
Frohnleiten	1,703,000	*Gemeindebetriebe Frohnleiten GmbH.*
St.Johann in der Haide	447,000	*AWV Hartberg*
Judenburg/Gasselsdorf	161,000	*Stadtwerke Judenburg AG*
Eisenerz	330,000*	*Restmüllverwertungs-GmbH (RMVG)*
Liezen	37,500	*AWV Liezen*
Allerheiligen/Mürztal	108,000	*AWV Mürzverband*
Halbenrain	723,000	*A.S.A. Halbenrain*
Köflach - Rosental	140,000	*MDK GmbH*
Bad Aussee	45,000	*Wasserverband Ausseerland*
Sum	**3,694,500**	

***** *approved together with mass waste landfill*

Table 7: Remaining capacities of mass waste landfills, as at 1 January 2009 (data from EDM reports of landfill operators)

The so-called "*landfill-mining*", i.e. the recovery of resources from already landfilled materials, would be a suitable instrument to increase landfill volumes on existing landfill sites. Together with other EU member states (Italy, Greece, Rumania, Bulgaria, Hungary and Slovenia) as LEAD partners and in the framework of transnational collaborations and networks, FA19D submitted the project concept "ETOILE" for funding via the South-East-Europe (SEE) programme.

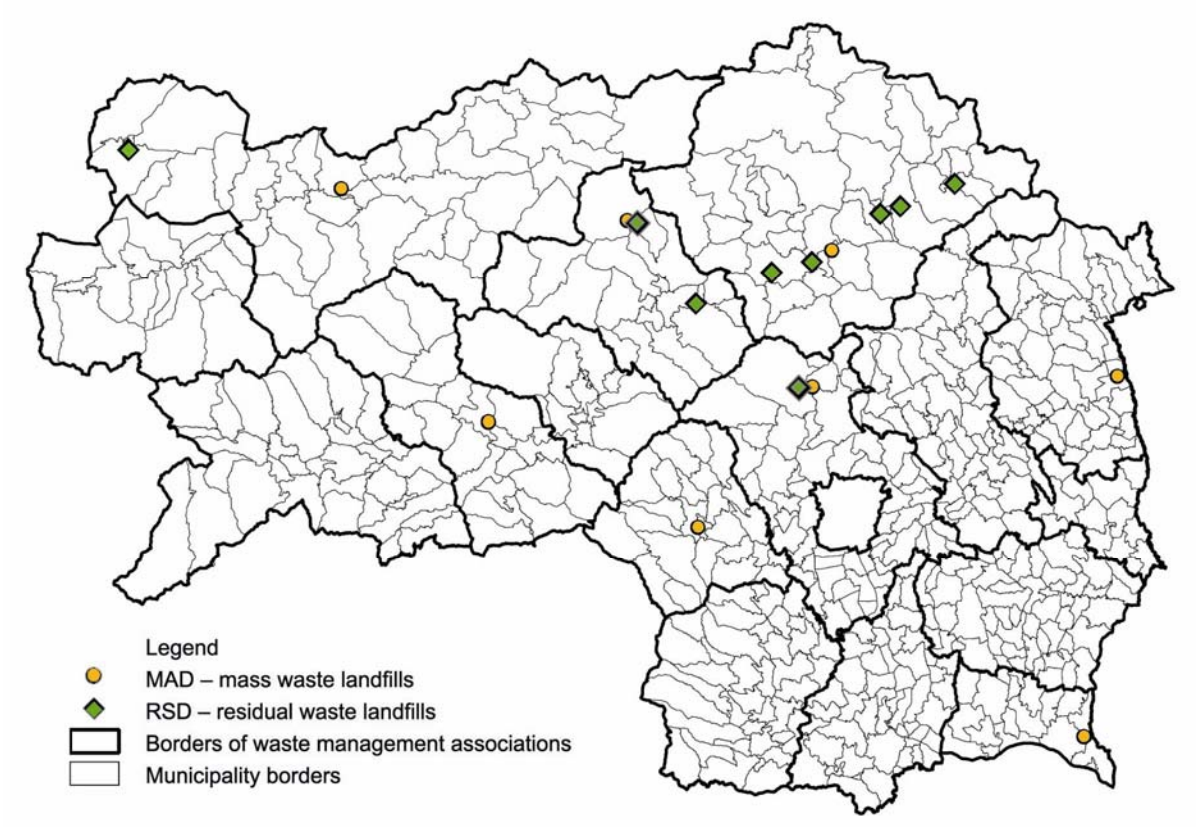

Figure 27: Mass waste- and residual waste landfill sites in Styria

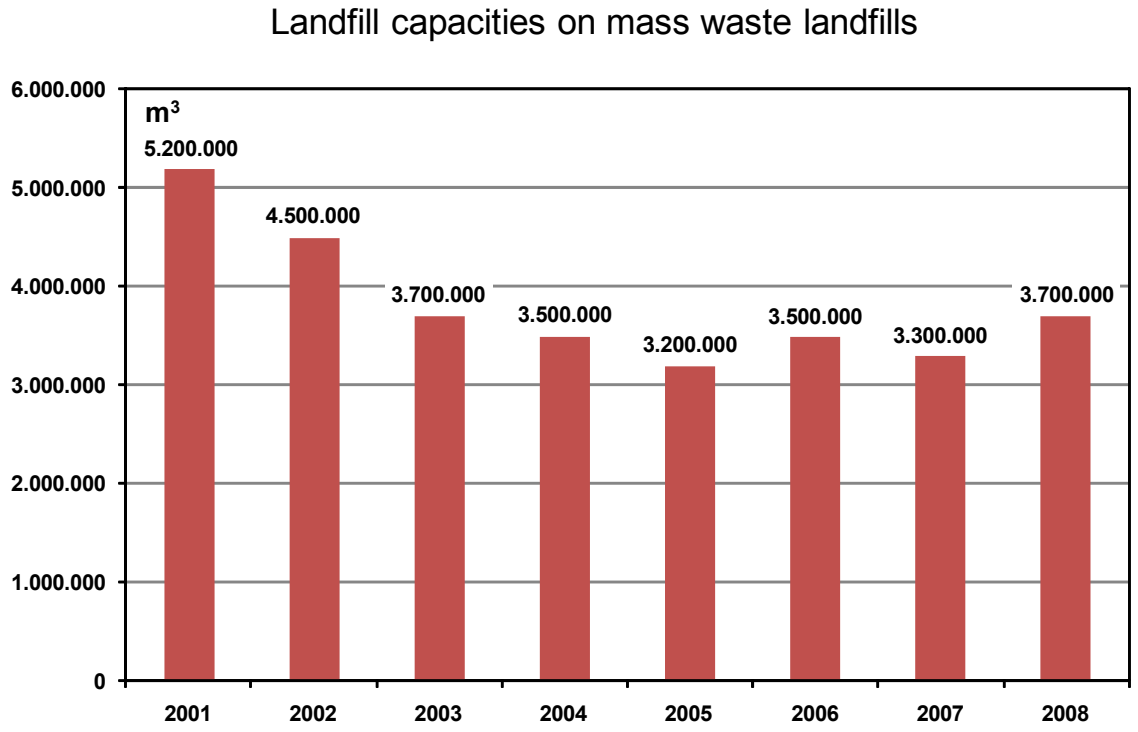

Figure 28: Temporal development of available landfill capacities on mass waste landfills in Styria. The increase of landfill capacities from 2007 to 2008 results from the expansion of the Halbenrain site.

Site	Remaining capacity in m^3	Operator
Kapfenberg	298,000	*Tongrube Ülmitz GmbH*
Eisenerz	330,000*	*Restmüllverwertungs-GmbH (RMVG)*
Leoben	90,000	*VOEST-Alpine Stahl Donawitz GmbH*
Ganz	7,600	*Böhler Bleche GmbH*
Krieglach	8,200	*Voest-Alpine Präzisrohrtechnik GmbH.*
Mitterdorf /Mürztal	150,000	*Breitenfeld Edelstahl AG*
Kapfenberg	168,000	*Böhler Edelstahl AG*
Frohnleiten	280,000	*Gemeindebetriebe Frohnleiten GmbH*
Total	**1,331,800**	

** approved together with mass waste landfill*

Table 8: Remaining capacities of residual waste landfills, as at 1 January 2009 (data from EDM reports of landfill operators)

3.3.3.4 Energy efficiency and climatic relevance

To define the future strategy for recovery and treatment of municipal residual waste in Styria, investigations were performed before preparation of the L-AWP 2010. They were intended to determine whether differentiated waste treatment (**mechanical-biological treatment of residual waste**) is an adequate treatment form in comparison to **thermal waste treatment by waste incineration in traditional waste incineration plants.** For this purpose, specific waste data were analysed with regard to **energy efficiency and climatic relevance** of MBT plants and compared with total waste incineration with and without utilisation of waste heat.

Energy efficiency

During the pre-treatment of residual waste in splitting and MBT plants as implemented since 1 January 2004, high calorific fractions are sieved **before** and **after** the biological treatment step. Of the **total quantity of residual waste** passed on to **splitting plants and MBTs** in 2008 **(253,769 t)**, **116,646 t** (46% of total input) of **high calorific waste** were separated before direct **thermal recovery** in industrial firing plants or further treatment to waste fuels with assured quality (e.g. in cement industry). Moreover, **8,930 tonnes of waste materials** (3.5% of total input) were sorted out during mechanical treatment for **material recovery**.

It must be noted that significant mass fractions of **other waste types**, e.g. from separately collected packaging waste (lightweight fraction), waste wood and waste cooking oils, can be energetically used directly or indirectly as (waste) fuels.

The energy contained in the individual waste fractions from Styrian municipal household wastes including sewage sludge and the energy potential resulting thereof are illustrated in Table 9. The total energy quantity contained in **Styrian municipal waste amounts to approx. 3.4 petajoules (PJ)**, i.e. **1.4% of the total gross domestic energy consumption** of Styria (2005) or approx. **238 PJ**[136]**.**

Waste type	Calorific value (MJ/kg)	Volume 2008 in t	MJ/year	PJ/year	%
Municipal residual waste	9.4	148,052	1,391,688,800	1.392	40.07
Bulky waste	10	43,059	430,590,000	0.431	12.41
Lightweight fraction	25	25,078	642,700,000	0.643	18.50
Waste cooking oils	36.5	1,047	38,215,300	0.038	1.09
Municipal sewage sludge DM	10	34,000	340,000,000	0.340	9.78
Biogenic waste as biogas	2.6	95,136	246,593,030	0.247	7.10
Waste wood	16	23,979	383,675,200	0.384	11.05
Sum			**3,473,462,330**	**3.473**	100.00

Table 9: Energy potentials of relevant municipal waste fractions in Styria

According to the *ÖWAV* publication *Regelblatt No. 519 Energetische Wirkungsgrade von Abfallverbrennungsanlagen - Energy efficiency factors of waste incineration plants,* it can be assumed

[136] Styrian Provincial Energy Responsible - *Landesenergiebeauftragter*, 2009.

that the **net efficiency factor** of **waste incineration plants** which use **thermal energy mainly for the generation of electricity** amounts to approx. **20-25%.** In comparison, waste incineration plants that mainly use process heat for the generation of electricity and heating (heat-energy coupling) all year long achieve efficiency factors of 70-80% (Table 10). According to valid Community legislation, however, energy efficiency - and not the plant efficiency factor - is referred to as criterion for the classification of waste incineration plants as recovery or disposal plants. Operating plants that were approved by 31 December 2008 must have an energy efficiency factor of at least 0.60. Plants approved after this date must reach a minimum energy efficiency factor of 0.65 to be classified as recovery plant. According to this regulation and calculation method, all Austrian waste incineration and co-incineration plants are classified as recovery plants.

Styrian residual waste splitting and MBT plants separate **high calorific fractions** (calorific values >18,000 kJ/kg) and **medium calorific fractions** (calorific values from 11,000 to 18,000 kJ/Kg). The waste high in calorific value is used as quality-assured waste fuel in cement industry, **completely substituting fossil energy sources**. The medium calorific fractions are mainly passed on to the fluidized bed firing plants in Niklasdorf and Lenzing (Upper Austria) for thermal recovery, achieving an **efficiency factor of approx. 80%.**

Plant	Efficiency factor	Fuel
Flötzersteig	67	Residual waste
Spittelau	72	Residual waste
AVN Dürnrohr	58	Residual waste
AVE Wels[137]	25	Residual waste
ASA Zistersdorf	20	Residual waste
KRV Arnoldstein	43	Residual waste
***ENAGES* Niklasdorf**	**80**	**High calorific fraction**
***RVL* Lenzing**	**79**	**High calorific fraction**

Table 10: Plant efficiency factors – waste incineration plants in Austria (selection) according to Mauschitz (2009)[138]

[137] Due to the heat utilisation established in 2009 the efficiency factor was increased to approx. 60%. Source: Anderer, T.: Oberösterreichischer Abfallwirtschaftsverband, personal communication, 23.02.2010.

High calorific waste fuels are thermally recovered in the cement works Retznei (*Lafarge Perlmoser*) and Peggau (*W&P*); the energy contained therein is almost fully exploited (not taking into account, however, the intrinsic energy consumption and the energy required for waste recovery).

Differentiated treatment and industrial thermal recovery allow for energy yields of approx. 83% for high calorific waste flows of Styrian residual waste.

Traditional waste incineration plants (grate firing plants) are not available in Styria. The distance between the geographical "waste centre" in Styria (area around Graz) and the waste incineration plants amounts to

- *MVA Wels* ~200 km
- *MVA Dürnrohr* ~255 km
- *MVA Zistersdorf* ~255 km

These numbers must be taken into account when evaluating alternative treatment strategies. An energy input of 162 Wh/t/km is required for the trucking of waste (diesel consumption: 0.3 l/km, weight of loading: 22 t, specific consumption 0.014 l/t/km); a specific energy consumption of 150 Wh/tonne has to be calculated for rail transports.

Climatic relevance

In **2006**, Austrian climate-relevant emissions related to residual waste amounted to **1.254 million t of CO_2 equivalents**, representing a **share of 1.5%** of the total emissions of CO_2 equivalents (84.22 million t). A comparison with the reference year 1990 shows that the emissions, initially amounting to 2.028 million t of **CO_2 equivalents, were reduced by more than 38% in the field of waste management.**[139]

In the past, the landfilling of untreated residual waste produced methane emissions of approx. 1.5 t of CO_2 equivalents per tonne of residual waste due to the anaerobic degradation of landfill masses. Mechanical-biological pre-treatment of waste, as performed **Styrian-wide since 1 January 2004**, allowed **reducing the gas production during landfilling by 90% compared with untreated residual waste**[140], corresponding to savings of approx. 261,000 t of CO_2 equivalents per year (data from 2008).

The *TRV* in Niklasdorf helps saving approx. 120,000 t of CO_2 equivalents per year[141], mainly resulting from savings during landfilling and the use of primary fuels.

The following factors are fundamental for the climatic relevance of residual waste treatment (MBT and waste incineration plants *MVA*):

Advantages and positive climate-relevant effects of waste incineration plants:

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[138] Mauschitz, G.: Klimarelevanz der Anfallwirtschaft IV. Bundeministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hsg.), Wien, 2009. http//publikationen.lebensministerium.at.

[139] Mauschitz, 2009.

[140] Schachermayer, E.: Umweltbundesamt: personal communication, 28.10.2009.

[141] Wilfinger, H. (*ENAGES*): personal communication, 07.04.2010.

1. By complete incineration of residual waste, all the energy contained therein is transformed into heat, which can be used for the production of electricity and process heat.
2. The solid residues generated during incineration can be landfilled on a residual waste landfill without climate-relevant secondary emissions.
3. Mechanical treatment and thermal recovery of residual waste in fluidized bed firing plants with power-heat-coupling can achieve higher efficiency factors, whereby metals can partly be separated during mechanical treatment. In particular ferrous metals can be recovered from bed materials of these plants.

Disadvantages and negative climate-relevant effects of waste incineration plants:

1. In older waste incineration plants with lower efficiency factors, only a small part of heat generated during incineration is used. It must be noted, however, that the major part of the generated heat is usually utilised, even in case of older Austrian waste incineration plants.
2. The carbon contained in the residual waste is converted into CO_2 and released into the atmosphere; thereby only the CO_2 produced from biogenic resources can be regarded as climate-neutral emission.
3. In Styria, waste incineration plants are not available for municipal residual waste. Transport routes of more than 200 km would be required to transport Styrian residual waste to waste incineration plants.

Advantages or positive climate-relevant effects of MBT:

1. Due to differentiated utilisation of high calorific parts of residual waste, which results in higher efficiency factors, energy can be used in considerably more efficient ways than in waste incineration plants. Consequently, significantly higher carbon credit rates are achieved with the high calorific fractions used as replacement for fossil fuels in industrial firing plants.
2. MBTs do not release the whole carbon fraction contained in residual waste into the atmosphere as CO_2: biological treatment of the low calorific fractions allows for degradation of about 50% of the biogenic carbon content to climate neutral CO_2, while the remaining carbon content remains in the MBT residue as stable humus-like structures. In the long term, this residue is trapped in the soil via landfilling (carbon sequestration of approx. 17% of total carbon shares contained in residual waste); current data, however, require further investigations in this field. In practice, the alternative CO_2-neutral incineration of the contained biogenic carbon is not effective since only the low calorific fraction of residual waste is processed in the biological treatment step.
3. Mechanical treatment in splitting plants and MBTs enables the separation of waste materials for material recovery (in particular ferrous metals and non-ferrous metals such as aluminium, copper). Carbon credits for metal recycling vary according to the type of metal[142].
4. An additional energy input is not required during biological treatment for the vaporisation of the water contained in residual waste, since the material heats itself during the hot rotting process.

[142] Cf. e.g. Hiebel, M. & Pflaum, H.: Recycling für den Klimaschutz – CO_2-Emissionen bei der Verwertung von Sekundärrohstoffen im Vergleich zur Nutzung von Primärrohstoffen. In: Müll und Abfall 1, 2009, p. 4-7.

5. The Styrian MBT plants (Liezen, Allerheiligen im Mürztal, Frohnleiten and Halbenrain) are situated in immediate vicinity of landfill sites; therefore the treatment residues can be landfilled on mass waste landfills without further transports (avoids further, transport-related emissions).

Disadvantages or negative climate-relevant effects of MBT:

1. The number of treatment residues generated in MBT plants is slightly increased compared with waste incineration plants, resulting in a minor raise in landfill volumes. Related to mass, the MBT residue to be landfilled equals approx. 40% of the material used; for waste incineration plants, this value amounts to 25-30%[143].
2. During biological waste treatment, methane (CH_4) and nitrous oxide (N_2O) emissions are released, possibly resulting in negative carbon credits. The actual quantities of climate-relevant gases produced during different rotting procedures are currently not quantifiable and will be subject to scientific investigations.
3. The carbon remaining in the residue to be landfilled (approx. 20% DM) may, however, cause climate-relevant emissions even for pre-treated waste as a result of biodegradation. These emissions would have to be considered with negative carbon credits; at present data on this subject are not scientifically confirmed and can therefore not be quantified.

The recycling of separately collected recoverabes results in further CO_2 reductions in the field of waste management. Based on data from the literature[144, 145] CO_2 emissions produced within the utilisation of secondary raw materials were compared with primary raw materials to estimate potential CO_2 savings from municipally collected fractions of recoverables. The values shown in Table 11 provide a **rough estimate** according to the data from the literature.

For waste glass, the value of CO_2 minimisation calculated for glass production was referred to; it was assumed to contain 80% of recycled glass[144]. Since no reliable values are available for the lightweight fraction, which is to a large extent used as waste fuel, the CO_2 saving potential of waste wood was assumed for this fraction. For non-ferrous metals, the value for copper was used while the value for polyethylen (PE) was used for separately collected plastic.[145]

The result, which is illustrated in Table 11, estimates an recycling-associated CO_2 reduction of **approx. 65,200 t of CO_2 equivalents per year**. This value could be increased by another ~20% by consequent separate collection of recoverables contained in residual waste.

[143] Federal Ministry of Agriculture, Forestry, Environment and Water Management (ed.): Waste – to – Energy in Austria. White Book – Figures, Data, Facts – 2nd Edition, Vienna, 2009.

[144] de Hesselle, M.: Die Glasindustrie – Einsatz für den Klimaschutz. In: Bundesministerium für Wirtschaft und Technologie (Hg.): Tagungsunterlagen Klimaschutz – Erfolge und Grenzen (BMWi Dialogreihe „Industrie und Umweltschutz“). Berlin, 2008; http://www.bmwi.de.

[145] Hiebel & Pflaum, 2009.

Fraction	Amount in t from municipal collection (2008)	CO_2 reduction per t in kg CO_2/t	CO_2 savings in t/y
Paper	101,194	90	9,107
Waste wood	23,980	770	18,465
Ferrous scrap	12,042	860	10,356
Non-ferrous metals	37	3,520	130
Lightweight fraction	25,708	770	19,795
Plastic	228	1,190	271
Waste glass	36,101	196	7076
Total			**65,200**

Table 11: Estimate of CO_2 equivalents saved through recycling of municipal recoverables and reduction potential per year. The CO_2 saving potential is estimated according to data from the literature [144, 145].

3.3.4 Summary 2009

Already in 2007, the Austrian waste management-related greenhouse gas emissions complied with the target defined in the climate strategy[146]. This reduction was mainly achieved thanks to the pre-treatment of landfilled wastes, which allowed reducing emissions of climate-relevant landfill gases (in particular CH_4 and CO_2) by approx 50% despite increasing waste volumes.

In Styria, major contributions to climate protection have been achieved since 1 January 2004 with the implementation of the Landfill Ordinance 1996: approx. 46% of waste passed on to MBTs and residual waste splitting plants are thermally recovered.

Since 2004, the annual consumption of landfill volumes has remained at a constant level of approx. 200,000 m^3/year. Therefore, a decrease in the consumption of landfill volumes was achieved in 2008 by approx. 45% compared with 1990 and by approx. 70% compared with 2003.

As at 1 January 2010, a landfill volume of approx. 3.0 million m^3 was available on Styrian mass waste landfills. Assuming a restrictive annual consumption of landfill volumes of 200,000 m^3, the **remaining capacity of mass waste landfills** would suffice for another 15 years from 1 January 2010 (i.e. **until 2025**).

Taking into account a period of around 10 years required for the prospection, development and approval of new landfill capacities, the L-AWP 2010 has to provide for adequate preparations to assess the demand for new landfill capacities by 2015 within its period of applicability. To protect available landfill capacities, **continuative measures for a reduction of residual waste volumes must be set.** Moreover, **a restrictive policy regarding the approval of waste imports is urgently required from the *BMLFUW***.

Analyses of data on residual waste treatment in Styria show that a further increase of material recovery is feasible and to be implemented in the following areas:

- decreasing the share of biogenic waste in residual waste (currently approx. 20%)

[146] Anderl et al., 2009.

- technical upgrading of mechanical treatment plants for an additional separation of non-ferrous scrap (NF scrap) in plants without fluidized bed separator
- increasing the quality of magnetic and non-ferrous scrap (80% iron and 50% aluminium) by adapting equipment and processes.

3.3.5 Mixed municipal waste from trade and industry

Municipal waste is "waste from private households and other waste types which are similar to waste from private households due to their nature and composition"[147]. Consequently, mixed municipal waste (residual waste) can also be generated in commercial institutions (trade, industry, agriculture, public institutions such as hospital and schools) and is classified as **"Municipal waste and similar commercial waste (waste key number 91101)**[148].

Part of the mixed municipal waste from commercial institutions is collected at the municipal level, while the major part is collected by private waste disposal companies. Reliable data on waste flows from commercial institutions (waste collected via community structures as well as commercial municipal waste collected by private companies) are not available. A summary of waste transferred to mechanical-biological treatment and splitting plants provides a rough estimate of residual waste volumes which are not collected via municipal structures. Data collected among the Styrian MBT and residual waste splitting plants showed that an annual quantity of approx. 254,000 t of municipal waste and similar commercial waste are received as waste key number 91101. Taking into account the residual waste volumes of 148,000 t/year from community collection it can be assumed that approx. 106,000 t/year, in the majority produced within commercial institutions, are collected and removed by private waste disposal companies (not including transports from and into other Federal Provinces).

In 2008 a baseline study was initiated to collect and analyse data[149] on the specific composition of residual waste, aiming to conclude recommendations in view of optimal waste management. The result of this study, which was performed by Vienna University of Technology, shows that the Styrian volumes of mixed municipal waste originating in commercial institutions amount to approx. 115,000 t/year. Thereof approx. 90,000 t (estimated uncertainty: ± 30%) are directly collected by private disposal companies and treated/recovered in residual waste splitting plants. Furthermore, the data of the study[149] suggest that approx. 25,000 t of mixed municipal waste are collected via community structures every year (estimated uncertainty: ± 50%). Consequently, the mass fraction of residual waste from trade and industry is estimated to account for approx. 17% of total collection volumes of residual waste.

Taking into account the indicated statistical uncertainties, the results of this study[149] correspond to the waste flows mentioned above: in addition to the municipally collected quantities, Styrian MBT and

[147] Art 2 para 4 N 2 AWG 2002.

[148] Classification according to the List of Wastes Ordinance.

[149] Laner, D. & Brunner, P.H.: Kriterien zur Trennung von Siedlungsabfall aus Industrie und Gewerbe als Voraussetzung zur Zuordnung zu Behandlungsverfahren (KRIGEZ). Studie (TU Wien) i.A. der Saubermacher Dienstleistungs AG und des Amtes d. Stmk. LReg., Amt d. Stmk. LReg. – FA19D, Graz, 2009.

residual waste splitting plants take over approx. 106,000 t of municipal waste and similar commercial waste (waste key number 91101) per year for treatment.

The study[149] of Vienna University of Technology investigates different scenarios for the separate or joint treatment of high calorific and low calorific fractions of residual commercial waste, evaluating possible effects on e.g. energy and climate balances. Due to uncertainties of available data the study did not detect any significant differences with regard to material flows in the different scenarios: *"As the calculated uncertainties in the context of scenario balances do not show any significant differences from each other […] and the scenarios are to be considered as "model systems", an evaluation with the calculated mean values seems to be appropriate*[150]*"(unofficial translation).* The recommended measures derived from the mean values of the calculated parameters for the different scenarios can be summarised as follows:

- Waste materials, sorted production residues and other homogenous wastes suitable for recycling or material recovery shall be collected separately to the largest extent possible and where they are generated.
- Mixed high calorific wastes shall preferably be treated in residual waste splitting plants; additionally separate collection of high calorific fractions might be advantageous with regard to energetic recovery and the climate balance resulting thereof.
- Waste management-related aspects (e.g. expenses for collection and treatment of waste as well as evaluations of climate and energy relevance of suitable waste treatment pathways) shall be taken into account during the development of specific waste management concepts.
- The poor quality of available data concerning volumes and composition of municipal waste from industry and commerce shall be improved.

The results of the study[149] provided by Vienna University of Technology clearly show that increased efforts are required in particular in the commercial sector to implement **separate collection of waste materials where they are generated**. Taking into account the regulations of the new Waste Framework Directive, stating that waste shall be recovered and waste materials shall be materially recovered wherever possible, measures for improved separate collection of recoverable/repairable and recyclable waste have to be set in the future. Internal waste management concepts are fundamental for an effective implementation of this target at the company level. In particular in the field of public and semi-public institutions, suitable steps for successful separate collection of the mentioned waste fractions should be taken, e.g. by creating the work group "*Wiederverwendung in Beschaffung und Bestandsverwaltung – Recycling in Procurement and Inventory Administration*.

[150] Laner & Brunner, 2009, p. 75.

3.4 Street sweepings and waste on public areas (littering)

3.4.1 Waste volumes

The term “street sweepings” is used for municipal waste generated on public streets, squares and parks that are by nature subject to residual waste treatment[151]. The overview of waste volume trends for street sweepings (Figure 29) shows varying results for the calculations of street sweeping volumes; this might be due to different waste classifications within the annual waste investigation at the municipal level. The long-term average volume ranges from **3 to 4 kg/inhab/year**.

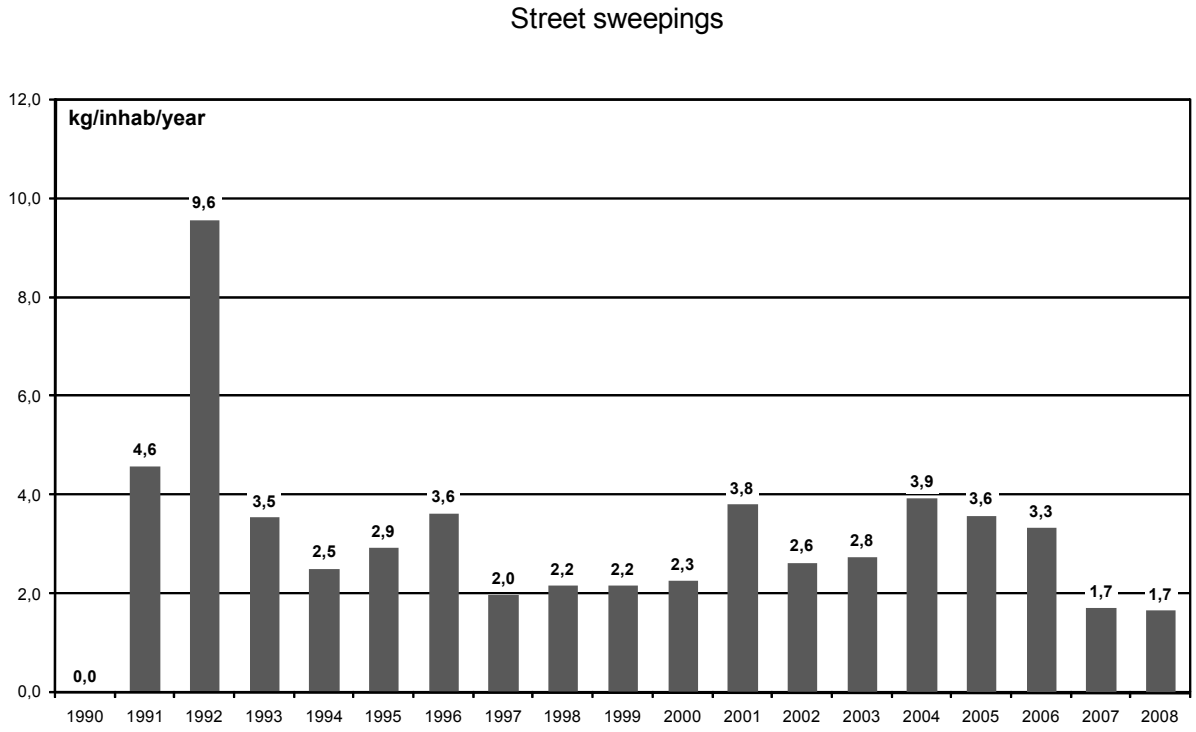

Figure 29: Street sweepings in Styria, 1990-2008

Waste on public surfaces (littering)

“Littering“ refers to improper handling and disposal of waste in public areas and implies that waste is left on streets, squares or in parks if it is generated there even though containers for disposal are in immediate vicinity (Figure 30). The term also includes the throwing of wastes (e.g. drink cans, food packagings, etc.) from vehicles on streets or parking areas (emptying cigarette trays).

[151] Art 4 para 4 N 4 StAWG 2004.

Figure 30: Littering observed the Grazer Schlossberg

This type of illegal waste disposal is mainly encountered in parking and resting areas, in poorly frequented street sections and in open spaces reserved for leisure activities, such as playgrounds or hiking paths. Over the last years, a significant increase in waste on and around Park&Ride areas was observed. Type and quantity of the illegally dumped waste suggest that it originates in households and companies.

Collection and disposal of litter represent a considerable burden for cities and municipalities (Figure 31). Frequently, cleaning services are required on Sundays and public holidays when increased littering is observed due to higher frequentation of public squares and parks, e.g. in warm summer nights. Because of personnel costs, the expenses for collection and treatment of littered wastes amount to up to 3,000 Euro/t.

Figure 31: Cleaning of public squares and parks are very cost-intensive for municipalities

Street sweepings are collected via municipal collection structures (municipal street cleaning) or by third parties before they are treated adequately. In Styria, around 450 waste collection containers are available along state roads, mainly on parking and resting areas and at bus stops, so that road users can dispose of their waste (e.g. packaging materials of food and drinks, cigarette packagings) while they are on the road. Street litterings are mainly collected by hand, and their disposal incurs expenses for the road maintenance organisation.

Municipal wastes generated in the context of events (e.g. festivals, concerts, open-air theatre performances, circuses) are not classified as street sweepings because these wastes can be assigned to a producer (organiser). The organiser must collect and recycle or dispose of all wastes generated during the event or performance.

Within the approval of events and festivities on public squares, streets and parks organisers may be obliged to distribute reusable dishes, possibly by application of a deposit system. The City of Graz has for instance agreed on *Richtlinien für die Erteilung der Zustimmung zur Durchführung von Veranstaltungen auf öffentlichen Flächen – Guidelines for the approval of festivities on public surfaces* on 15 November 2007. Art 4 lit 5 defines the obligation to distribute reusable dishes if food and drinks are served. Moreover, a disposal concept has to be developed for the remaining waste, which has to be presented to the environmental agency of the City of Graz for approval.

3.4.2 Waste treatment

In principle, street sweepings are treated with residual waste. If (recyclable) fractions can be separated during manual collection, they are materially recovered.

Waste which cannot be collected via organised disposal structures (system collection) is not only more cost-intensive, but also holds responsible for increased emissions due to additionally required collection vehicles.

3.4.3 Summary 2009

To enforce separate collection of waste on highway resting and parking areas, information boards were installed on the occasion of the 2008 UEFA European Football Championship (EURO08) and the consequently increased traffic volumes (Figure 32). The concept was developed and implemented by FA19D, *ASFINAG* (plans, finances, maintains and tolls the entire Austrian motorway and expressway network) and technical unit Waste and Waste Water Management of the Regional Economic Chamber of Styria. Additionally, panels with information in English language and pictograms are available at 23 resting areas along the Styrian highway sections of A2 and A9.

Figure 32: Information signpost on waste separation, installed at the occasion of the EURO08 at 23 highway resting areas in Styria.

The L-AWP 2005 does not contain estimates related to street sweepings. Already in the year 2001, however, the project ***G'scheit Feiern*** (*The new way of celebrating in Styria*, http://www.gscheitfeiern.steiermark.at) was initiated by the Province of Styria, contributing since then to reduced waste volumes generated during festivities. Specific ***G'scheit feiern* criteria** were defined, which result – if respected – in a reduction of specific waste volumes of approx. 0.7 kg per guest of festivities and events (Figure 34). In 2009, FA19D filed an application to register the word mark and logo *G'scheit feiern* as trademark (Figure 33).

Figure 33: Registered trademark "*G'scheit Feiern*" by FA19D

The **criteria for *G'scheit Feiern*** festivities include:

- waste prevention by using reusable dishes (renting the "dish mobile")
- waste prevention by using reusable cups (deposit system)
- regional added value by offering regional food
- increased gastronomy culture by eating from porcelain dishes instead of plastic plates
- increased gastronomy culture by drinking from glasses instead of plastic cups
- satisfied guests thanks to the excellent logistics provided by *Ökoservice GmbH*
- sensibilisation towards sustainable mobility by promoting the use of public transport, shuttle services, car sharing, taxis or – in particular cases – carriages

Figure 34: Littering after an event (left side) and waste generation after a festivity organised according to *G'scheit Feiern* criteria (right side)

To raise public awareness for the problem of public littering among as many Styrian citizens as possible, FA19D organised the initiative ***Der große Steirische Frühjahrsputz*** – *Styrian spring-cleaning* (http://www.abfallwirtschaft.steiermark.at) in 2008 and 2009. It was supported by municipalities, waste management associations, schools and NGOs (e.g. *Berg- und Naturwacht, Landesfeuerwehrverband*) and was organised by waste consultants at the regional level. The participants (20,000 persons in 2008 and 33,000 in 2009) collected approx. 120,000 kg of waste in 2008 and approx. 140,000 kg in 2009, respectively (Figure 35).

Summarising, the participating institutions came to the conclusion that such initiatives are suitable measures to raise public awareness, representing a major contribution to fight littering. Therefore, the initiative will be repeated every year.

Figure 35: School children participating in the initiative *Der große Steirische Frühjahrsputz*, 2009

3.5 Bulky municipal waste (bulky waste) and waste wood

3.5.1 Waste volumes

Since the late 1980s, volumes of bulky waste and separately collected waste materials have been steadily increasing in **Austria** due to a higher standard of life, growing household numbers and more consumption of products with shorter service life (in particular applicable for furniture and household appliances).

In 2004, around **236,000 t of bulky waste** were produced by **Austrian** households and similar institutions. The volumes per federal province for the same year range from **12 to 39 kg/inhab**. These numbers, however, cannot fully be compared with each other because an organised pre-collection of recoverable fractions is not offered in all municipalities or provinces. In this case, the separated materials are only partially classified as bulky waste or are mainly found in various waste material fractions in the provinces. To some extent, however, collection volumes are comparable because bulky waste volumes basically depend on the residual waste containers used. Summing up the total bulky waste volumes of the provinces in 2004 (around 236,000 t) and the separately collected bulky waste ("household scrap" amounting to approx. 99,000 t and bulky waste wood amounting to approx. 121,000 t) results in a **federal bulky waste volume of approx. 456,000 t** or **56 kg/inhab**[152].

[152] *BMLFUW*: 2006.

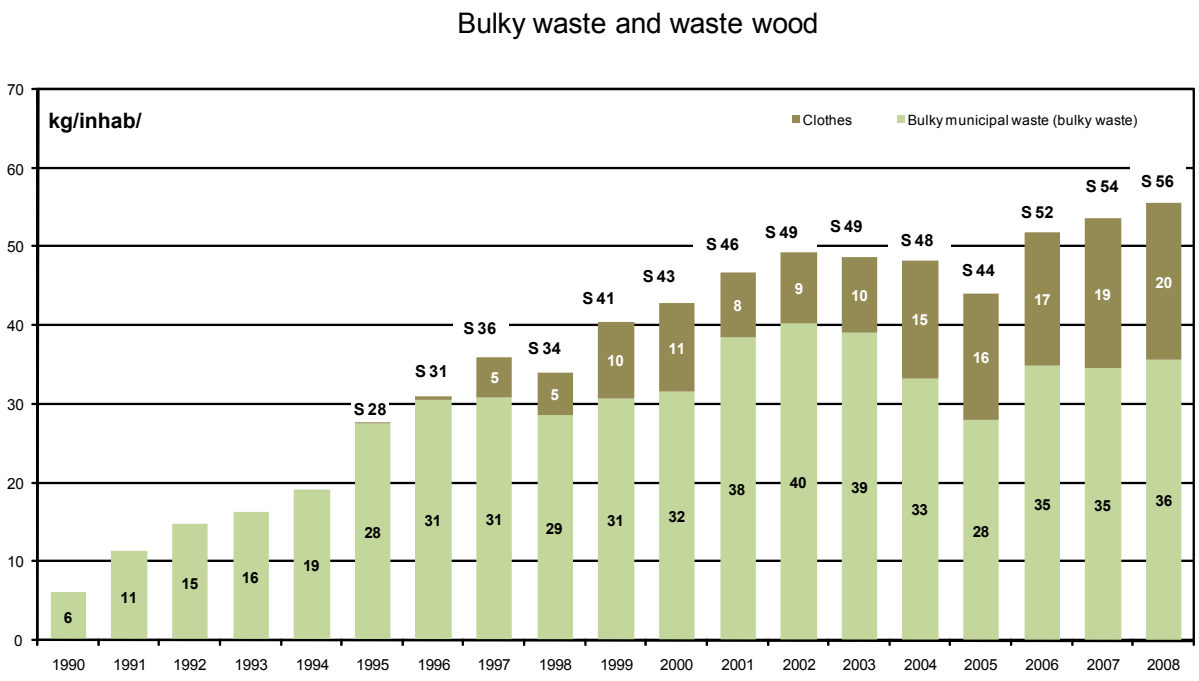

Figure 36: Collection volumes of bulky waste and waste wood in Styria, 1990 - 2008

Figure 36 shows that the bulky waste volume increased from 6.1 kg/inhab in 1990 to 36.3 kg/inhab in 2008. Waste wood is mainly collected via municipal waste material collection centres where it can be disposed of during the opening hours. Since 1995, collection volumes of waste wood have been indicated separately. The amount of separately collected waste wood increased from 5 kg/inhab in 1997 to 20 kg/inhab in 2008. Styrian bulky waste collection is also performed via the 383 **waste material collection centres (bring-it-yourself system)**.

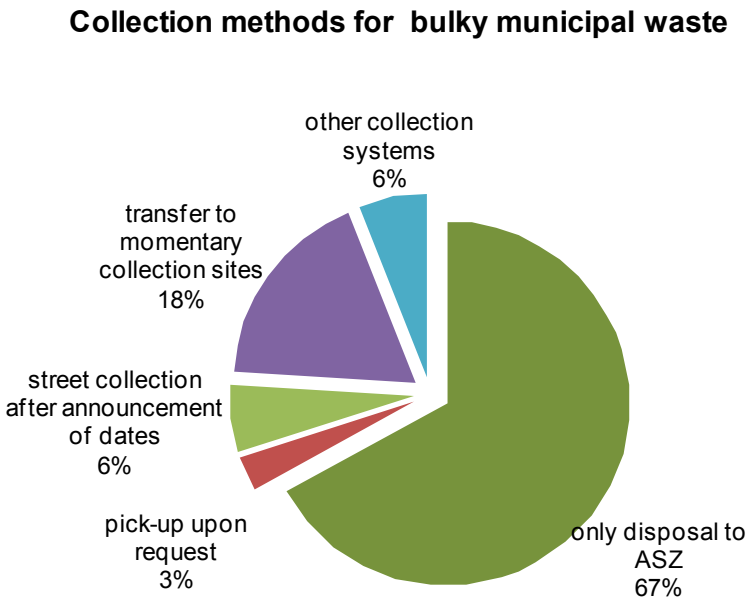

Figure 37: Collection of bulky municipal waste in Styria (data collected from 117 municipalities)

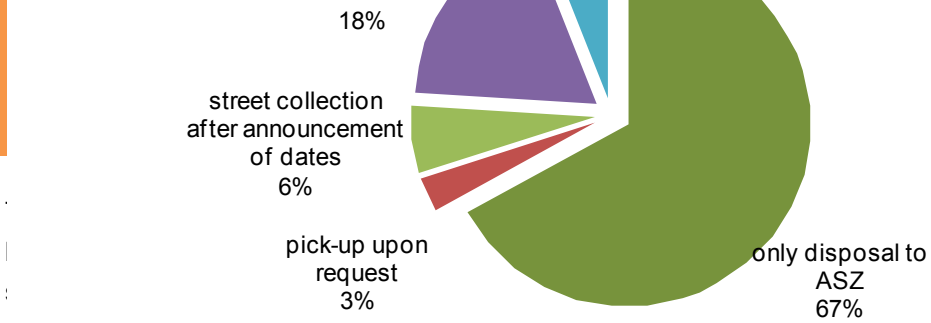

Figure 37, bulky waste is exclusively collected via waste material collection centres in 67% of municipalities; in comparison mobile bulky waste collection (in 3% upon request, in 6% following an announced schedule) plays a minor role.

3.5.2 Waste treatment

In the waste material collection centres, waste wood is divided into treated or untreated waste wood before it is materially (e.g. production of particle boards) or thermally (e.g. production of expanded clay, industrial fluidized bed firing) recovered. The energy contained in waste wood (calorific value: 16,000 kJ/kg in DM) replaces primary (fossil) energy sources in the field of industrial incineration.

Waste metals contained in bulky waste (mainly ferrous scrap and aluminium, e.g. of car rims) are recycled, which allows saving energy and greenhouse emissions compared with metal production by use of primary resources.

3.5.3 Summary 2009

Contradictory to the forecasts of the L-AWP 2005, estimating residual and bulky waste shares of 42%, the actual rate amounted to only 38% of total waste volumes. Total bulky waste collection volumes were reduced by 7% between 2003 and 2008; related to the number of inhabitants the decrease amounted to 9%. Both values remained therefore below the forecast value.

In the same time, the collection volumes of waste wood doubled, whereas the number of waste wood disposed of as residual waste has been reduced to 0.4 kg/inhab/year since 2003.

A current study of the Province of Upper Austria on the composition of provincial bulky waste shows that 84.7% of waste materials are disposed of as bulky waste. This number is composed of 29.5% of furniture and composite materials, 8.1% of non-packaging plastic materials, 7.6% of demolition and construction waste, 6.4% of mattresses and 6.4% of textiles and carpets.[153] Consequently, there is an evident potential for recycling and recovery of bulky waste, which also has to be exploited to an increasing extent in Styria.

[153] Europaticker: Umfassende Sperrabfallanalyse in Oberösterreich dokumentiert: moderne Abfallaufbereitung bringt Geld und schafft Arbeitsplätze. http://www.umweltruf.de, 15.03.2010.

3.6 Biogenic municipal waste (organic waste)

3.6.1 Waste volumes

In **Austria** an average quantity of **86 kg/inhab** (714,900 t in absolute numbers)[154] of biogenic municipal waste was collected in the year 2008.

In **Styria**, 95,136.2 t of biogenic waste were collected and recovered in 2008. This corresponds to **78 kg/inhab** and is composed of 56 kg/inhab/year of kitchen and garden waste collected in organic waste containers, 20 kg/inhab/year of municipal garden and park waste and 2 kg/inhab/year of biogenic cemetery waste (Figure 38). Data on biogenic waste recovered in home or community composting are not collected comprehensively; they are estimated to amount to approx. 50,000 t/year.

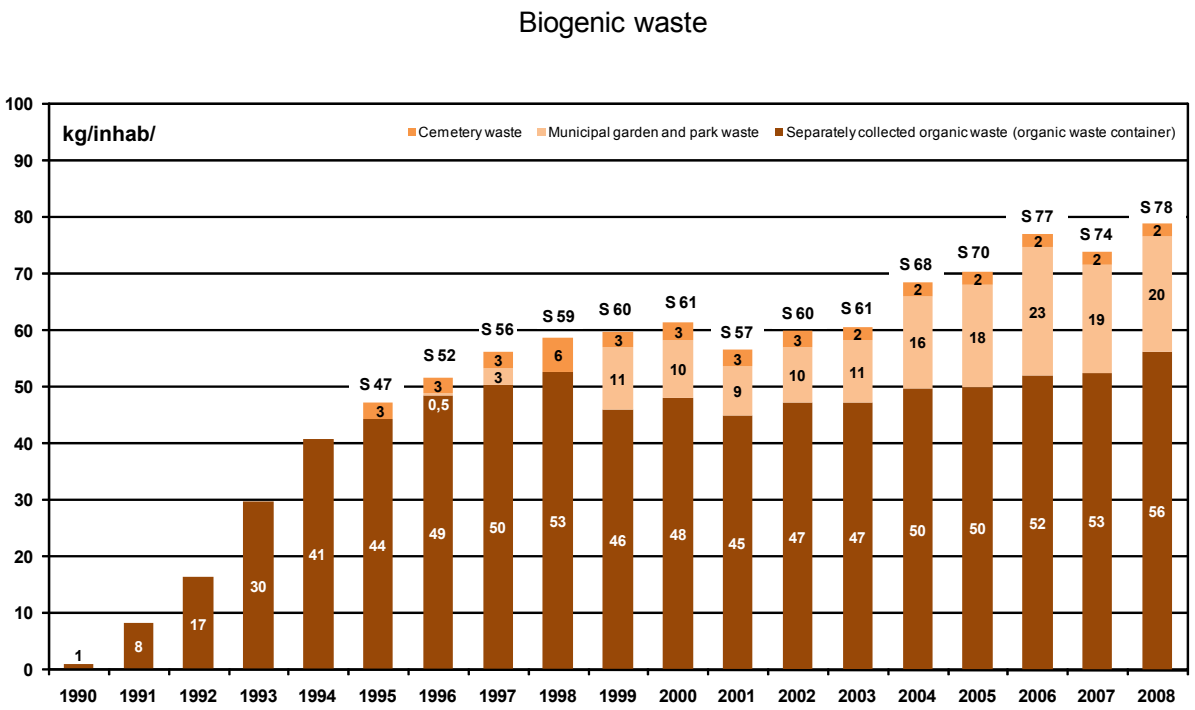

Figure 38: Collection volumes of separately collected biogenic waste in Styria, 1990-2008.

The separate collection of biogenic wastes and their recovery were introduced as pilot projects in Styrian waste management from 1987 to 1989 and were defined as targets in the Styrian Waste Management Concept 1989. As first Austrian province, Styria legally implemented the separate collection of biogenic waste by integrating it into the Styrian Waste Management Act 1990 (StAWG). As early as in 1993, the set goal of separately collecting and composting biogenic waste was fully achieved at the provincial level. Currently, around 51% of household biogenic waste is collected in organic waste containers. The rest, mainly biogenic waste originating in gardens and green spaces, is collected via municipal structures or socio-economic organisations. In rural areas and households with gardens, biogenic waste is recovered by home or community composting, which has been

[154] Umweltbundesamt GmbH, 2010.

encouraged by the Provincial Government of Styria according to the slogan "as centralised as required and as decentralised as possible". FA19D published a brochure with guidelines for "*Dezentralisierte Kompostierung in der Steiermark - Decentralised composting in Styria*"[155], which can be downloaded under www.abfallwirtschaft.steiermark.at (Figure 39).

Figure 39: FA19D brochure "*Dezentralisierte Kompostierung in der Steiermark*"

The results of the project *Steirischer Abfallspiegel 2009* with regard to distribution of containers for biogenic waste collection are illustrated in Figure 40 (distribution of containers) and Figure 41 (collection intervals). In Styria, biogenic waste is mainly collected in 120 l containers. In most municipalities collection intervals vary according to the seasons: organic waste containers are emptied every week in the summer months and every two weeks in winter.

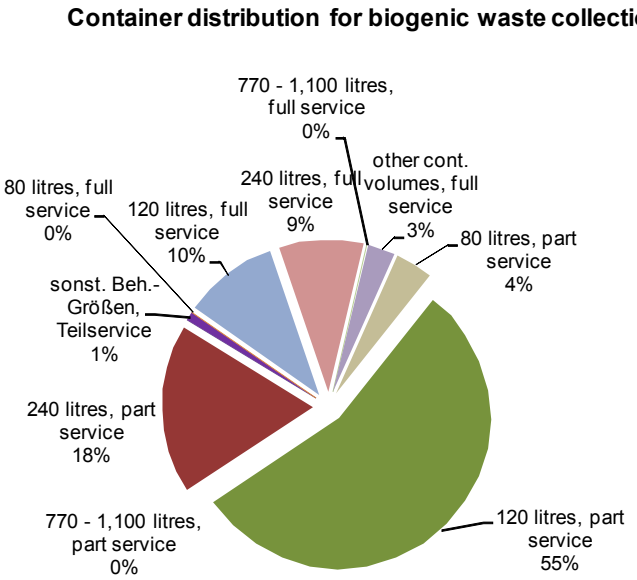

Figure 40: Distribution of containers for organic waste collection in Styria (data collected in 117 municipalities)

[155] Amt d. Stmk. LReg. – FA19D (Hrsg.): Leitlinie. Dezentrale Kompostierung in der Steiermark. Graz, 6. Auflage, 2009.

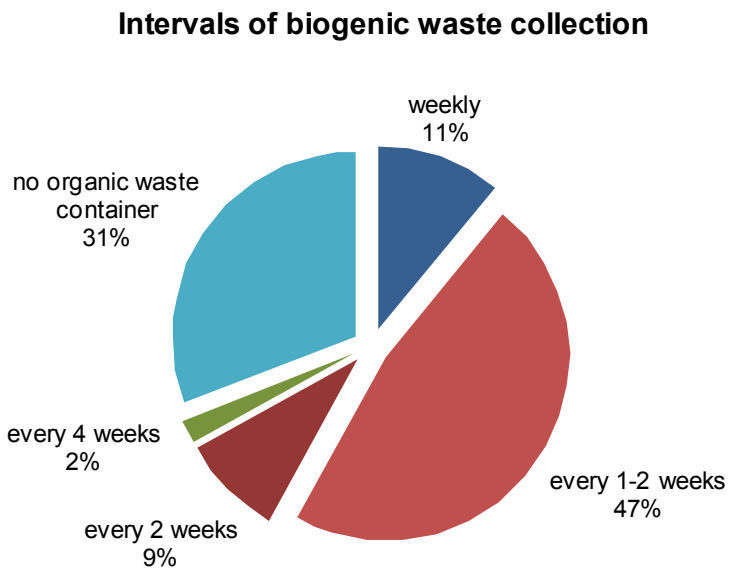

Figure 41: Intervals of biogenic waste collection in Styria (data collected in 117 municipalities)

Collection container volumes between 368 l/inhab/year and 2,185 l/year inhab (median: 832 l/inhab/year) are available for serviced households, achieving collection volumes from 81 kg/inhab/year to 374 kg/inhab/year (median: 156 kg/inhab/year). Comparing the data gathered in the project *Steirischer Abfallspiegel 2009* with the number of citizens in the participating communities, the median for the specific collection volume of biogenic waste amounts to 37 kg/inhab/year.

3.6.2 Waste treatment

Two treatment forms are possible for biogenic waste: aerobic treatment (composting) and anaerobic treatment (fermentation).

3.6.2.1 Composting

In Styria, the main form of biological treatment of biogenic municipal waste is composting (Figure 42), aiming to generate a product rich in humins (compost) from biogenic waste[156]. If the requirements of the Compost Ordinance are met, the used wastes eventually lose the characteristic properties of waste: they run through specific processes before defined output qualities are determined and can then be considered a competitive product which is returned to the natural cycle.

Impurities in biogenic municipal waste (“misthrows”, any false disposals) can significantly increase the pollutant content of biogenic waste, making it inadequate for composting. Since only high-quality biogenic waste is suitable for composting impurities must be separated, which necessitates technical efforts or increased personnel input. Modern systems automatically detect impurities in organic waste containers and allow reducing their number by informing the waste producer or by not emptying the

[156] Note: municipal sewage sludge is also composted, see Chapter 3.16.

containers in question[157]. In the future, measures to reduce false disposals should be taken in particular in areas where a lot of impurities are detected in organic waste containers.

24 communal or commercial composting facilities (Table 12, Figure 43) with a processing capacity of approx. 65,000 t/year are available in Styria. Moreover, 46 agricultural composting plants (Table 13, Figure 43) with a processing capacity of approx. 55,000 t/year hold approvals. Therefore, the total Styrian processing capacity amounts to 117,000 t/year[158].

Figure 42: In Styria, composting of separately collected biogenic waste is mainly performed in uncovered piles

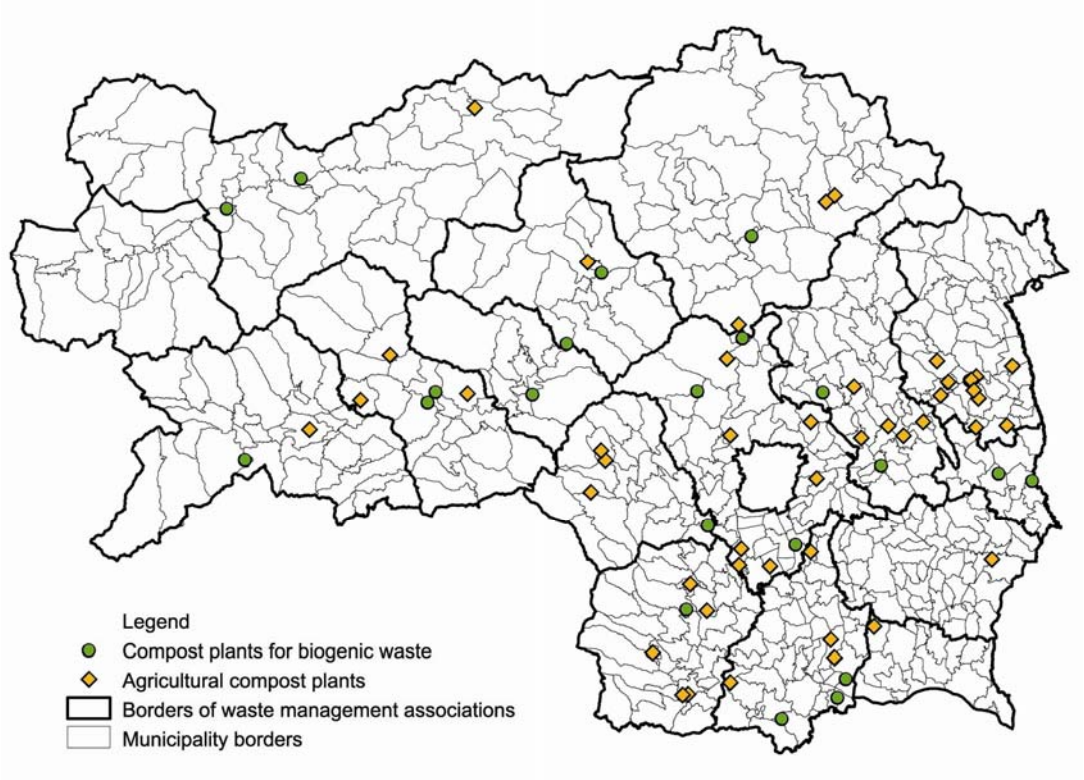

Figure 43: Sites of corporate and agricultural composting facilities in Styria (as at January 2010)

[157] cf. eg: Neues von Maier & Fabris: Innovation am Detektionssystem. In: KGVÖ Newsletter No. 130, 2008, p. 2 f.

[158] as at January 2010.

Site	Capacity in t/year	Operator
Bad Gams	2,500	*Franz Groß*
Fürstenfeld	1,200	*Stadtwerke Fürstenfeld*
Großwilfersdorf	200	*Gemeinde Großwilfersdorf*
Loipersdorf	75	*Gemeinde Loipersdorf*
Fernitz bei Graz	300	*Gemeinde Fernitz*
Röthelstein	10,000	*TRANS BETON GesmbH. (CEMEX)*
Übelbach*	660	*U.M.S. Dienstleistungs- und Handels GmbH*
Kaindorf	2,000	*A.D. BioERDE und Kompost GmbH*
Judenburg	1,800	*Stadtwerke Judenburg*
St.Margarethen/Knittelfeld	12,490	*Naturgut Dietmaier - Poschacher*
Leutschach	2,780	*Musger ARGE Süd*
Spielfeld	1,200	*BIOWOLF*
Straß *)	240	*Marktgemeinde Straß*
Kraubath	5,000	*Naturgut Dietmaier - Poschacher*
Trofaiach	800	*Stadtwerke Trofaiach*
Irdning	800	*Marktgemeinde Irdning*
Liezen	6,000	*AWV Liezen*
Allerheiligen	6,500	*AWV Mürzverband*
Laßnitz bei Murau	100	*Stadtgemeinde Murau*
Neumarkt	100	*Gemeinde Neumarkt*
Söding	2,900	*U.M.S. Dienstleistungs- und Handels GmbH*
Gleisdorf	2,500	*U.M.S. Dienstleistungs- und Handels GmbH*
Mortantsch	5,000	*Johann Eder*
Thannhausen	325	*Gemeinde Thannhausen*
Total	**65,470**	

* Conversion of approved cubature to tonnes, taking from the literature values for density of input materials

Table 12: Commercial and municipal composting facilities in Styria (data from licensing notices; as at January 2010)

Site	Capacity in t/year	Operator
Pernegg/Mur	500	*Oskar Sarkleti*
Rassach	400	*Franz Legenstein*
Schwanberg	305	*Alois Masser*
Stainz	800	*Johannes Haas*
Wies	400	*Josef Lipp*
Wies	700	*Josef Jauk*
Fehring	220	*Manfred Koller*
Dobl	2.000	*Stefan Pongratz*
Dobl	1.200	*Johann Pracher*
Gratkorn	100	*Franz Lanz*
Kumberg	390	*Anton Gauper-Ertl*
Laßnitzhöhe	300	*Heinz Lukas*
Wundschuh	320	*Thomas Baier*
Ebersdorf	1.600	*Karl Peheim*
Friedberg	100	*Peter Ringhofer-Rechberger*
Großhart	1.500	*Josef Radl*
Hartberg Umgebung	1.100	*Ingrid Rodler*
Hofkirchen	800	*Josef Peinsipp*
Kaindorf	1.350	*Anton Thaller*
Kaindorf	1.600	*Maria Jagerhofer*
Rohr/Hartberg	2.200	*Günter Raser*
Schönegg/Pöllau	1.000	*Johann Berger*
Tiefenbach/Kaindorf	300	*Josef Singer*
Fohnsdorf	5.350	*Sonja Wildbolz*
St.Oswald/Möderbrugg	380	*Josef Pfandl*
St. Peter/ Judenburg	70	*Johann Russold*
Unzmarkt -	23	*Johann Hebenstreit*
Gabersdorf	2.000	*Josef Luttenberger*
Gabersdorf	2.700	*Ernst Holler*
Gabersdorf	2.400	*Maria Huss*
Oberhaag	160	*Franz Tinnacher*
St. Ulrich/Waasen	580	*Richard Reisenhofer*
Gai	4.320	*Mag. Marieluise Thoma*
Großreifling	1.300	*Otto Duller*
Krieglach	110	*Vinzenz Rothwangl*
Krieglach	110	*Johann u. Elisabeth Rossegger*
Frojach-Katsch	1.140	*Werner Maier*
Mettersdorf/Saßbach	2.100	*Johannes Weber*
Maria Lankowitz	4.000	*Erich Krammer*
Graden	4.000	*Peter Blümel*
Graden	2.000	*Michaela Ortner*
Albersdorf-Prebuch	750	*Josef Matzer*
Ilztal	1.000	*Christine Mandl*

Pischelsdorf	500	*Josef Jandl*
St. Ruprecht/Raab	350	*Peter Hofer*
Thannhausen	240	*Peter Painer*
Total	**54.768**	

Table 13: Agricultural composting facilities in Styria (data from licensing notices, as at January 2010)

The scope of approval does not only cover (treated) biogenic municipal waste, but frequently includes other biogenic wastes. Composting facilities which also take over sewage sludge are additionally listed in Chapter 3.16.

Material collected in organic waste containers and sewage sludge must be mixed with bulking materials such as tree and bush cuttings before composting. An in-depth examination of material flows during composting (Figure 44) shows that a mass fraction of approx. 55% of the total input is biodegraded ("rotting loss"). Approx. 0.7% of the total input must be considered as impurities (in particular plastic and metals). Then the composted materials are sieved. The screening overflow (approx. 10% of sieved materials) is reintegrated into the composting process. Approx. 90% of the sieved materials, i.e. approx. 40% of the original input material, leave the facility as commercial compost. An annual quantity of approx. 46,000 t of commercial compost could be produced in Styria if all approved processing capacities of composting facilities were exploited. The amount of impurities largely depends on the quality of input materials, whereas the share of rotting losses depends on the type of input materials and processes. Therefore, the indicated data must be considered as average values.

Within the observation period from 2005 to 2008 40% of composts produced in Styria were suitable for classification as quality compost class A+, 53% as quality compost class A, and 7 as quality compost class B.

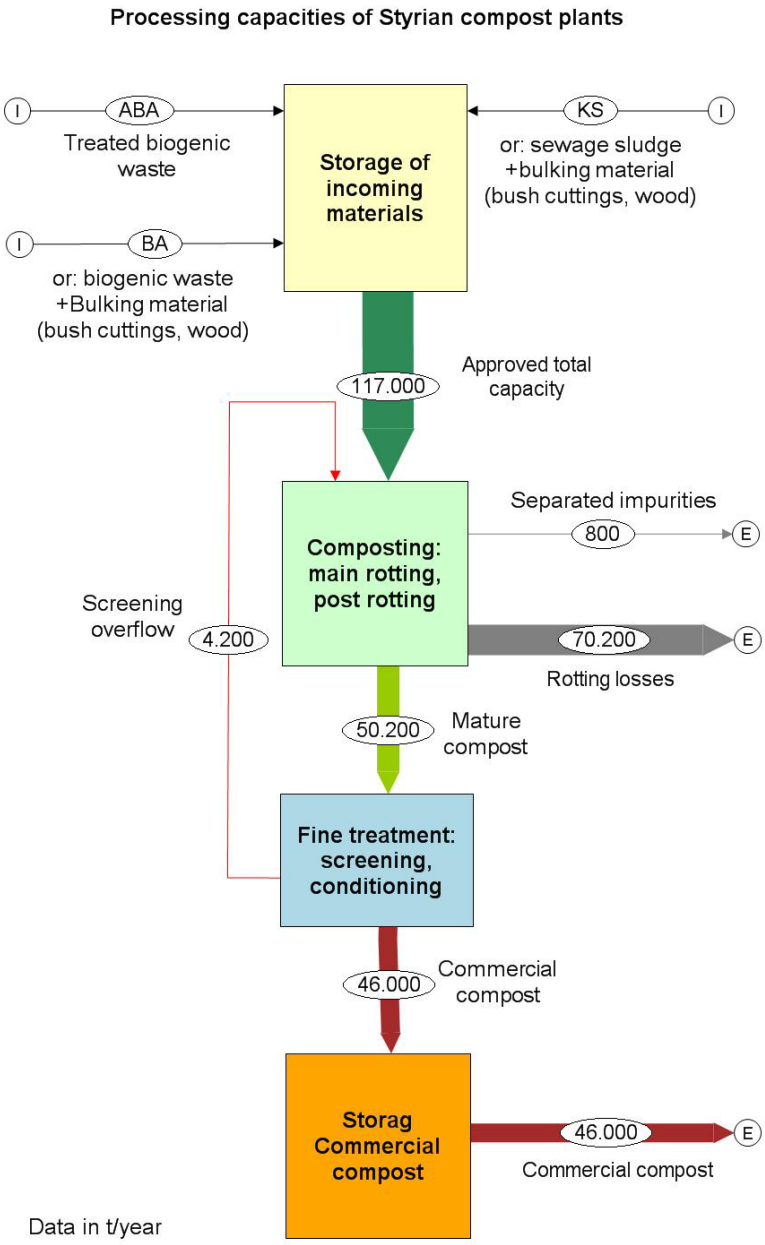

Figure 44: Capacities of Styrian composting facilities and illustration of material flows

During the composting process, the organic input substance is biologically degraded: for instance, organic carbon is converted into carbon dioxide (CO_2), hydrogen contained in the organic mass into water (H_2O). This mass reduction caused by biodegradation processes is referred to as “rotting loss” and on average amounts to approx 50%. Subsequently, approx. 50% of used organic carbon is released into the atmosphere as CO_2 without being any further exploited. Additionally, methane (CH_4) and nitrous oxide (N_2O) are produced in anaerobic compartments, which may be the result of insufficient ventilation of the rotting material. According to data of the *Klimaschutzbericht 2009 - Climate Protection Report 2009*[159] anaerobic waste treatment, and in particular composting, account for 5.0% of all GHG emissions produced by the waste management sector. Moreover, these GHG

[159] Anderl et. al, 2009.

emissions have experienced a major augmentation by 214.2% since 1990, representing the highest increase within this sector.

Equally, the heat generated during composting is lost without being exploited. As advantage of composting some organic carbon of the used biomass is on the long term trapped in the humus as part of the terrestrial carbon sink. According to calculations of the Environmental Protection Encouragement Agency (EPEA)[160] composting 1 t of biogenic waste allows for permanent trapping of approx. 35 kg carbon in 60 kg humus. The agency also underpins the positive effects of composting for soil fertility, biodiversity and soil structure.

3.6.2.2 Biogas plants

In biogas plants (Figure 45) biogenic raw materials (waste and/or agricultural residues) and, to some extent, sewage sludge are biologically converted into biogas and a remaining fermentation residue. This process does not require oxygen (anaerobic treatment) and is done by microorganisms, producing combustible biogas from the carbon contained in the biogenic raw materials. Biogas is a mixture of 60% vol. CH_4 and 40% vol. CO_2 with a calorific value of approx. 22 MJ/Nm^3, depending on the CH_4 content.

As at January 2010, 44 biogas plants with a total processing capacity summing up to approx. 500,000 t/year were operated in Styria (Figure 46). In about half of all biogas plants energy crops (so-called renewable resources) and farm-produced fertiliser (in particular pig manure) are treated, whereas agricultural residues and other commercial biogenic waste (from food, beverage and feeds industries, gastronomy, etc.) are treated in the remaining plants. Currently, the **treatment of biogenic municipal waste in biogas plants** plays a **minor role**; the same is true for the joint treatment of biogenic waste and municipal sewage sludge in digestion towers of sewage treatment plants (so-called **co-fermentation**). In principle, kitchen waste and grass cuttings would be well suited for fermentation, whereas wooden parts (tree and bush cuttings) are not biodegradable during anaerobic processes.

Figure 45: Biogas plant/fermentation tank with foil gas storage

[160] EPEA: Ökologisches Leistungsprofil von Verfahren zur Behandlung von biogenen Reststoffen. Kompass für die Entscheidungsfindung vor dem Hintergrund der geplanten Überarbeitung des Erneuerbaren-Energien-Gesetzes. Hamburg, 2008; http://www.epea.com.

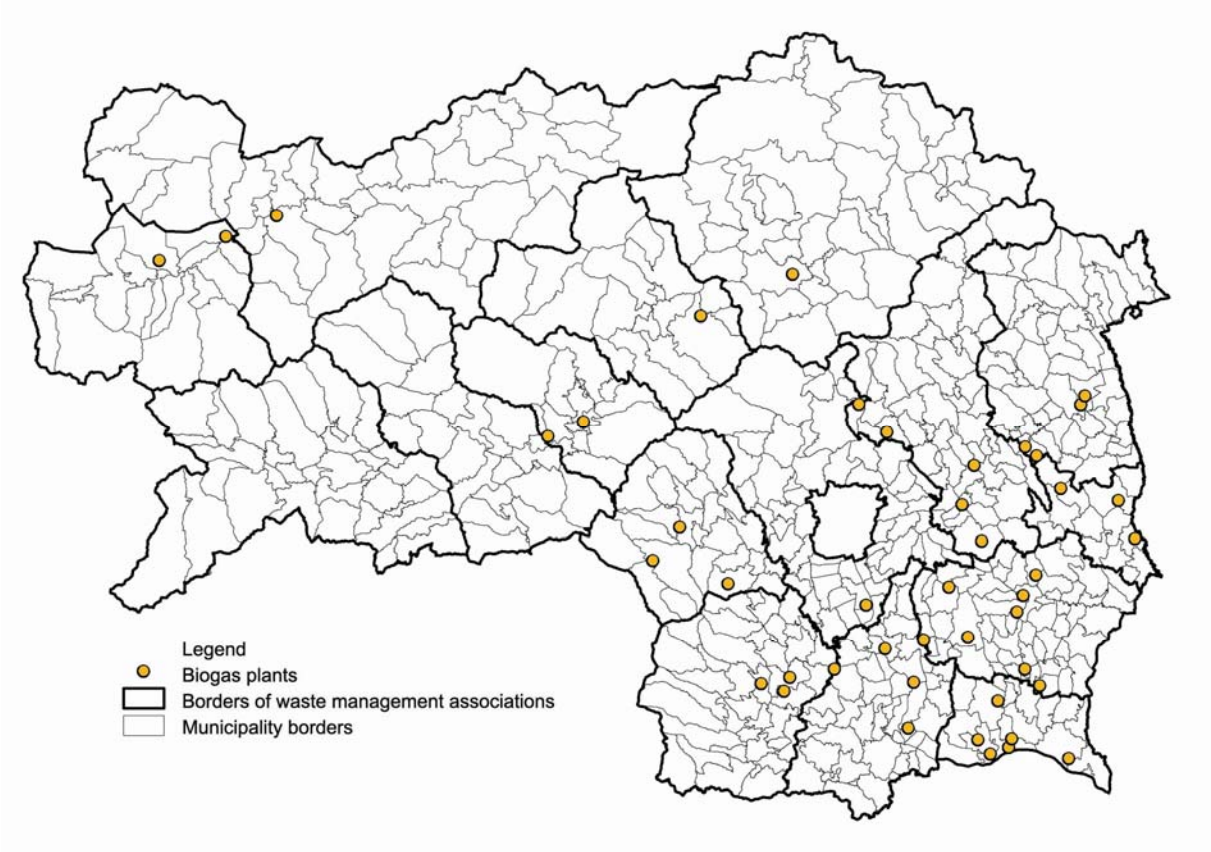

Figure 46: Sites of biogas plants in Styria (as at 1 January 2010). Input materials comprise approx. two thirds of energy crops and farm-produced fertilisers. To date, the use of separately collected biogenic waste and sewage sludge is limited.

Figure 47 illustrates the treatment principle of biogas plants. The material flows are based on available Styrian plant capacities. During treatment, impurities still contained in the waste are separated because they can have negative impacts on the substrate and process flow. The main impurities are floating matters such as wood, straw, plastic etc. as well as settling sediments such as metals, sand, stones, glass, etc.

To adjust the optimum dry matter content in the fermenter, already fermented material (recyclate) is partly re-introduced. Alternatively, water is introduced into the plant with the input materials.

The produced biogas can either be transformed into electric energy and heat in block heating stations or heat can be generated directly. Alternatively, correctly purified biogas can be introduced into the natural gas system or used to operate vehicles. To 75%, the fermentation residue (also referred to as biogas manure if only energy crops and farm-produced fertiliser were used) is directly applied to agricultural surfaces as fertiliser. Approx. 25% are pressed and composted, or thermally recovered. The waste water generated during the pressing process is either recovered agriculturally or introduced into waste water treatment plants.

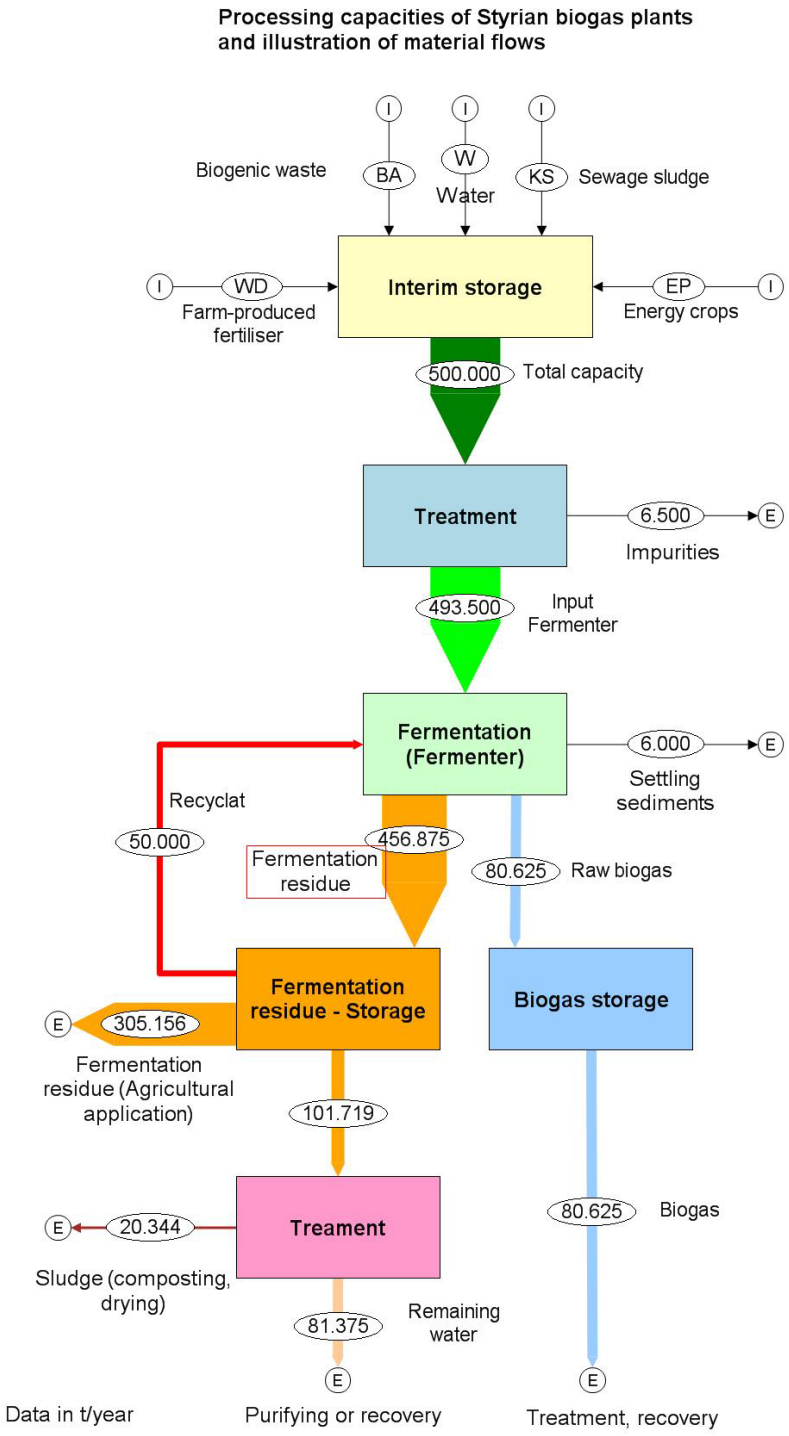

Figure 47: Capacities of Styrian biogas plants and illustration of material flows

Since fermentation is a biological process involving various plant designs, the material flows illustrated in Figure 47 represent only average values: in practice, differences in plant conception and process design may involve major deviations from the scheme shown.

In biogas plants, approx. 85% of the carbon input is transformed into useable biogas with “climate neutral” combustion due to its biogenic origin. Minor quantities of the greenhouse gas methane (CH_4) are contained in the fermentation residue and may be emitted into the atmosphere if stored inadequately (e.g. in open storages) or during application to agricultural surfaces. Additionally, the

fermentation residue also contains nitrogen, mainly in the form of ammonia nitrogen, whereof approx. 13% are lost as NH_3 during application. The greenhouse gas N_2O can form in the soil from the applied nitrogen.

A study performed by the University of Rostock[161] on the ecological evaluation of fermentation of biogenic waste concludes that the positive greenhouse effects resulting from the different biological waste treatment processes are related to the "non-release of nitrous oxide and methane emissions". With regard to climate protection and taking into account other ecological effects (such as the release of ammonia or fine particles) fermentation of organic waste container contents followed by composting of the fermentation residue (together with bush cuttings) would be the process of preference.

Therefore, a combination of biogas production and composting should be considered during the development of new plants, while considering the regional characteristics and economic possibilities. For existing plants measures to reduce emissions have to be taken for reasons of climate protection, including:

- avoiding methane emissions by consequent application of anaerobic processes during composting
- self-contained storage of fermentation residues until application
- applying low emission methods for the application of fermentation residue
- if possible, optimising the combustion efficiency factors of biogas plants, e.g. utilisation of waste heat

3.6.3 Summary 2009

Compared with 2003, collection volumes have increased by approx. 30% in 2008; in the majority this is the result of a decline in home and community composting. Current estimates of waste volumes for Styria[162] expect this trend to continue in the field of home composting, accompanied by a simultaneous increase of households serviced with organic waste containers. By 2020, this development is anticipated to have increased the volumes of biogenic waste collected in organic waste containers by approx. 10%.

The target set in the L-AWP 2005 with regard to the production and use of high-quality composts in agriculture was achieved: 40% of composts produced in Styria are quality class A+ and 53% quality class A according to the criteria defined in the Compost Ordinance 2001.

Extensive official controls for compliance with the criteria defined in the Compost Ordinance guarantee the correct operation of agricultural composting plants. 84% of the operators of agricultural and commercial composting plants are member of a quality assurance system. Hence, the targets set in the L-AWP 2005 in terms of biogenic waste management were met at the municipal level.

To establish a quality management in biogas plants, the pilot project "*Biogasanlagenmonitoring Steiermark - Monitoring of Styrian biogas plants*" was realised with 15 participating biogas plant

[161] Morschek, G., Nelles, M.: Ökologischer Vergleich zwischen der Kompostierung und Vergärung von getrennt gesammelten Bioabfällen des Abfallwirtschaftsverbandes Leoben. Universität Rostock, 2008.

[162] Beigl & Lebersorger, 2009.

operators. The project aimed at emphasising the optimisation potentials and examining material flows in biogas plants. The results were presented at an international conference (Orbit 2009, Peking) and are available at www.biogas.steiermark.at.

According to the collected plant data and analysis results, most participating biogas plants have potential for optimisation. In terms of plant equipment, the average number of full load hours per year should be increased in some plants. Optimised process organisation and notably an increase of combustion efficiency factors would allow for better exploitation of the used substrates. For this purpose, continuous monitoring of the characteristic process parameters and daily documentation of used input materials and process parameters is recommended. Deficits with regard to combustion efficiency factors have been detected in particular for heat utilisation.

The composition of fermentation residues showed that regular analyses of the residues from all plants are indispensable for fertilisation planning and to avoid pollutant manifestations in soil during agricultural recovery. Continuing the established benchmarking database as instrument of quality assurance is desirable.

3.7 Waste paper

3.7.1 Waste volumes

In **Austria**, the specific paper consumption has increased by factor 1.6 from 166 kg/inhab/year in 1990 to 263 kg/inhab/year in 2007. In 2008, a slight decline of the *per capita* consumption to 252 kg/year was recorded. In the same time, the Austrian return rate of waste paper rose from 51.8% (1990) to 69.3% (2007). The return rate describes the share of collected waste paper measured against the consumption of new paper in the same period. Approx. 20% of paper products are not suitable for recovery for technical or hygienic reasons. The overall Austrian paper and cardboard production amounted to 2.932 million tonnes in 1990 and had increased to 5.199 million t in 2007, whereof 14.8% (769,000 t) were distributed within Austria and 84.9% (4.414 million t) were exported into 150 different countries. The amount of waste paper used by the Austrian paper industry has augmented by factor 2.1 between 1990 (1.143 million t) and 2007 (2.394 million t)[163].

Since 1990, **Styria** has succeeded to continuously increase waste paper collection volumes from 32,601 t (28 kg/inhab/year) to 101,194 t (**84 kg/inhab/year**) in 2008. Collection volumes therefore tripled in the observation period from 1990 to 2008 (Figure 48).

[163] Austropapier - Vereinigung der Österreichischen Papierindustrie (Hsg.): Die österreichische Papierindustrie 2008. Ein Wirtschaftszweig lebt Nachhaltigkeit. Wien, 2008; http://www.austropapier.at.

Waste paper

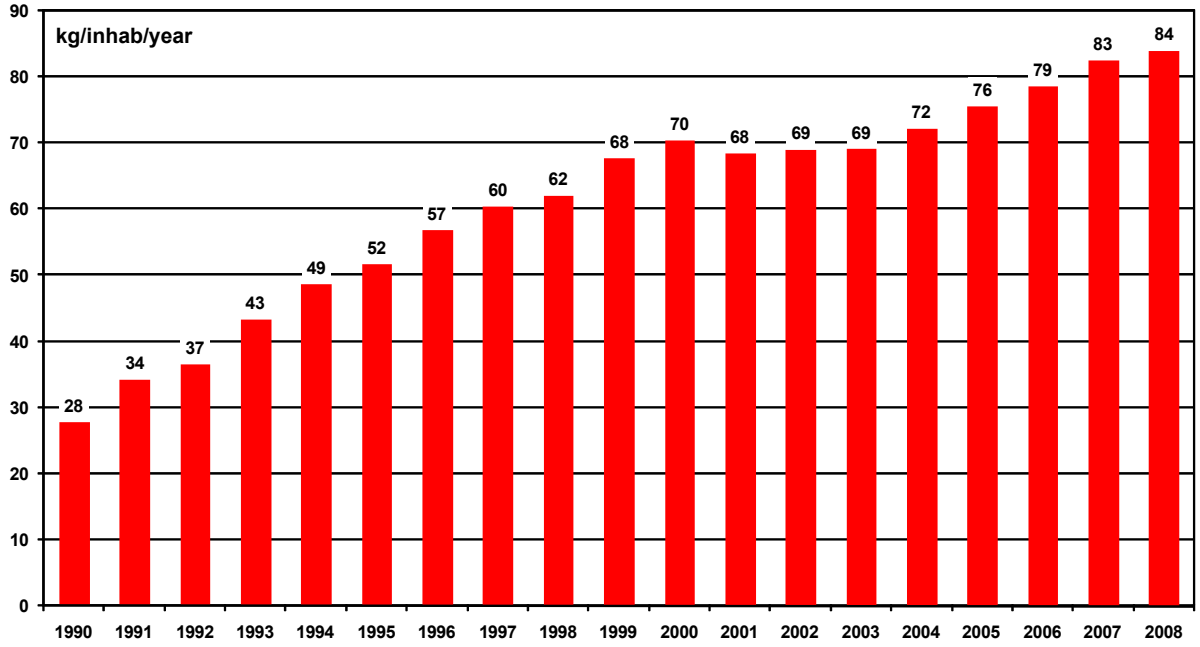

Figure 48: Municipal collection volumes of waste paper in Styria, 1990-2008.

Municipal waste paper is collected as “mixed waste paper“. Non-packagings (newspapers, printed forms etc.) and packagings (cardboards) are collected in one collection container, frequently in residential containers (red container). The mass fraction of packaging paper in the waste paper containers amounts to approx. 16%. ARA compensates for the expenses incurred to municipalities during the collection of packaging paper plus an extra 70% volume fee (i.e. extra fee for cardboards). In the district of Hartberg, daily newspapers are collected separately for the production of insulating materials. Separate collection of daily newspapers allows for two- to threefold higher revenues compared with mixed paper.

In total, 141,680 containers are available for Styrian citizens for the collection of waste paper. They are situated either residentially, in collection bays, or in waste material collection centres. The results presented in the *Steirischer Abfallspiegel 2009* show that the 117 participating municipalities cover a **collection volume** spectrum from **357 l/inhab/year to 1,211 l/inhab/year** (median: **646 l/inhab/year)**, mainly collected in 240 l containers (Figure 49). The most frequent collection intervals are six weeks, followed by eight weeks (Figure 50). The specific collection volumes in the participating municipalities range from **50 kg/inhab/year** to **93 kg/inhab/year** (median: **65 kg/inhab/year)**. During the last year, a shift from the bring-it-yourself system to household collection (disposal system) has been observed, resulting in a significant improvement of collected volumes as well as waste paper quality.

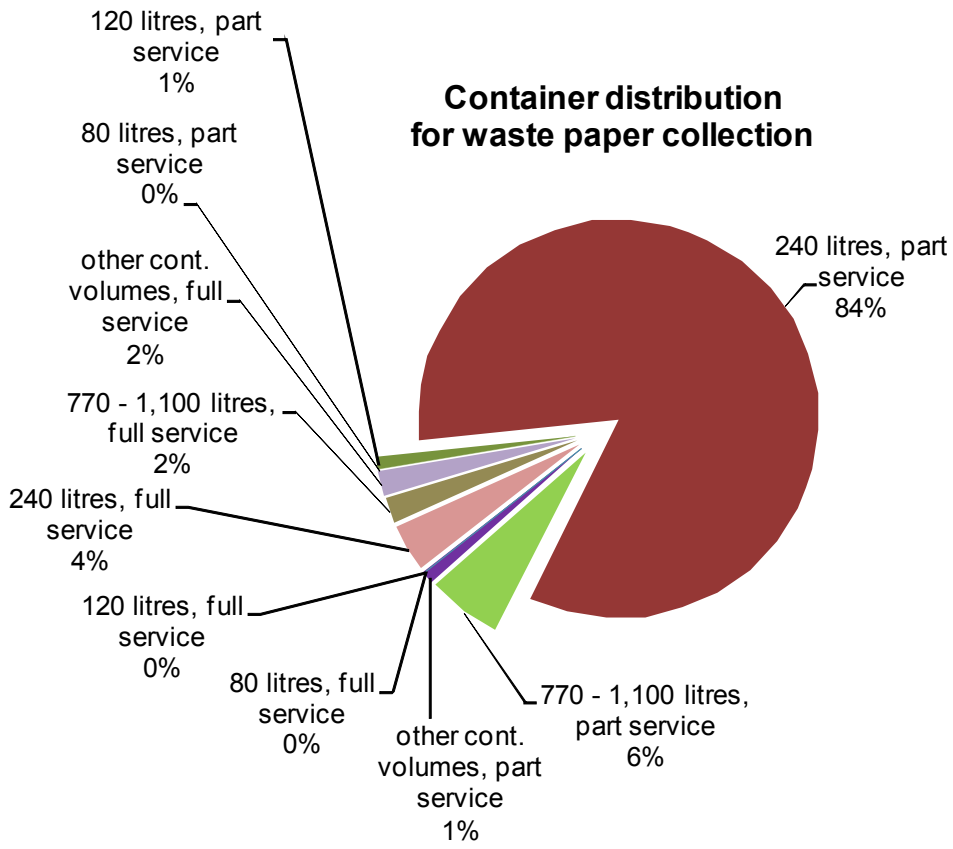

Figure 49: Distribution of containers for waste paper collection in Styria (data collected in 117 municipalities)

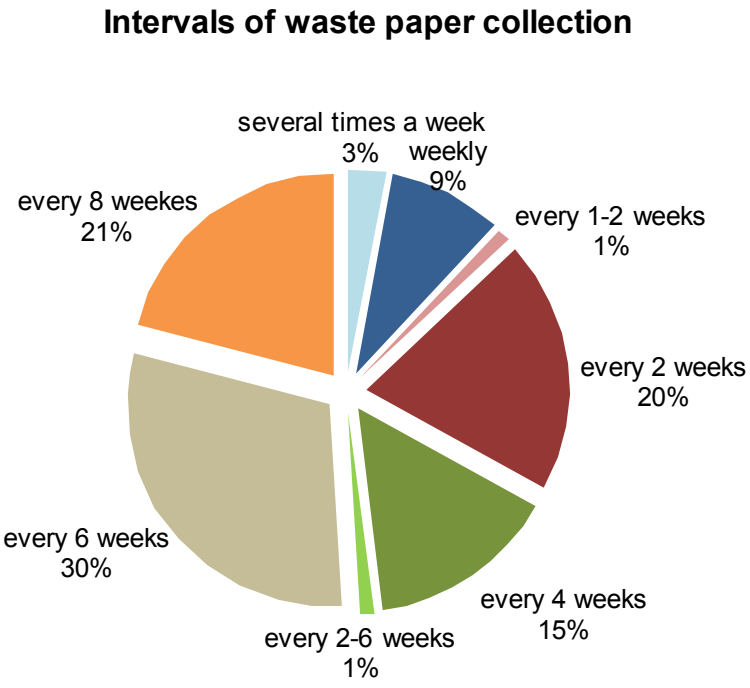

Figure 50: Overview of waste paper collection intervals in Styria (data collected in 117 municipalities)

3.7.2 Waste treatment

Waste paper originating in Styria is mainly transferred to Styrian paper mills (*Mayr-Melnhof Karton AG* in Frohnleiten and *Norske Skog Bruck GmbH*) for almost 100% material recovery. The energy input required for the production of recycled paper is considerably (approx. two thirds) lower than for the production of new paper made from wood (virgin fibre paper), the water consumption is reduced to 15%, the water pollution amounts to only 5%. Therefore, recycling of paper represents an important contribution to environmental protection.

The daily newspapers separately collected in the district of Hartberg are processed to insulating materials by the company *Zellulosedämmstoffproduktion CPH Beteiligungs GmbH & Co KG* (annual capacity approx. 9,000 t).

3.7.3 Summary 2009

In 2008, an average of 12.4% of residual waste consisted of paper and cardboards[164], corresponding to approx. 15 kg/inhab/year. Thereof, 76% are very dirty (e.g. napkins, handkerchiefs), i.e. not suitable for separate collection. A comparison of data from the **residual waste analyses** and collection volumes in the years from 2003 to 2008 shows that more paper is disposed of as residual waste increased more in rural than in urban areas. The latter showed similar growth rates for separately collected waste and residual waste; on the other hand, growth rates of waste volumes disposed of as residual waste were higher than those of separately collected waste volumes in rural areas.

If the trend in waste paper volumes continues, approx. 94 kg of waste paper/inhab/year will be produced in the year 2020. Due to i) improvements in separated collection at the site where the waste is generated and ii) reduced disposal of waste paper through domestic fuels, collection volumes by 2020 might even surpass the quantity of 2008 by as much as 26%.[165]

3.8 Waste glass

3.8.1 Waste volumes – glass packagings

The **Austrian** market input of glass packagings amounted to 235,000 t (29.3 kg/inhab/year) in 2000 and reached a quantity of 275,500 t (33.3 kg/inhab/year) in the period until 2007. At the federal level collection volumes of waste glass increased from 200,500 t (2000) to 221,100 t (2007). The Austrian *per capita* collection from private households rose from 23 kg (2000) to **24 kg (2007)**. In 2000 the Austrian **recycling quota** (recovery quantity related to the market input) amounted to **84%** and **decreased to 80%** in 2007. The collection containers provided for the public covered a volume of 8.5 l/inhab in 2000, which increased to 9.6 l/inhab by 2007. Taking into account the number of emptyings the data mentioned above result in a collection volume (disposal capacity) of 130 l/inhab (2000) or 149

[164] Vogel et al., 2009.

[165] Beigl & Lebersorger, 2009.

l/inhab (2007). On average, waste glass collection containers were filled slightly less in 2007 (77%) than in 2000 (78%)[166].

In **Styria**, waste glass collection volumes (packagings) augmented from 21,370 t in 1990 to 35,120 t in 2008, corresponding to a raise in the specific collection volume of 18 kg/inhab/year (1990) to **29 kg/inhab/year** (2007), i.e. an increase by factor 1.6 (Figure 51).

Around 28,610 containers are available all over Styria for the collection of glass packagings (hollow glass, glasses, bottles). Waste glass is collected in the bring-it-yourself system (collection bays and waste material collection centres). Containers are emptied onto collection vehicles via a dumping system, i.e. by tilting the container, or by a lifting system (Figure 52), i.e. containers are lifted onto the vehicle by means of a crane.

Figure 51: Municipal collection volumes of waste glass (packagings) in Styria, 1990 - 2008

[166] AGR - Austria Glas Recycling GmbH (Hsg.):Vereinfachte Umwelterklärung. Nachhaltigkeitsbericht 2009. Wien; http://www.agr.at.

Figure 52: Double chamber container for waste glass collection, lifting system

3.8.2 Waste treatment – glass packagings

Used glass packagings are exploited as raw material for the production of new glass packagings. Approx. 80% of all glass packagings made in Austria are recycled in three glassworks (of *Vetropack Austria GmbH* in Pöchlarn and Kremsmünster and *Stölzle-Oberglas GmbH* in Köflach).

In the production of new glass packagings, waste glass replaces in particular the primary raw materials quartz sand, lime, dolomite and soda. Hence, the use of recycled waste glass allows protecting these resources and natural scenery while contributing to a reduction in greenhouse gas emissions. Since waste glass melts at lower temperatures than the mix of primary raw materials, approx. 196 kg of CO_2 equivalents are saved per tonne of waste glass, i.e. the demand of energy is reduced by approx. 3% per 10% input of waste glass[167].

Additionally, waste glass is exploited in the production of foam glass as insulation material.

3.8.3 Waste volumes – flat glass

The flat glass fraction contains glass that has not been used as packaging material, such as window glass, car windshields and safety glass. According to the Federal Waste Management Plan 2006, the total flat glass volume in 2004 amounted to 37,000 t whereof only approx. 15% were generated in households. These data are based on the quantities reported for the Federal Provinces Upper Austria and Styria. The data available for 2008 cover only separately collected waste from industry and trade (42,000 t)[168]. **No current representative data** are available for the Austrian-wide **municipal collection volumes** of flat glass. In **Styria**, **around 981 t (0.81 kg/inhab)** of flat glass were collected **at the municipal level** via waste material collection centres. The volume trends (Figure 53) show a significant increase over the last years despite generally low levels.

[167] de Hesselle, 2008.

[168] Umweltbundesamt GmbH, 2010.

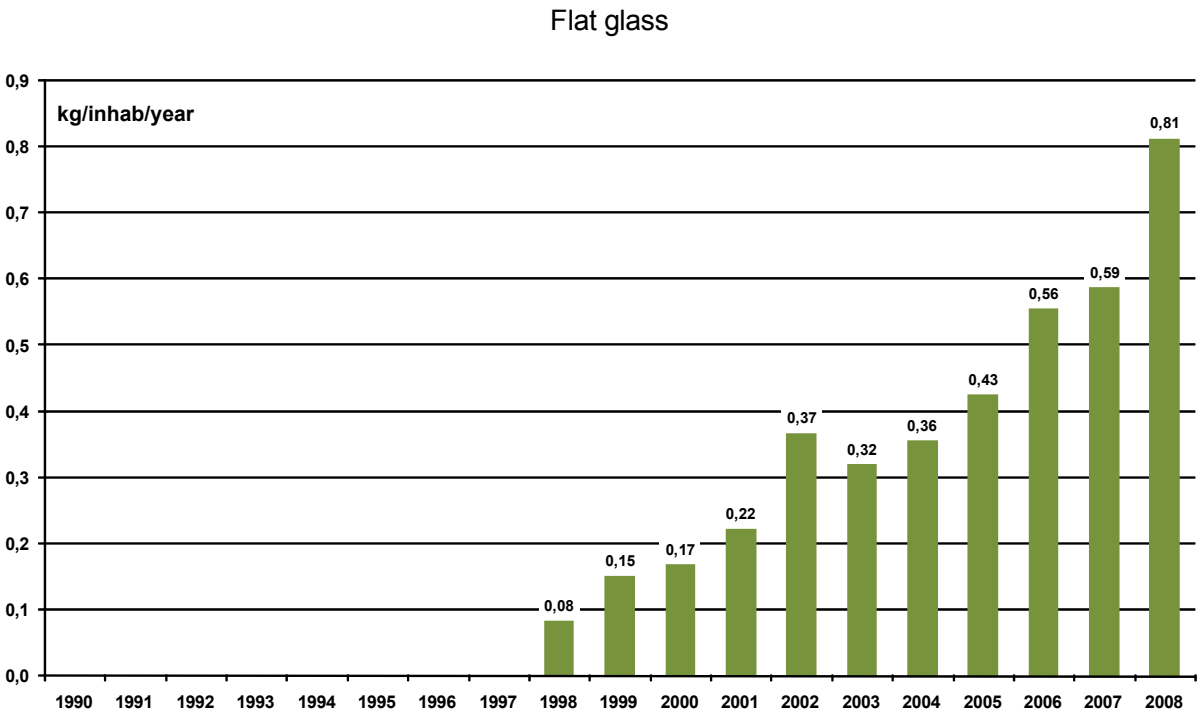

Figure 53: Municipal collection volumes of flat glass in Styria, 1990 - 2008

3.8.4 Waste treatment – flat glass

In Styria the collected flat glass (Figure 54) is prepared by *Schirmbeck GmbH* for the further recycling process to produce flat glass granulates with different grain sizes. Due to varying chemical compositions and melting points the joint recovery of flat glass and glass packagings is not feasible.

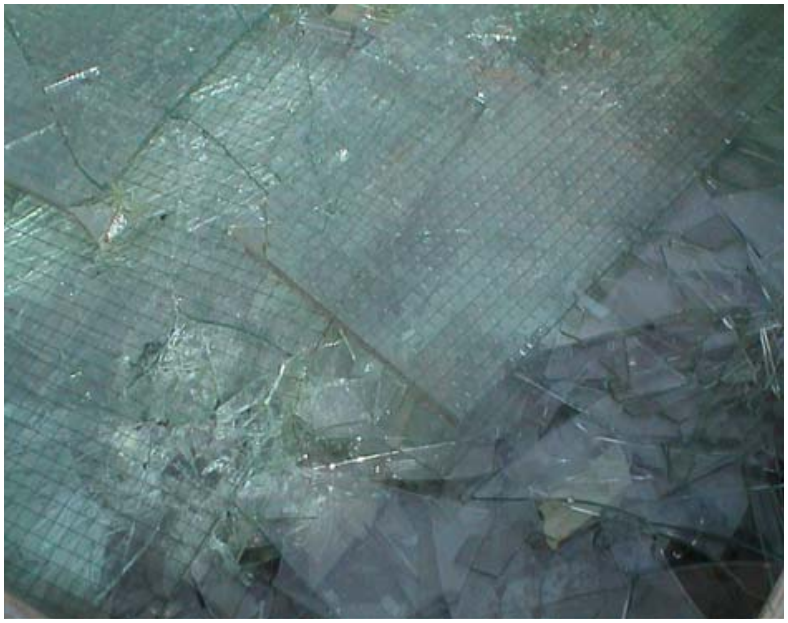

Figure 54: Flat glass

3.8.5 Summary 2009

Although many glass packagings, in particular of beverages, have been replaced by plastic packagings (PET) in the years after 1993, the collected volumes of waste glass have increased by approx. 65% since 1990. The Municipal Solid Waste Analysis 2008[169] stated that the quantity of glass disposed of as residual waste amounts to only 4.3%, corresponding to an annual quantity of approx 5 kg/inhab/year.

In the beverage sector, the re-use quota amounted to 40.1% in the year 2007, including gastronomy. For private consumption of drink packagings a re-use share of only 24% was recorded for 2007[170].

Taking into account waste management-related aspects, re-use of glass packagings must be preferred to recycling. Measures encouraging deposit or other take-back systems – also in a regional context during marketing of regional products, such as the "Styria Bottle" – as well as feasibility studies of whole glass collection projects are required to protect resources.

3.9 Metal packagings and waste metals

3.9.1 Waste volumes – metal packagings

Metal packagings such as beverage cans (tinplate and aluminium cans), food cans (mainly tinplate cans) and foils (chocolate packagings, lids of yoghurt cups) are part of packaging waste. The collection of metal packagings performed by *ARA* in 2008 comprised 41,101 t of packagings made of ferro-metals and aluminium in **Austria**. Around 2,400 t (6%) of metal packagings collected in 2008 originated from industry and trade while the majority (94%) resulted from residential collection. Household collection is mainly performed with collection containers (blue containers) situated in centralised collection bays. With a collected quantity of 112 l/inhab/year at the federal level in 2008, a **collection volume of 3.8 kg/inhab**, i. e. a total collection volume of 31,637 t, was achieved. In addition to separate collection, approx. 7,100 t of metal packagings were collected with other waste fractions and materially recovered in 2008[171].

In some regions of **Styria** (AWV Liezen and AWV Schladming) metal packagings are collected with lightweight packagings and subsequently sorted. In some areas, non-packagings and metal packagings are collected in the same container; apart from that, metal packagings are collected as individual fraction. For this purpose, 18,636 containers or bags (129 l/inhab/year) were available in 2008. This resulted in 5,655.3 tonnes being collected, representing a specific collection quantity of **4.7 kg/inhab** (Figure 55).

[169] Vogel et al., 2009.

[170] Steinparzer, R.: Mehrweg im Getränkesektor. Aktuelle Situation und Trends. Ferialarbeit, Amt der oberösterreichischen Landesregierung, 2008; http://www.land-oberoesterreich.gv.at.

[171] ARA - Altstoff Recycling Austria AG (Hsg.): Leistungsreport 2008. Wien, 2009; http://www.ara.at.

3.9.2 Waste volumes – waste metals

In 2008, the additionally collected volume of waste metals at the municipal level (without scrapped vehicles) amounted to 12,042 t or 10 kg/inhab (Figure 55).

Ferrous and non-ferrous metals are collected as waste materials in waste material collection centres. Non-ferrous metals are partly collected with ferrous scrap or are divided into the fractions copper, brass, aluminium and taps. The profits that may be earned when selling waste metals depend on current indices (*Wiesbadener Index* and *WKÖ Index Sekundärrohstoffhandel - Trade with secondary raw materials* for ferrous scrap as well as *LME* index for non-ferrous metals).

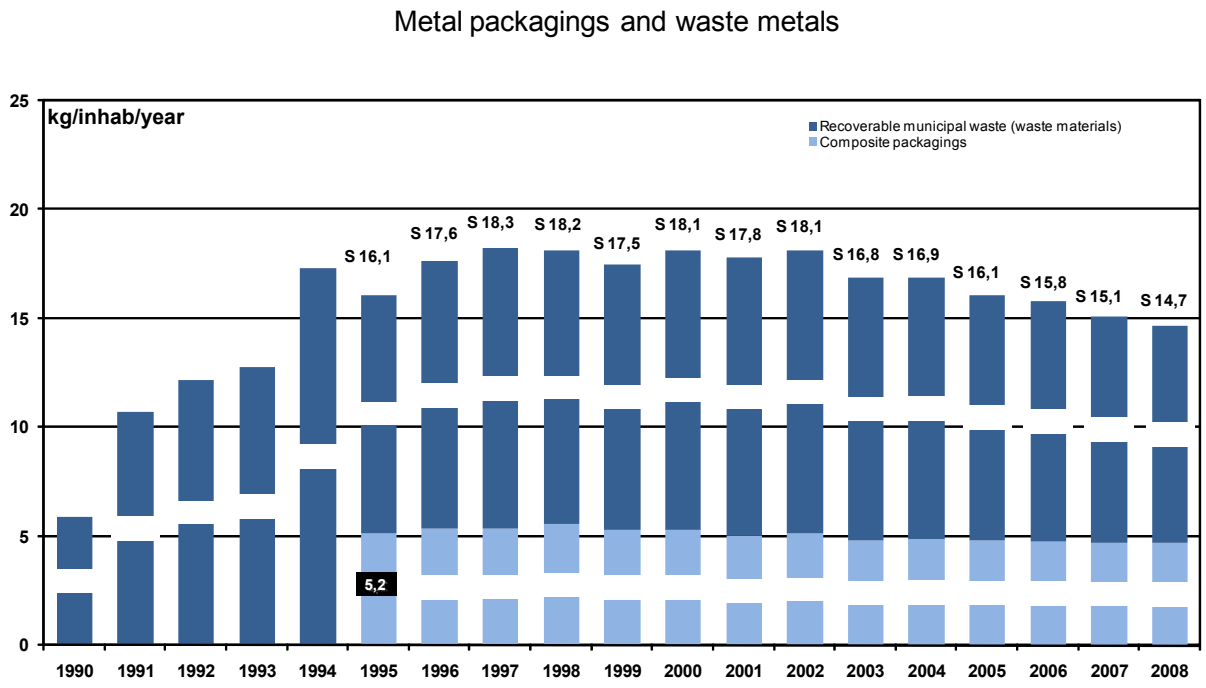

Figure 55: Municipal collection volumes of waste metals (packagings) and metal/ferrous scrap (waste materials) in Styria, 1990 - 2008

3.9.3 Waste treatment – metal packagings and waste metals

The separately collected packagings are processed in sorting or shredding plants: tinplate or aluminium cans, foils, etc. are sorted mechanically by different procedures (magnet separation, shredder) and separated from other metals and impurities. Pressed into packets or as compact shredded scrap the waste metals, other scrap types and raw iron are used as high-quality raw material for steel production. Metal packagings are almost 100% materially recovered.

The energy required for the production of metals is significantly reduced if secondary raw materials are used instead of primary resources. Re-melting of aluminium requires only around 5% of the energy input needed for the production of the same quantity of primary aluminium. Another advantage of aluminium is that it can be infinitely re-used and recovered without losing its specific properties such as solidity, formability, conductibility, corrosion resistance, physiological harmlessness, etc.

3.9.4 Summary 2009

Since the year 1995, when metal packagings were for the first time collected separately from other metals, specific collection volumes have remained at quite constant levels. Thus, the general trend of increasing wastes volumes cannot be observed for metal packagings; collection volumes for waste metals have been declining for the last years.

The quantity of metal packagings disposed of as residual waste (Figure 56) has slightly decreased to 1.7 kg/inhab/year since 2003[172]. As described in Chapter 3.3.3.1 all metals contained in residual waste should be separated for recovery if this is technically feasible.

Figure 56: Metal packagings disposed of as and separated from residual waste (Municipal Solid Waste Analysis 2008)

3.10 Lighweight packagings

The Packaging Ordinance 1992 introduced the separate collection of packaging materials in Austria. The Packaging Ordinance 1996, meanwhile amended three times, re-defined the collection of packaging waste.

In 1993, *ARA* (*Altstoff Recycling Austria, Waste Material Recycling Austria)* was founded for licensing, collection and recovery of household packaging materials. Together with the sectoral recycling companies (*AGR, ARGEV, ARO, ALUREC, AVM, FERROPACK, ÖKK, VHP*) *ARA* has met the requirements laid down in the Packaging Ordinance 1996. Since 1 October 2005 the sectoral recycling companies until then responsible for the different packaging materials and related services have been merged with ***ARA AG***. Only ***AGR*** is still operating and currently forms the ***ARA* system** together with *ARA AG*.

Additionally, **other system operators** than *ARA* system exist (*UFH, EVA, Bonus, Repack*) in the field of commercial packagings.

[172] Vogel et al., 2009.

3.10.1 Waste volumes

In 2008, **823,397 t of packaging materials** made of paper, cardboard, paperboard, glass, lightweight packagings, metals and woods were collected within the *ARA* system at the federal level; thereof **774,342 t** were **thermally and materially recovered**.

In 60% of the **federal state territory,** lightweight packagings (packagings that consist of plastic, composite materials, wood, textiles, ceramics and biogenic packaging materials) are collected together in the so-called **"yellow bag"** or **"yellow container".** 40% of Austrian households (Vienna and partly Lower Austria, Salzburg and Carinthia) are serviced by the so-called **"hollow parts collection",** i.e. only materially recoverable plastic packagings (bottle collection) are collected in "Kermit containers". The remaining lightweight packagings are collected and thermally recovered with residual waste.

At the **Austrian** level, *ARA AG* increased the collection volume of **lightweight packagings** from **households, industry and trade** from 137,958 t (2000) to **203,253 t** (2008). With a specific collection volume of to 611 l/inhab/year within **residential collection structures** (yellow bag/yellow container) the collected quantity at the federal level amounted to **130,880 t** or **15.7 kg/inhab.**

In **Styria**, lightweight packagings are collected in the "yellow container" in urban areas, whereas the "yellow bag" is available in rural areas. For this purpose 48,251 containers are available in Styria and 271,304 households are serviced by bag collection. The provided specific container volume amounts to 759 l/inhab/year. The Styrian collection volume increased from 16,523 t (1995) to **25,708 t** (2008), i.e. a specific collection volume of **21.3 kg/inhab** was reached (Figure 57).

Additionally, "Module 4" (*ARA* system) has been established in 100 Styrian waste material collection centres for the separate collection of packaging materials (PET, hollow parts, EPS, LDPE and LLDPE packagings).

Data from the Styrian Municipal Solid Waste Analysis 2008 suggest that the average **mass fraction of packagings in residual waste** in Styria still amounts to **16%, i.e. 44% vol,** despite the separate collection of packaging materials.

Plastic wastes which are not classified as packaging materials, such as foils, polystyrene, toys, etc. (materially identical non-packagings), are collected during bulky waste collections or can be disposed of in waste material collection centres, the latter receiving a quantity of 253.8 t in Styria in 2008.

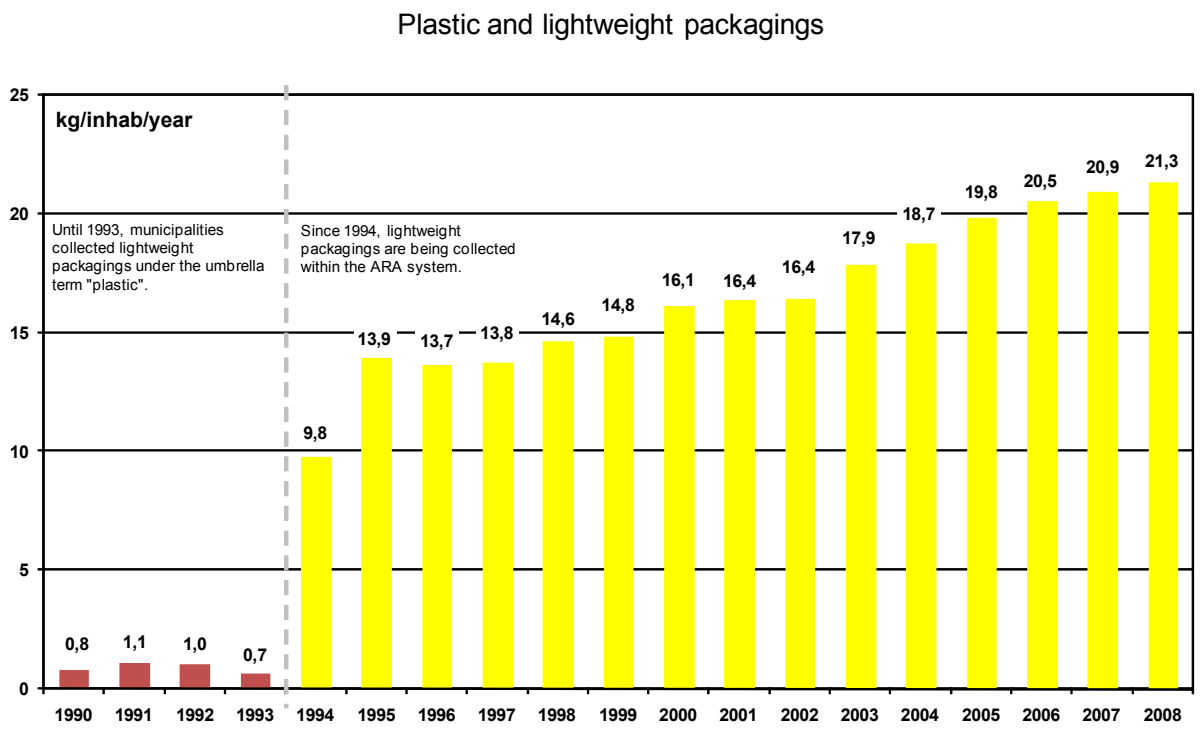

Figure 57: Municipal collection volumes of plastic and lightweight packagings in Styria, 1990 - 2008

3.10.2 Waste treatment

In compliance with the Packaging Ordinance 1996 packaging waste (Figure 58) must be materially recovered by packaging material type (e.g. paper, cardboard, plastic, beverage composite packages, other composite materials, wood) to varying extents, depending on the type and quantity of packaging materials placed on the market.

In 2008 167,811 t (82.5%) of the total quantity of lightweight packagings (203,253 t) collected in **Austria** were recovered. The share of sorted plastic used for **material recovery** amounted to **65,812 t (32.4%).**

The sorted PET packagings are shredded, washed, dried, melted and granulated before they are used in plastic processing plants as raw materials for the production of new products. Fibre production is an important field of application for PET bottle flakes. Despite strict hygiene criteria for food and beverage packagings new technical procedures allow generating products made from PET, HDPE, EPS, PP and PS recyclates for the food and beverage industry, which are indistinguishable from products made from new materials (**bottle-to-bottle-recycling**). In addition, 6,844 t of mixed packagings were “materially” recovered in 2008 for the production of simple, formed thick-walled products such as boards, roof tiles, etc. (“downcycling”).

In the Austrian provinces Vienna, Lower and Upper Austria, Salzburg and Carinthia small-sized lightweight packagings are collected with residual waste: that way, a quantity of 58,881 t of lightweight packagings was thermally recovered in 2008. These provinces achieve a **specific collection volume of 4 to 7 kg/inhab/year** with separate collection of bottles for **material recovery**.

Figure 58: Material from residential packaging collection (Yellow Container, Yellow Bag)

In Styria, separately collected packaging lightweight fractions are passed on to splitting plants. The following fractions are sorted for **material recovery** (Figure 59):

- HDPE bottles
- HDPE buckets
- HDPE canisters
- PET white
- PET green
- PET blue
- PS / PP
- LDPE white
- LDPE coloured
- LLDPE stretch
- EPS
- wood packagings

A mass fraction of approx. 40% of the total input of collected lightweight packagings is materially recovered in Styria. Taking into account the specific collection volume of 21.3 kg/inhab for 2008 (the Austrian average was 15.7 kg/inhab) the share of **materially recovered lightweight packagings in Styria amounts to 8.5 kg/inhab/year.**

Figure 59: Sorted fractions of lightweight packagings for material recovery (from top to bottom: PE foils white, PET white, PET green)

In Styria, the high calorific packaging materials remaining after the splitting process (Figure 60) are used as quality-assured waste fuels for industrial combustion plants (e.g. for cement industry). Combined with residues from mechanical-biological residual waste treatment plants, high calorific (calorific values >18,000 kJ/kg) and mean calorific (calorific values: 11,000 to 18,000 kJ/kg) fuel fractions are produced.

Figure 60 Lightweight packaging fraction for thermal recovery

During thermal recovery in industrial combustion plants the energy contained in the waste is exploited

- in cement production with efficiency factors of approx. 90%
- in fluidized bed firing plants with combined heat-power generation, such as Niklasdorf or Lenzing, with efficiency factors of approx. 80%.

This exploitation is considerably better than in conventional waste incineration plants which, depending on site and technology in question, reach efficiency factors from 20 to 25% (in the case of “pure” power generation) or up to 80% in the case of all-seasonal generation of district heat and power.

The concept of separate collection of packaging waste as implemented in Styria allows achieving

- specifically increased collection volumes,
- increased material recovery,
- significantly higher energy yields by differentiated thermal recovery as waste fuels with assured quality.

3.10.3 Summary 2009

The collection volumes of lightweight packagings increased by 21% between 2003 and 2008, i.e. they exceeded the growth rate that had been estimated in the L-AWP 2005. Since a 19% rise was also observed for separately collected glass packagings in the same period, the higher volume may not only be caused by an increased use of lightweight packagings that replaced glass packagings; instead, it was probably the result of a general increase in the number of packagings put into circulation.

9 kg of lightweight packagings *per capita* are disposed of as residual waste every year, corresponding to approx. 30% of the total lightweight packaging waste volumes. During the next years, measures likely to entail increased separate collection volumes will be required. In addition, the EU Waste Framework Directive regulates the obligation for material recovery, which requires extensive separate collection of lightweight packagings wherever possible.

The performed estimate on waste volumes[173] predicts a growth by approx. 24% of the 2008 quantities by 2020 if i) current trends continue, ii) collection quota increase, and iii) illegal disposal via domestic fuels can be reduced.

Avoiding the use of plastic bags as shopping bags is a good example for preventive measures in the field of lightweight packaging waste.

3.11 Waste textiles

3.11.1 Waste volumes

In 2008, around 26,900 t of waste textiles were collected in Austria[174].

With a share of 0.6%, waste textiles represent only a minor share of total waste material collection volumes in **Styria**. In 2008, the specific collection volumes of waste textiles amounted to approx. **2.4 kg/inhab** (Figure 61). In comparison, the Municipal Solid Waste Analysis 2008[175] indicated that around 6.3 kg of waste textiles/inhab are disposed of with residual waste every year, corresponding to a share of textiles in residual waste of approx. 6%.

Old clothes are collected either via stationary collection systems (bring-it-yourself collection) or bag collection (pick-up system). The latter (performed e.g. by the Red Cross) has frequently been replaced by stationary collection containers for old clothes, into which shoes can also be disposed of. The recycling steps of old clothes and shoes are divided into collection, transport, sorting, marketing and recovery. Around 1,500 collection containers for old clothes are distributed in around 400 municipalities.

[173] Beigl & Lebersorger, 2010.

[174] Umweltbundesamt GmbH, 2010.

[175] Vogel et al., 2009.

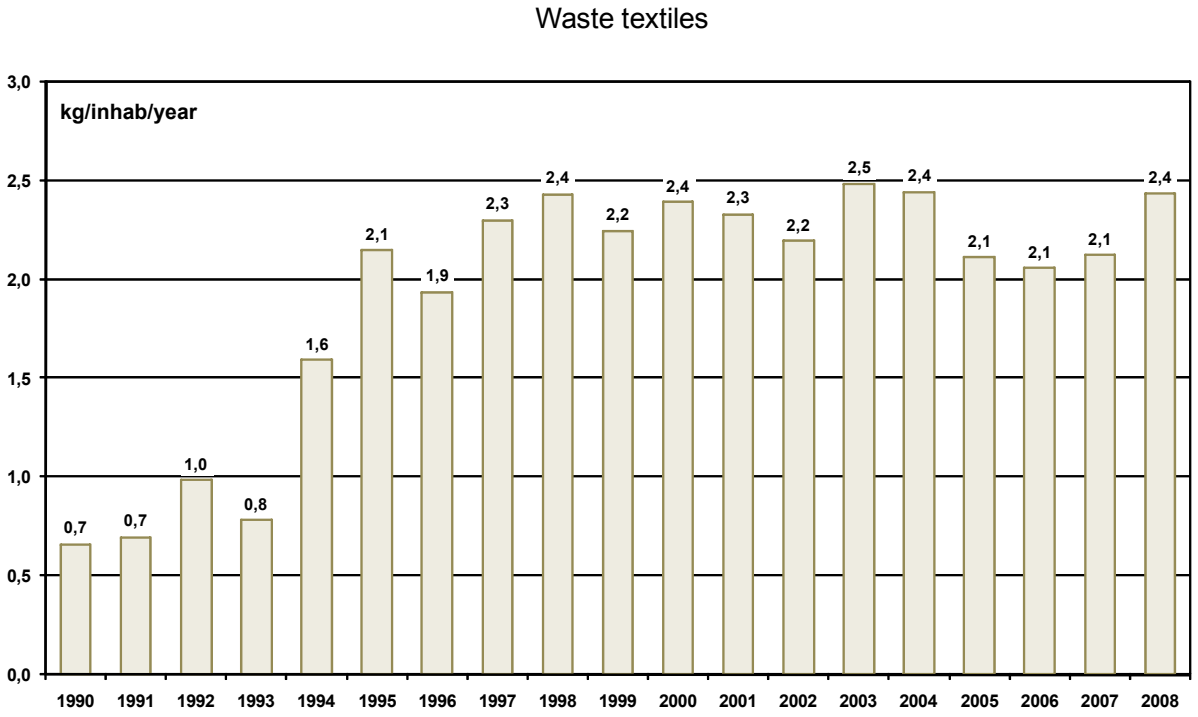

Figure 61: Municipal collection volumes of waste textiles in Styria, 1990-2008.

3.11.2 Waste treatment

The largest part of separately collected waste textiles is passed on directly to national and international sorting plants by different disposal companies (*ASA, Saubermacher, AVE* and *ÖPULA*).

In the sorting plant of *HUMANA* (*Verein für Entwicklungszusammenarbeit,* an NGO for development aid) in Vienna the collected textiles are sorted according to quality and divided into summer and winter clothes. The 14% with the highest quality are sold in Austrian second-hand fashion stores of *HUMANA*, while most of the remaining part is exported to Africa.

Landfilling of waste textiles disposed of with residual waste is not permitted due to their high carbon contents. Since biological treatment of plastic fibres is not possible, the majority of non-recoverable waste textiles is only thermally recovered.

3.11.3 Summary 2009

The volumes of separately collected waste textiles have increased since 1990 from 0.7 kg/inhab/year to 2.4 kg/inhab/year. In particular since 2003, however, clear trends in volume development have not been detected. An important target to be met is to increase the share of separately collected waste textiles suitable for re-use and recovery.

3.12 Problematic substances

3.12.1 Waste volumes

The collected volume of problematic substances rose from 1,564 t in 1990 to 3,530.2 t in **2008**, corresponding to an increase from 1.3 to **2.9 kg/inhab/year**, i.e. the volume more than doubled (Figure 62).

These quantities **(2008)** include:

- old stocks of herbicides and pesticides
- waste varnish and paint
- vehicle batteries and equipment batteries
- aerosol cans (spray cans)
- laboratory waste and residues of chemicals
- lye
- solvents
- liquid mineral oil waste (waste oils)
- fat- and oil-contaminated solid waste
- mercury-containing waste
- acids, etc.
- waste medicine

From 1991 to 1997, waste cooking oils and fats (Chapter 3.13) were also collected as problematic substances; waste electrical and electronic equipment (WEEE, Chapter 3.14) was collected with problematic substances until August 2005. Only then did the Waste Electronic and Electrical Equipment Ordinance implement the separate collection of this waste fraction.

In general, **waste medicines from private households** have to date been collected as problematic substances and handed over to authorised collectors for thermal treatment. Since the concentration of active ingredients contained in most waste medicines from private households can be considered as harmless, medical products from households (free of cytostatics and live vaccines) have no longer been classified as problematic substances since 2009. These products, however, are still collected exclusively via waste material collection centres or pharmacies, their disposal as residual waste is prohibited.

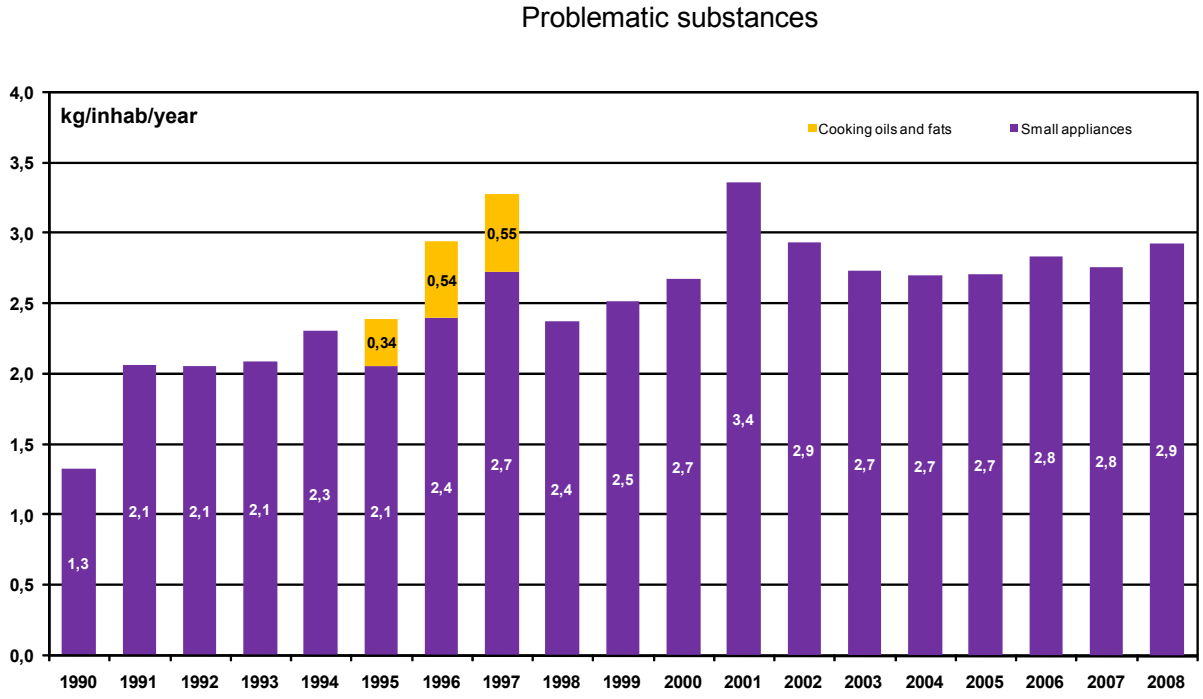

Figure 62: Municipal collection volumes of problematic substances in Styria, 1990-2008. Since 1998 waste cooking oils and fats have no longer been classified as problematic substances (Waste Classification Ordinance). As problematic substances classified are: vehicle batteries, waste mineral oils and unspecified problematic substances.

Problematic substances are collected in the collection cells run by the municipalities (collection cells for problematic substances) or, at least twice a year, via mobile collection of problematic substances. The collected products are handed over to authorised collectors and processors of hazardous wastes[176].

Beyond municipal collection, waste batteries are collected by the voluntary interest representations "*Umweltforum Batterien*" and "*Umweltforum Starterbatterien*" at the Austrian level. "*Umweltforum Batterien*" provides trade companies with collection boxes for waste batteries free of charge. The boxes are collected by authorised collectors in regular intervals and disposed of. "*Umweltforum Starterbatterien*" organises the take-back of starter batteries intended for disposal in Austria.

Since 16 May 2008, when the Battery Ordinance got into effect, producers and importers of batteries are held responsible for financing the environmentally friendly treatment of batteries. Since then, batteries have not only been collected via municipal structures, but also by retailers; simultaneously, collection and recovery systems have also been established by producers and importers. The same structures apply for the collection of vehicle batteries, whereby take-back by municipal collection cells and municipality associations can be done voluntarily. Industrial batteries must be taken back by producers and importers (those who placed them on the market) and are not collected via municipal structures.

[176] according to Art 25 AWG 2002.

3.12.2 Waste treatment

The chemical properties of problematic substances are distinct from each other. Problematic substances are either processed (disposed of) in chemical-physical or thermal treatment plants. While waste oils and waste solvents of mineral origin can, for instance, be treated in Styria, the main part of hazardous waste materials (problematic substances) is incinerated in the disposal plant of *Fernwärme Wien* (*District Heating Vienna*, formerly *Entsorgungsbetriebe Simmering – EbS*), which is the only large-scale incineration plant (rotary furnace plant) for hazardous waste in Austria. Certain hazardous wastes are efficiently exploited for thermal treatment in fluidized bed firing plants provided official approval has been granted.

Waste batteries are processed in other provinces or abroad.

3.12.3 Summary 2009

The conclusions that can be drawn from a comparison of current WEEE collection volumes with data from 2003 are limited by the fact that waste electrical and electronic equipment is now separately collected and classified as individual fraction. The L-AWP 2005 did not contain an estimate on the development of collection volumes for problematic substances. Between 2003 and 2008, the specific collection volume of problematic substances increased by 6.8% from 2.7 to 2.9 kg/inhab/year. Additionally, 6.0 kg/inhab of waste electrical and electronic equipment were collected via municipal collection structures in 2008.

3.13 Waste cooking oils and fats

3.13.1 Waste volumes

Waste cooking oils and fats are edible oils and fats of vegetal or animal origin which

- have been used for frying, baking, deep frying or pickling of food
- are rancid or
- are for other reasons no longer used for cooking.

In compliance with the definitions of the List of Wastes Ordinance 2003, waste cooking oils and fats are not classified as problematic substances. According to the special treatment obligations for waste owners[177] as laid down in AWG 2002, waste cooking oils and fats must be collected separately before they are passed on to authorised waste collectors and processors.

In 2001, approx. 3 litres of waste cooking oils were produced in **Austrian** households. Of the total volume of 24,000 t, however, only 4% were recovered.[178]

[177] Art 16 para 6 AWG 2002.

[178] Pressetext.austria: Altspeiseöl als alternative Energiequelle. Villach, pte/05.03.2001/14:59; http://www.pressetext.at/news/010305046/altspeiseoel-als-alternative-energiequelle.

In 1995 **Styria** introduced an extensive collection system for waste cooking oils and fats. They are collected in collection buckets called "*Fetty*" (i.e. *Fatty*, Figure 63). For households, 3.5 and 5 l collection buckets are available; for industry, the volume is 30 l. The filled buckets are taken over in waste material collection centres and exchanged against empty ones.

Figure 63: The Styrian "*Fetty*" bucket for the collection of waste cooking oils and fats

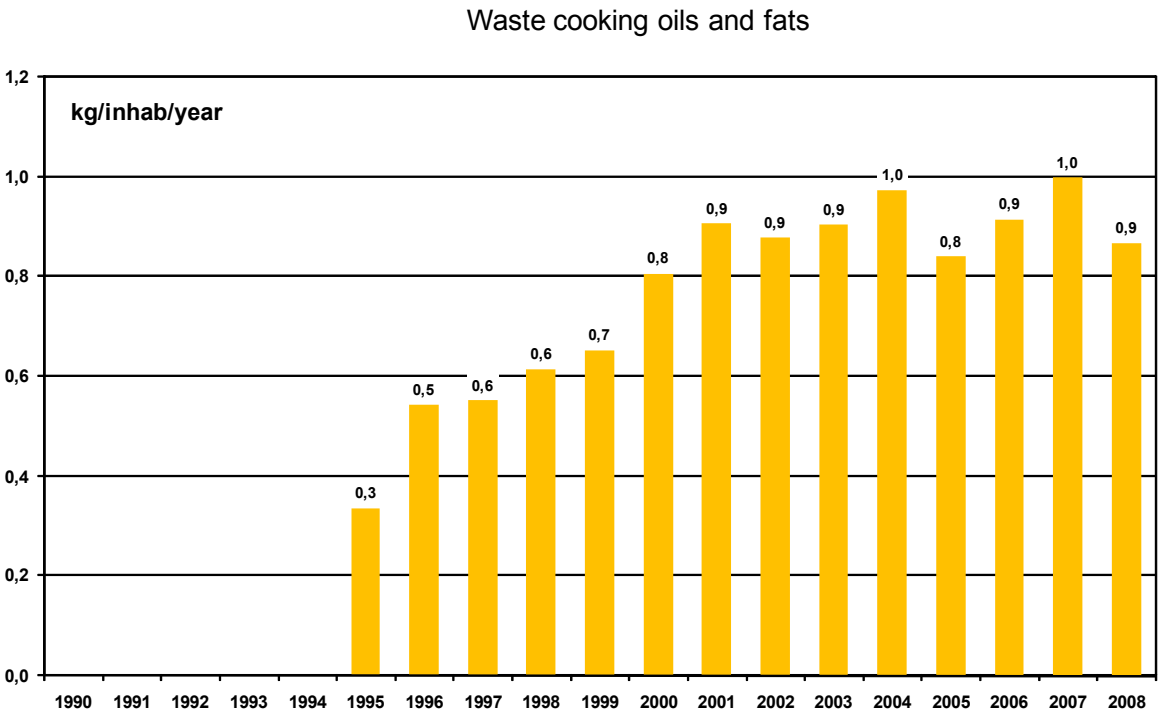

Figure 64: Municipal collection volumes of waste cooking oils and fats in Styria, 1995-2008.

After a continuous increase of collection volumes (Figure 64) following the introduction of "*Fetty*", collection volumes of waste cooking oils and fats have remained at a constant level of approx. 1,000 to 1,200 t per year since 2001. In 2008 1,047 t were collected, corresponding to a collection volume of approx. 0.9 kg/inhab. The waste management associations reported collection volumes from 0.3 to 2.5 kg/inhab/year for the period from 2005 to 2008. Since waste material collection centres take over collection containers from households and industry, an unambiguous classification of received volumes cannot be made. In general, a share of approx. 3.5 kg/inhab/year is assumed to be produced in private households, equalling an absolute quantity of around 4,200 t/year. Consequently, only around 30% of produced waste cooking oils and fats are at present collected via municipal collection structures in Styria. No data are available on the remaining quantity; it is, however, assumed that illegal disposal via the sewer system is common practice in many households.

3.13.2 Waste treatment

Waste cooking oils and fats are to be recovered if this is ecologically useful and technically feasible and if the resulting extra costs are not disproportionate[179]. Separate collection helps save costs in waste water treatment and sewer maintenance because waste cooking oils and fats contained in waste water can cause depositions and blockages in the sewer system. Valuable secondary raw materials for the production of biodiesel, soaps, cleaning and lubrification agents can be obtained from separately collected waste cooking oils and fats. Moreover, they can be exploited directly as co-substrates for the generation of biogas or electricity and heat in biogas plants.

In Styria, separately collected waste cooking oils and fats are mainly processed in the transesterification plant *Südsteirische Energie- und Eiweißerzeugungsgenossenschaft (SEEG reg.Gen.m.b.H.)* in Mureck for biodiesel production (biodiesel standard EN 14214). The produced biodiesel is for instance used for the bus fleet of *Graz AG Verkehrsbetriebe*. Glycerol phase, the by-product of biodiesel production, can be used as co-substrate in biogas plants, or it is purified and used as raw material in chemical, pharmaceutical or cosmetic industry. Waste cooking oils and fats are also used for the production of soft soap or cleaning agents, such as at *Ökoprodukte Ott* in Judenburg.

Biodiesel production is the most important recovery pathway for waste cooking oils and fats. A study dating back to 2008[180] shows that 8,700 t of waste cooking oils and fats were processed to biodiesel in 2007; the number reported from Styrian biodiesel plants for 2008 amounted to 17,600 t[181]. Thereby, the used oils and fats originated from Austria and the neighbouring EU countries. The percentage of waste cooking oils collected via municipal facilities amounted to approx. 14% of the overall quantity of waste cooking oils used in 2007 and to approx. 7% in 2008. Overall, 49,000 t of biodiesel were obtained in Styria in 2008 from 51,800 t of input materials (waste oils and vegetable oils). The biodiesel produced in Styrian plants from municipally collected waste cooking oils allows covering a distance of approx. 16 million kilometres in a private car. Based on the life-cycle analysis for biodiesel

[179] Art 16 AWG 2002.

[180] Jungmeier, G.; Canella, L. & Kaltenegger, I.: Umweltbewertung der Biodieselproduktion in der Steiermark im Vergleich zu mineralischem Diesel. Bericht IEF-B-14/08 (Joanneum Research Forschungsgesellschaft mbH Graz), Amt d. Stmk. LReg. – FA19D, 2008

[181] According to Jungmeier et al. (2008): Einschätzungen der Jahresmengen durch die befragten Betriebe, as at May 2008.

performed in the study mentioned above, the reduction of greenhouse gases resulting from recovered waste cooking oils collected in Styrian municipalities currently amounts to approx. 2,000 t of CO_2 equivalents per year. Since the municipal collection volume could theoretically be increased to approx. 4,200 t/year, the potential greenhouse gas reduction amounts to 7,000 t of CO_2 equivalents per year.

3.13.3 Summary 2009

Separate collection of waste cooking oils and fats is well established in Styria and shall be continued. Estimates on future waste volumes collected in the municipalities are not included in the L-AWP 2005. Compared to other Austrian provinces, the Styrian levels achieved for the collection of waste cooking oils and fats are relatively high. Higher collection volumes at the municipal level were achieved in Burgenland[182] with approx. 1.6 kg/inhab in the year 2005. The highest collection volume in Styria was reached in 2004 by AWV Weiz with 3.5 kg/inhab. While reaching this amount all over Styria is the defined long-term goal, the volume collected in Burgenland can be considered a realistic benchmark for the average value of a province. It can be defined as medium-term goal to be achieved by 2015. Meeting this target would represent an increase of absolute municipal collection volumes to approx. 1,900 t/year for Styria.

Vision 5 defined in L-AWP 2005 states that waste has to be materially recovered according to European and national requirements. This target has been fully met for municipally collected waste cooking oils and fats. Taking into account, however, a theoretical generation of approx. 3.5 kg/inhab/year in the households, only approx. 30% are collected and recovered in Styria. The intended increase of municipal collection volumes to an average of 1.6 kg/inhab/year by 2015 shall be achieved by suitable measures and actions to create awareness among citizens and municipalities.

[182] Amt der Bgld. Landesregierung, Abteilung 9 – Wasser- und Abfallwirtschaft Referat Abfallwirtschaft (Hsg.): Landes-Abfallwirtschaftsplan Burgenland – Fortschreibung 2006. Eisenstadt, 2006.

3.14 Waste electrical and electronic equipment

3.14.1 Waste volumes

In 2008 a total of **163,530 t** of waste electrical and electronic equipment (WEEE) was put into circulation in **Austria** and **61,400 t** were collected **as WEEE**. Table 14 provides an overview on individual equipment categories.

Collection and treatment category	Mass put into circulation (t)	Collection volume (t)
Large electrical and electronic appliances	64,931.6	16,057.9
Refrigeration equipment	20,999.7	14,186.6
Screen appliances	20,042.8	16,354.6
Small electrical and electronic appliances	46,940.7	17,125.1
Gas discharge lamps	7,872.4	906.6
Total	**154,787.2**	**64,630.8**

Table 14: Circulating electrical equipment and WEEE collection volumes for 2008 (as at autumn 2009)[183]

The specific federal **WEEE collection volume** was increased from **5.9 kg/inhab (2005)** to **8.06 kg/inhab (2008),** therefore meeting the **targeted EU-wide collection volume of 4 kg/inhab/year** right from the start.

In **Styria** waste electrical and electronic equipment (WEEE) from household is has been collected separately in municipal waste material collection centres and collection cells for problematic substances since 1995. In addition, the agreement on a "*Freiwillige Selbstverpflichtung zur umweltgerechten Sammlung, Verwertung und Entsorgung elektrischer und elektronischer Altgeräte in der Steiermark - Voluntary commitment on environmentally friendly collection, recovery, and disposal of waste electrical and electronic equipment in Styria*" was signed in the year 2000. This paper was initiated by FA19D of the Province of Styria in cooperation with the Styrian waste management associations and the regional Economic Chamber of Styria (Waste and Waste Water Management, Provincial Board for Trade of Radios and Electrical and Electronic Equipment, Provincial Board for Trade of Secondary Raw Materials, Recycling and Disposal). This initiative made it possible already before the implementation of the Waste Electrical and Electronic Equipment Ordinance to return WEEE free of charge to retailers if a new device is bought.

[183] Elektroaltgeräte Koordinierungsstelle Austria GmbH (Hsg.): Tätigkeitsbericht 2008. echomedia verlag gesmbh, Wien, 2009; URL: http://www.eak-austria.at. – personal communication, E. Giehser (EAK), 26.03.2010.

Effective as from 13 August 2005 the Waste Electrical and Electronic Equipment Ordinance defines targets for the recovery and recycling of WEEE. Since then, Styrian collection points have collected the following five categories of WEEE:

- large electrical and electronic appliances
- small electrical and electronic appliances
- screen appliances
- refrigeration equipment
- gas discharge lamps

Collection volumes of WEEE in **Styria** are still on a stable and high level (Figure 65). In 2008 more than 9,600 t of WEEE from private households were handed over to Styrian collection points before they were disposed of in an environmentally friendly manner. Thereof, 7,300 t were received in community collection centres. Correspondingly, the *per capita* collection volume for 2008 amounts to 6 kg (municipal level) or 8 kg (all collection points)[184]. The collection volume targeted at the European level of 4 kg per inhabitant and year has therefore been surpassed by more than 100%. The Municipal Solid Waste Analysis 2008 showed that approx. 0.6 kg of WEEE per inhabitant and year are disposed of with residual waste.

[184] Number of inhabitants based on the annual average population per province, according to Statistics Austria (values deviate from calculations of the EAK activity report 2008).

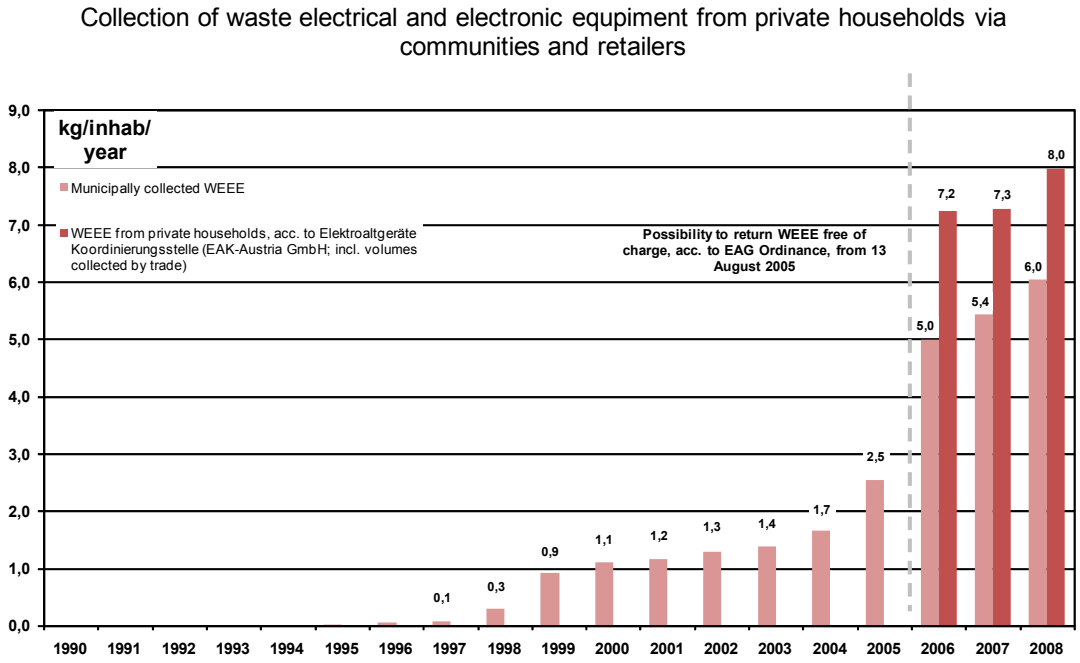

Figure 65: Collection volumes of waste electrical and electronic equipment from private households in Styria 1990 - 2008; municipal collection volumes (indicated in orange), collection volumes according to *EAK* including volumes collected by retailers (indicated in red)

Figure 66 illustrates the distribution of WEEE collection volumes according to equipment categories in 2008.

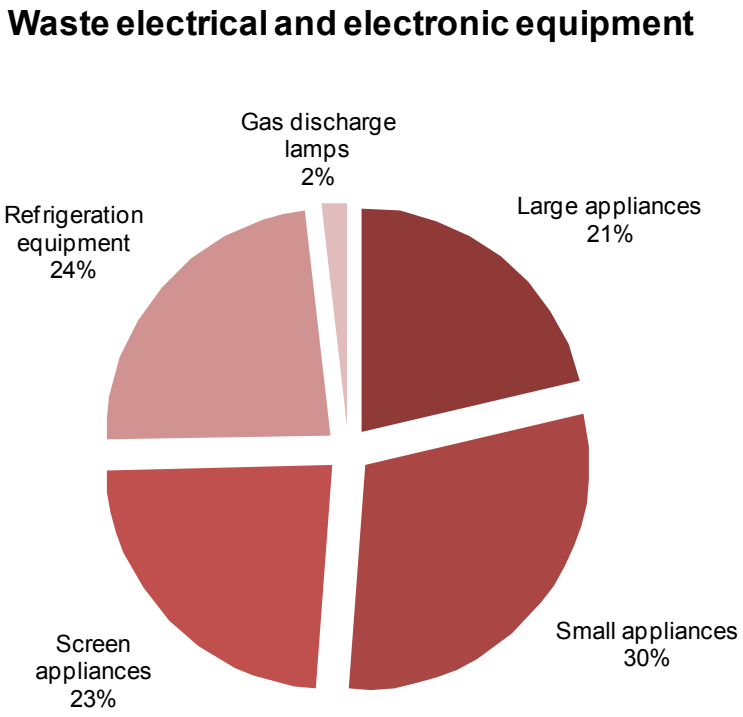

Figure 66: Total composition of collection volumes of WEEE from private households in %, Styria 2008 (total specific waste volume: 8.15 kg/inhab)[185]

In Styria **359** registered **collection centres** are **available** for the collection of waste electrical and electronic equipment (Figure 67). This number is composed of **351 municipal collection centres, 1 producer collection centre and 7 mixed municipal and producer collection centres[185].** In addition, WEEE can be returned to **retailers** of electrical and electronic equipment if new devices are bought.

Disposal of WEEE in collection centres does not involve any costs for the end consumer. The costs for collection and treatment of disposed WEEE equipment is calculated independently of a simultaneous return of waste equipment and added to the price of all new devices.

WEEE collection containers are designed as to avoid damage done to the WEEE wherever possible. On the one hand the subsequent pollutant elimination (disassembly of pollutant-containing construction parts) has to be facilitated and the release of pollutants during transport or storage must be avoided, on the other hand it has to be guaranteed that recoverable or repairable WEEE is handed over undamaged. At present deficits in the damage-free collection and separation of reusable WEEE can be observed.

[185] Data from: Elektroaltgeräte Koordinierungsstelle Austria GmbH, 2009.

Figure 67: Collection of waste electrical and electronic equipment in a waste material collection centre, fraction small electrical and electronic appliances

The main responsibility of the coordination centre *EAK* is the Austrian-wide organisation of pick-ups of WEEE as well as waste batteries. In this function it acts as central platform for the definition and payment of infrastructure flat rates of municipalities or municipality associations.

Most WEEE and waste batteries are collected and recovered via collection and recovery systems established by contracts with individual collection centre operators, regional associations or provinces. These structures cannot completely guarantee that the WEEE and waste batteries received in collection centres are taken over by the respective systems. For this reason, the WEEE Directive and the Battery Ordinance provide for additional possibilities for collection centres to dispose of collected WEEE and old batteries via coordinated pick-ups. In 2008, the coordinated pick-up was used 1,525 times in Styria (1,917 times for Austria).

3.14.2 Waste treatment

On the one hand, waste electrical and electronic equipment contains materials hazardous for human health and the environment (e.g. mercury, lead, cadmium), on the other hand the high metal content of this waste type (e.g. copper, iron, noble metals) is of particular interest for recycling.

After manual elimination of pollutants, waste electrical and electronic equipment is primarily materially recovered[186]. Thereby, the pollutants contained in certain large electrical or electronic appliances (e.g. washing machines) are already eliminated in the waste material collection centres; any other WEEE is treated by authorised waste processors in compliance with category-specific collection criteria.

[186] Ordinance of the Federal Minister for Agriculture, Forestry, Environment and Water Management on waste treatment obligations (Treatment Obligations Ordinance), Federal Law Gazette II No. 459/2004 as amended in Federal Law Gazette II No. 363/2006 und ÖNORM S 2106 (date of issue: 1998-01-01)

Furthermore, waste electrical and electronic equipment is collected and specifically processed by socio-economic companies in collaboration with waste management associations or private disposal companies in **Styria** *("E-Schrott Taxi" BEST Voitsberg*[187]*, BAN*[188]*, GBL*[189]*, SÖBSA*[190] and *CHAMÄLEON*[191]). For instance, the socio-economic company *Chamäleon* in Feldbach received and processed approx. 260,000 kg of WEEE in 2007. According to the transposition of the EU Waste Framework Directive into national law, material recovery of WEEE is only an option if primary recovery is not possible.

With regard to the climatic relevance of WEEE treatment, particular care has to be taken for the professional elimination of pollutants from refrigeration equipment which may still contain relevant quantities of chlorofluorocarbons (CFC). *"In Austria alone, around 900,000 t of CO_2 are avoided per year due to the recovery of CFCs from refrigeration equipment […] Every year 310,000 refrigerators containing cooling media and insulation materials with CFCs are treated in Austria. These appliances have a particularly high greenhouse gas potential (CO_2 equivalents) of up to 14,400, i.e. one kilogramme of CFCs contributes 14,400 fold stronger to the greenhouse effect than one kilogramme of CO_2."*[192] *(unofficial translation)*

3.14.3 Summary 2009

The significant growth of collection volumes in 2005 and 2006 can be related to the fact that WEEE has been classified as separate waste fraction since August 2005. Production volumes of waste electrical and electronic equipment are increasing, and products are disposed of as wastes in shorter intervals. WEEE is the fastest growing waste flow and is still expected to double within the next 12 years. In this context, the principles defined in the ReUse guideline published by the *BMLFUW* with regard to damage-free collection and separation of recoverable or repairable WEEE have to be implemented.

The Europe-wide switch to the use of energy-saving lamps, which require considerably less energy, will result in a significant increase of disposals in waste material collection centres and retailers: the disposal of energy-saving lamps (pertaining to the category of gas discharge lamps) as residual waste is not permitted.

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[187] *BEST* Voitsberg

[188] *BAN* - Beratung, Arbeit, Neubeginn - Sozialökonomische BetriebsgmbH, Graz

[189] *GBL* - Gemeinnützige Beschäftigungsgesellschaft m.b.H. Liezen

[190] *SÖBSA* – Sozial – Öko und Beschäftigungs- Service Aichfeld GmbH, Knittelfeld

[191] *Chamäleon* – Atelier für Textilarbeit und Dienstleistungen, Feldbach

[192] o.V.: Elektroaltgeräte gegen Rohstoffknappheit und Treibhauseffekt. In: Umweltschutz der Wirtschaft 2, 2008, p. 32.

3.15 Batteries and accumulators

3.15.1 Waste volumes

Since the implementation of the AWG 1990[193] municipalities have had to meet the obligation to collect batteries and accumulators as problematic substances (hazardous waste from private households). An obligation for the collection and take-back of waste batteries (Figure 68) is being effective since 1991 in the framework of a Battery Ordinance.

The collection, treatment and recycling of waste portable batteries and accumulators as well as from industry and vehicle batteries and accumulators is at present regulated in the EU Directive on batteries and accumulators (2006/66/EC), which has been transposed into Austrian national law with the implementation of the Battery Ordinance. The Battery Ordinance came into effect the 26 September 2008 and contains the obligation for all end retailers to take back waste batteries free of charge regardless of the purchase of new batteries or accumulators, which are also taken back free of charge in municipal collection centres.

Similar to WEEE, five collection and recovery systems are at present provided in Austria, which are managed by the *EAK* Austria (Coordination Office for Waste Electrical and Electronical Equipment Austria, www.eak-austria.at).

Every year, more than **100 million pieces of portable batteries** are sold, corresponding to roughly 12 pieces per inhabitant and year. Thereof 8 batteries are disposed of within the collection of problematic substances, the remaining 4 are disposed of as residual waste despite a large number of possible take-back options.

Figure 68: Portable batteries (left side) and vehicle batteries (right side) from waste battery collection

During the last quarter of 2008 an Austrian-wide collection volume of 364 t of portable batteries and 3,374 t of vehicle batteries was reported to the EAK[194]. 1,517.7 t of portable batteries were collected

[193] Federal Law Gazette No.325/1990, as amended in Federal Law Gazette No.114/2002.

[194] Elektroaltgeräte Koordinierungsstelle Austria GmbH, 2009, E. Giehser 2010.

and reported in 2008 via collection centres operated by retailers, municipalities and commercial institutions.[195]

In **Styria** the municipal collection of waste batteries is organised in the categories small cell batteries and vehicle batteries, both classified as problematic substances. The municipal collection volume (**Figure 69**) of small cell batteries increased from 0.06 kg/inhab in 1995 to 0.10 kg/inhab in 2001 and has since remained relatively constant at this level. In the same period, the collection volume of vehicle batteries increased from 0.60 kg/inhab (1995) to 0.66 kg/inhab (2001); since 2001 collection volumes gradually decreased to 0.35 kg/inhab in 2008. This development can be related to the fact that vehicle batteries are mainly returned to **retailers**.

Development of municipal collection volumes of waste batteries and accumulators in Styria

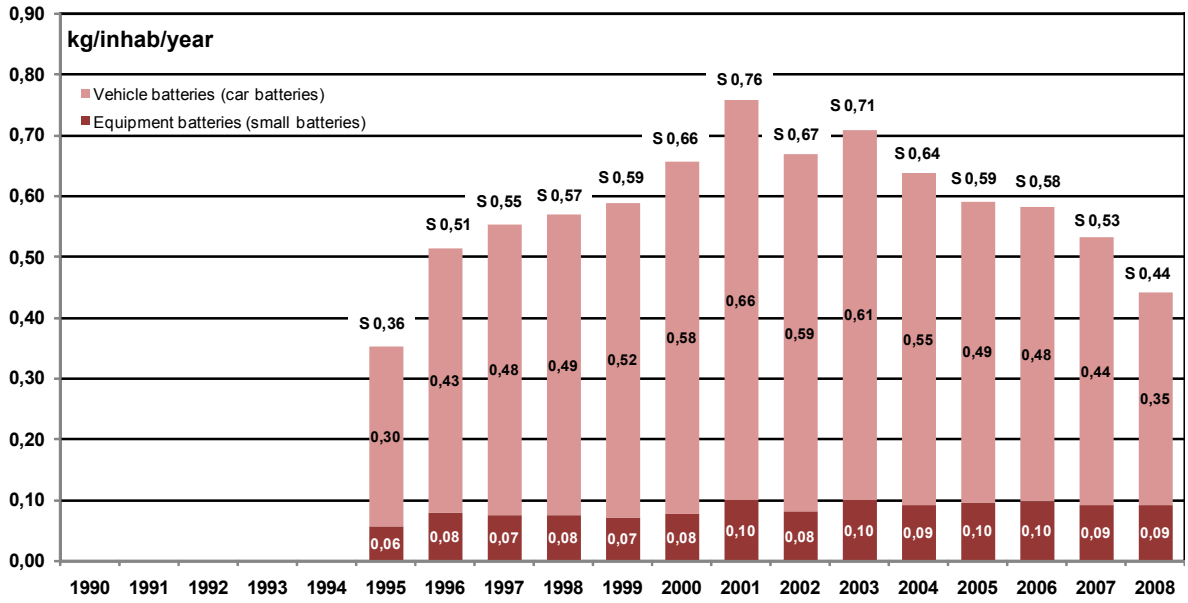

Figure 69: Municipal collection volumes of batteries and accumulators disposed of in ASZ and via collection of problematic substances; before 1995 the fraction problematic substances was not separately indicated.

3.15.2 Waste treatment

The collected portable batteries are sorted and separated into the fractions

- alkali-mangane and zinc-carbon batteries
- nickel-cadmium (Ni Cd) batteries (rechargeable)
- nickel metal hydride batteries (rechargeable)
- button cells.

Zinc-carbon batteries and alkali-manganese batteries are accepted in a recycling plant operated by *Fernwärme Wien*. Button cells (small batteries in form of buttons, mostly in silver colour) are processed in a German recycling plant. For recovery purposes Ni Cd batteries are transported to

[195] Elektroaltgeräte Koordinierungsstelle Austria GmbH, 2009.

Sweden, France or Germany where nickel and cadmium are exploited in primary production. Nickel metal hydride batteries are transported to France or Germany, in particular for the recovery of nickel. Lithium ion batteries, mostly used in mobile phones, are processed and recovered in France.

Vehicle batteries represent a valuable raw material due to their high content of recoverable lead and are recovered in Austria.

3.15.3 Summary 2009

The L-AWP 2005 did not consider batteries and accumulators as individual waste fraction. Although the contribution of this fraction to total waste volumes is relatively insignificant, separate collection of batteries and accumulators must be aspired wherever possible for to the hazardousness of their components. For this purpose, their collection volumes are specifically examined starting from the L-AWP 2010.

3.16 Sewage sludge from municipal waste water purification

3.16.1 Waste volumes

Sewage sludge is a product of waste water treatment in sewage treatment plants or related plants (also in dewatered/dried state or otherwise treated). Municipal sewage sludge is sewage sludge originating from municipal waste water purification plants.

As at 1 January 2008 560 sewage treatment plants were operated in Styria, extendible by a capacity of >50 population equivalents (PE)[196] and covering for an approved purification capacity of 2.2 million of PE. In 2008, their average efficiency amounted to roughly 1.8 million of PE (approx. 79%). Before further treatment, sewage sludges undergo a stabilisation process (45% aerobic, 59% anaerobic). For stabilisation and dewatering of sewage sludges from small treatment plants, about 60 additional reed beds (so-called “humification plants”) were additionally operated in Styria.

At present, Styrian municipal sewage treatment plants produce approx. 1.1 million m^3 of sewage sludge per year with a dried matter (DM) content of around 3%, corresponding to approx. 34,000 t of DM per year (Figure 70). In 2007, the specific sewage sludge volume per inhabitant amounted to approx. 17 kg.

[196] A population equivalent (PE) indicates the amount of oxygen required for aerobic degradation of the organic waste pollution load produced by one person within 24 hours.

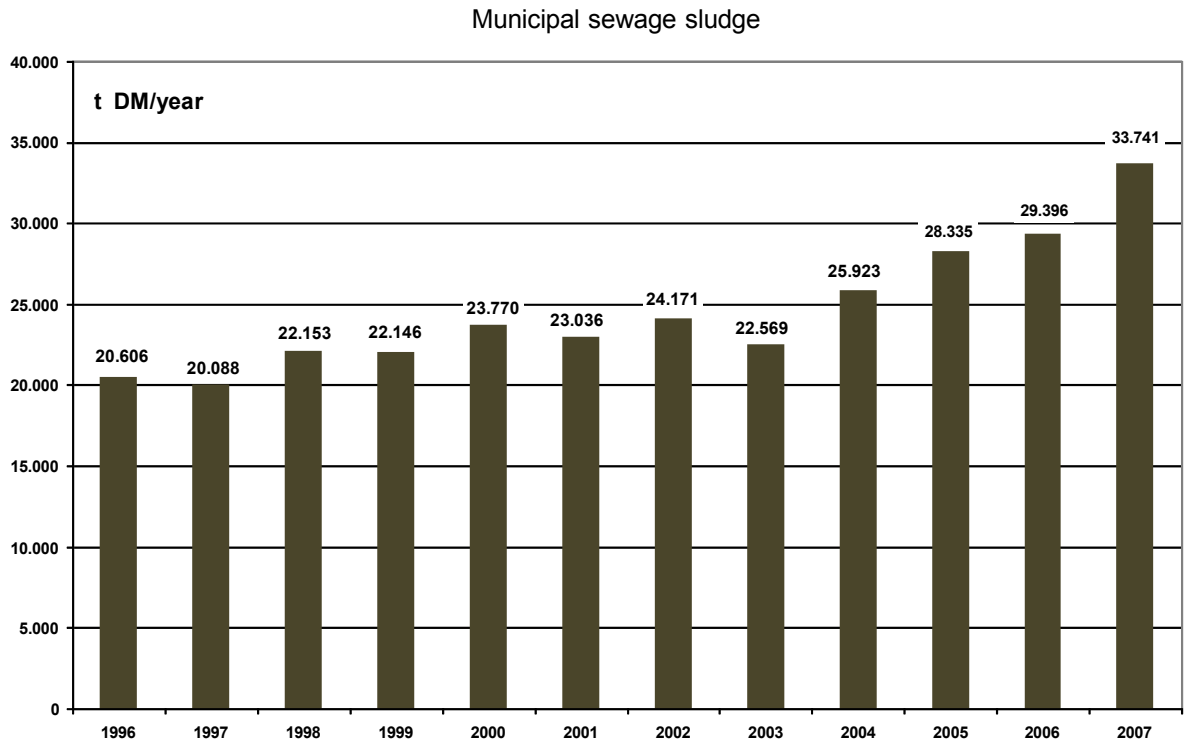

Figure 70: Municipal sewage sludge volumes in Styria, 1996-2007.

3.16.2 Waste treatment

Figure 71 illustrates the percentages of individual recovery and treatment pathways of total municipal sewage sludge volumes; *under construction

Table 15 lists all approved sewage sludge treatment plants.

Most importantly, with a share of 37%, sewage sludge is used for landscaping, including the application of sewage sludge for the cultivation of surfaces not used for agricultural purposes, such as sport areas and street embankments. In the field of landscaping, sewage sludge may only be applied as compost in compliance with the Compost Ordinance.

Around one quarter of sewage sludge is used in agriculture for soil improvement or fertilising purposes. Approx. one third of agriculturally used sewage sludge is composted before application; around two thirds are applied directly, i.e. as dewatered sludge or wet sludge, according to an application certificate.

22% of municipal sewage sludges are incinerated. The sludge qualities required for this purpose depend on the type of incineration plant (waste incineration plants, mono-incineration plants, industrial co-incineration plants). Sewage sludge has climate-neutral properties when incinerated and can be used for co-incineration if its DM content exceeds 30%.

Frequently, sewage sludge is dried before thermal recovery to approx. 90% DM to obtain a high calorific granulate and to reduce costs for storage and transport. Drying is performed either technically (with fossil fuels or utilisation of process heat) or by means of solar energy. The calorific value of dried sewage sludge amounts to an average of 10,000 kJ/kg DM and is comparable to that of brown coal. Therefore, dried and dewatered sewage sludges are used by industry to replace fossil fuels.

Only minor quantities (5%) of municipal sewage sludge are landfilled. Since 1 January 2004 the direct landfilling of sewage sludge has been prohibited; the obligatory mechanical-biological pre-treatment of sewage sludge is performed by the waste treatment plants (MBTs) in Frohnleiten, Halbenrain and Allerheiligen, respectively.

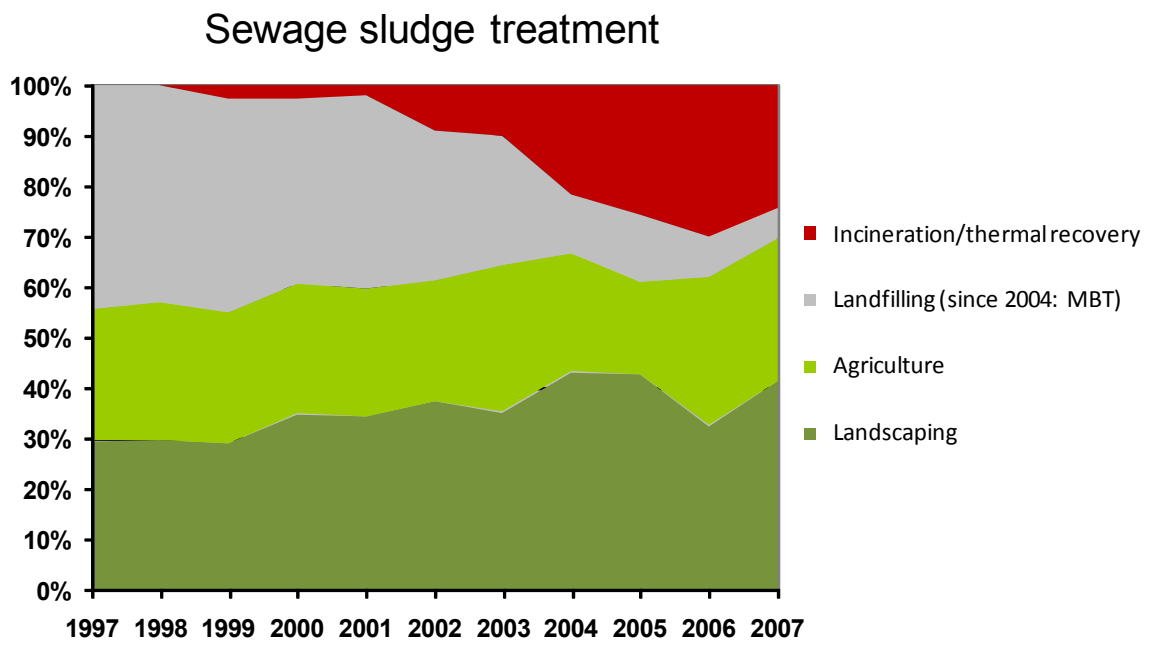

Figure 71: Shares of main treatment pathways for municipal sewage sludge in Styria, 1997 - 2007, in %.

Plant site	Sewage sludge treatment	Type of treatment
MVA Niklasdorf	*ENAGES mbH*	incineration
Gratkorn	*SAPPI*	incineration
Kraftwerk Mellach	*Verbund ATP*	co-incineration
Zementwerk Retznei	*Lafarge Perlmooser GmbH*	co-incineration
Peggau	*Wietersdorfer und Peggauer*	co-incineration
Grosswilfersdorf*	*Kalogeo*	technical drying and incineration
Halbenrain	*A.S.A. Abfallservice Halbenrain*	mechanical-biological
Frohnleiten	*Servus Abfall*	mechanical-biological
Allerheiligen	*AWV Mürzverband*	mechanical-biological
Gössendorf	*AEVG*	technical drying
Frohnleiten	*ABL - Frohnleiten GmbH*	technical drying
Leoben	*RHV Leoben*	co-fermentation and technical drying
Dobl-Muttendorf	*RHV Unteres Kainachtal*	solar drying
Sebersdorf	*RHV Safen-Saifental*	solar drying
Straß	*AWV Leibnitzerfeld Süd*	solar drying
Knittelfeld	*AWV Knittelfeld u. Umgebung*	co-fermentation and solar drying

Bad Waltersdorf/Leitersdorf	*RHV Safen-Saifental*	solar drying
Passail	*AWV Passailer Becken*	solar drying
Hartberg-Habersdorf	*Biokraft Hartberg Energieproduktions GmbH*	co-fermentation
Röthelstein	*Transbeton G.m.b.H. (Cemex)*	composting
Übelbach	*U.M.S. Dienstleistungs- und Handels GmbH*	composting
St. Margarethen/Knittelfeld	*Naturgut G.m.b.H.*	composting
Gabersdorf	*AWV Leibnitz-Wagna-Kaindorf / L. Huß*	composting
Söding	*U.M.S. Dienstleistungs- und Handels GmbH*	composting
Sulmeck-Greith	*AWV Oberes Sulmtal*	composting
Lafnitz/St. Ilgen	*RHV Oberes Lafnitztal*	composting
Übelbach	*Marktgemeinde Übelbach*	composting
Wies	*Marktgemeinde Wies*	composting
Thannhausen	*Gemeinde Thannhausen*	composting
Graden bei Köflach	*Peter Blümel*	composting
Pernegg	*Oskar Sarkleti*	composting
Fohsdorf	*Sonja Wildbolz*	composting
Großreifling	*Otto Duller*	composting
Frohnleiten	*Gemeindebetriebe Frohnleiten GmbH*	composting
Großpesendorf	*RHV Ilztal*	composting
Trofaiach	*Stadtwerke Trofaiach*	composting
Aigen/Ennstal	*VwG Aigen im Ennstal*	composting

*under construction

Table 15: Treatment plants of municipal sewage sludges in Styria (as at April 2009).

Climatic relevance

Sewage sludge is climate neutral when incinerated. Assuming a calorific value of 10 MJ/kg DM and an original share of 25% of DM, the energy required for drying to obtain high calorific granulates is regained during the incineration process. The chosen drying technique is fundamental: while technical drying requires small quantities of additional energy, solar drying (Figure 72) followed by incineration is energy self-sufficient and even produces some excess energy. Potentials for optimisation are observed, for instance, if waste heat is used in the drying process[197].

During anaerobic stabilisation of sewage sludge as performed in larger Styrian sewage treatment plants, methane-containing sewer gas is produced by degradation of the organic substance contained therein, covering part of the energy required to operate the sewage treatment plants (power supply for gas motors, generation of electricity, heating, etc.). The anaerobic treatment of sewage sludge and other wastes in digestion towers is referred to as co-fermentation, which helps increase the yield of combustible methane and allows for a more efficient use of the infrastructure provided.

[197]Obernberger, I.; Supancic, K. & Polzer, A.: Stoffflüsse und Reststoffnutzung aus Klärschlamm. Endbericht (BIOS Bioenergiesysteme GmbH, Graz), Amt d. Stmk. LReg. – FA19D, Graz, 2007.

Figure 72: Solar sewage sludge drying plant, waste water association Leibnitzerfeld Süd

With regard to resource protection through material recovery, important progress has been made over the last years in the development of technologies for the recovery of phosphor from sewage sludge ashes. A pilot plant has been operating in Leoben since June 2008, eliminating heavy metals from sewage sludge ashes in the so-called *Ash Dec* procedure[198]. This thermo-chemical treatment eventually produces phosphorous-containing fertiliser. While phosphor is available for the plants only to a limited extent if sewage sludge is directly agriculturally recovered, the properties of the produced fertilisers correspond to those of conventional phosphate fertilisers.

3.16.3 Summary 2009

The estimated quantity of future sewage sludge volumes of up to 30,000 t of DM was already surpassed in 2007, when an actual volume of 34,000 t of DM was reached. On the one hand, this growth can be related to the increased connection to treatment plants among the Austrian population; on the other hand, it is the result of a more precise identification of waste volumes and an improved data collection. According to the literature, the specific sewage sludge waste volume amounts to 18 to 28 kg/inhab/year, depending on treatment and stabilisation methods. Amounting to 17 kg/inhab/year, the average specific sewage sludge volume in Styria is therefore relatively low.

Vision 2 of the L-AWP 2005, stating that 60% of the energy contained in municipal waste and sewage sludge shall be used, was not reached for sewage sludge because only small quantities (22% in 2007) were passed on for thermal recovery. Upon operation of already approved drying plants to produce sewage sludge-derived waste fuels, the sewage sludge volumes intended for thermal recovery are expected to increase by approx. 3,000 t of DM, i.e. to 30%.

Increasing the share of thermal recovery to 60% according to the requirements defined in Vision 2 would represent an additional 13,000 t of DM intended for incineration, taking into account current volumes. The required capacities are available in Styria. An increase can, however, not be expected

[198] www.ashdec.com

within the next years since long-term treatment contracts have been set up for sewage sludge, and because the cost structures in the field of sewage sludge treatment have to be taken into account.

According to Vision 3 of the L-AWP, the use of landfill capacities shall be reduced by 55% compared with 2003. Implementing the Landfill Ordinance 2004 by prohibiting the landfilling of untreated wastes allowed for a decrease of landfilled sewage sludges from 5,400 t of DM in 2003 to 1,800 t of DM in 2007. The required mechanical-biological pre-treatment results in rotting losses of approx. 50%, i.e. the effective capacity required for landfilling amounts to only approx. 900 t of DM. For sewage sludge, Vision 3 has at present already been achieved due to reduced disposals, i.e. without taking into account the volume reductions achieved during mechanic-biological pre-treatment.

A contribution to Vision 4, aiming for a decrease of pollutant manifestations in soil, was achieved by introducing lower threshold values for heavy metal concentrations for direct agricultural recovery of sewage sludge as defined in the Styrian Sewage Sludge Ordinance 2007. Examination of potential hazards of until now neglected pollutants, such as hormone-active substances or antibiotic-resistant germs, shall be enforced in the future.

Vision 5 as set out to be achieved by 2015 in the L-AWP 2005, defining that waste must be materially recovered according to European and national legislation, was reached in 2007 for 60% of sewage sludges because they were recovered in agriculture and composting.

3.17 Demolition and construction waste and excavated materials

3.17.1 Waste volumes

The term “construction waste“ comprises any wastes produced during construction and demolition of buildings and civil engineering works. They are divided as follows:

- **excavated materials** (excavated earth, excavated soil material, technical fill material, etc.)
- **demolition and construction waste**
  - road construction waste (bitumen-containing or hydraulically bound materials, road stones, etc.)
  - construction waste (tiles, bricks, mortar etc.)
  - concrete waste
  - track ballast
  - asbestos cement and asbestos cement dust
  - construction site waste (plastic, paper, metals, cables, etc.)

According to the Federal Waste Management Plan 2006 the volume of **excavated materials** produced in **Austria** in 2004 amounted to around **22 million t** (2.7 t/inhab), while **construction waste** (demolition and construction waste) volumes amounted to roughly **6.6 million t.** Taken together, these waste categories produce more than half of the total Austrian waste volume. Since 1 January 1993, the Ordinance on the Separation of Waste generated during Construction[199] has provided the legal

[199] Federal Ministry of the Environment, Youth and Family, Ordinance on the Separation of Waste generated during Construction, Federal Law Gazette No. 259/1991.

framework for the obligatory recovery of all waste demolition and construction materials exceeding the determined thresholds as listed in Table 16.

Material group	Threshold
Excavated soil	20 t
Concrete waste	20 t
Asphalt waste	5 t
Waste wood	5 t
Waste metal	2 t
Waste plastic	2 t
Construction site waste	10 t
Mineral construction waste	40 t

Table 16: Thresholds according to the Ordinance on the Separation of Waste generated during Construction

Due to the high content of demolition and construction waste on total waste volumes, the European Parliament and the Council introduced a new Waste Framework Directive (2008/98/EC), defining that **70% of non-hazardous demolition and construction wastes must be recovered or recycled by 2020.**

FA19D does not have access to systematic reports and statements on waste volumes related to the field of construction (commercial and industry wastes). Since 2007, Styria has been partner in an EU-supported project on the **development of a concept, specifications and management criteria for the sustainable use of demolition waste (*ENBA*).** This project roughly estimates mineral construction waste volumes for 2008 amounting to 1 million t (Table 17). The waste types “mineral construction waste”, “road construction waste” and “concrete waste” account for approx. 75% of the total volume of demolition and construction waste (without excavated materials).

Demolition and construction waste	Volumes in t
Mineral construction waste	360,000
Asphalt waste	172,800
Asbestos cement	11,800
Concrete waste	195,000
Track ballast	63,400
Construction site waste	158,400
TOTAL:	**961,400**

Table 17: Demolition and construction waste in Styria, 2008[200]

[200] Daxbeck, H. & Flath, J.: Darstellung der Massenflüsse an Baurestmassen und an Bodenaushub in der Steiermark. Unveröffentlichte Studie (Ressourcen Management Agentur, Wien) i. A. des Amtes d. Stmk. LReg., 2009.

Data uncertainty has been observed for excavated material volumes from the building industry. For 2008, the volume of excavated materials was expected to amount to approx. 4 to 6 million t. In particular data from the field of civil engineering must be considered as uncertain, because excavated soil is frequently used directly on site for fillings and is therefore not reported.[200]

The share of construction waste **collected via municipal structures** (Figure 73) is relatively small. In 2008, only approx. 30,000 t of this waste type were collected at the municipal level, the majority originating from private home improvement activities.

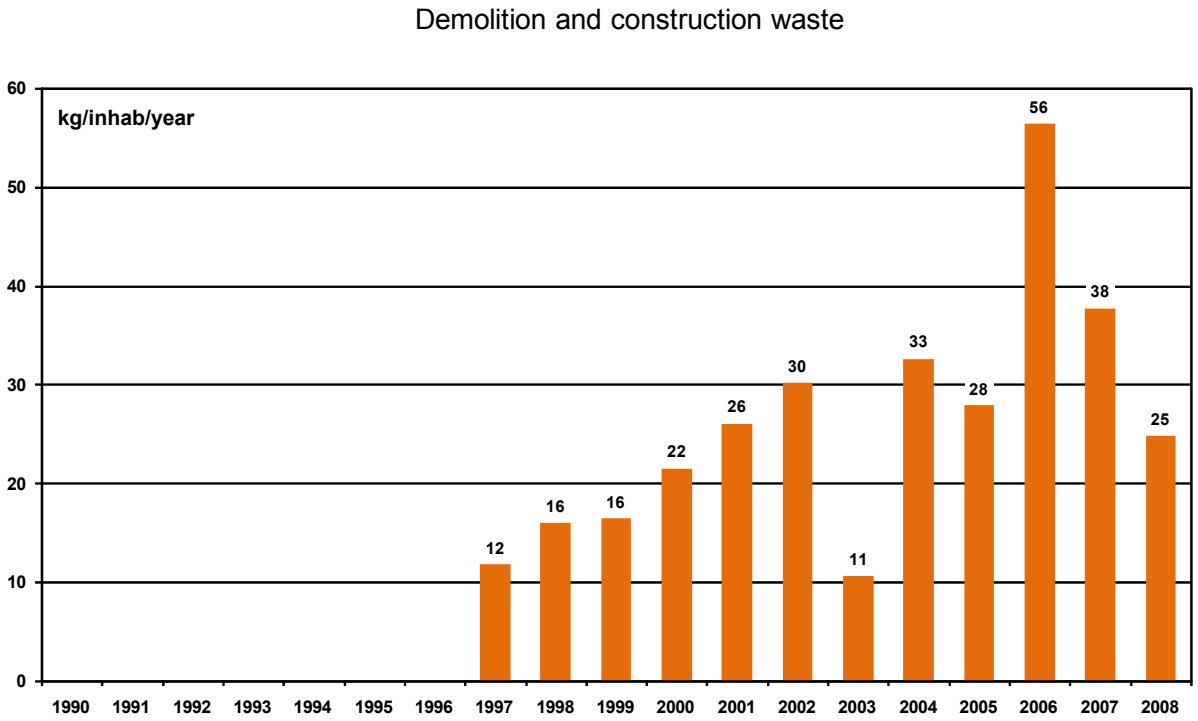

Figure 73: Municipal collection volumes of demolition and construction waste in Styria, 1999 - 2008

3.17.2 Waste treatment

Overall, 10 stationary and 18 mobile treatment plants were available for the treatment of mineral construction waste in Styria in 2008 (Table 18). In theory, full operation of these plants would allow for recovery of approx. 2 million t of mineral construction waste per year. Quality-assured processed demolition and construction waste, so-called recycled demolition and construction waste, have a large spectrum of use and represent a useful alternative to traditional primary construction materials in many fields. Prerequisite for high-quality treatment of demolition and construction materials is separate collection at the construction site.

The *Austrian Association for Recycling of Demolition and Construction Waste* (*Österreichischer Baustoff-Recycling Verband, BRV*)[201] publishes guidelines for the recycling of demolition and construction waste to define quality standards. To some extent, these requirements were taken over

[201] *BRV* (Hsg.): Richtlinie für Recycling-Baustoffe. 8. Auflage, Wien, 2009.

into the *Steiermärkische Bauproduktegesetz* 2000[202] (*Baustoffliste ÖE*). Recycled demolition and construction waste is divided into the following categories:

- recycled mineral demolition and construction waste from buildings
- recycled sand
- recycled tiles sand; recycled tile chips
- recycled tile sand from buildings; recycled tile chips from buildings
- recycled sand from buildings; recycled chips from buildings
- recycled broken asphalt granulate
- recycled broken concrete granulate
- recycled broken mixed granulates from asphalt/concrete
- recycled broken mixed granulates from concrete and/or asphalt and stone
- recycled stone granulate

The above-mentioned guidelines define fields of application and quality requirements for recycled demolition and construction waste in view of construction- and environment-relevant properties. The most important handbooks are the so-called "*Rote Richtlinie – Red Directive*" on the recovery of demolition and construction waste from buildings and the "*Grüne Richtlinie – Green Directive*" on the recovery of underground structural demolition and construction waste. The quality requirements defined therein are approved by the *BMLFUW* and have, if already set at the time, been included in the Federal Waste Management Plan 2006, Chapter "Quality requirements for recovery of construction waste".

Figure 74: Quality certificates for recycled demolition and construction waste

Recycled demolition and construction waste that meets the requirements of the listed guidelines and that was manufactured by member companies of the *ÖGSV* (*Austrian Association for the Protection of the Quality of Recycled Demolition and Construction Waste*) may be awarded the *Gütezeichen für Recycling Baustoffe - Quality certificate for Recycled Demolition and Construction Waste* (Figure 74) by the ÖGSV.

[202] Gesetz vom 20. März 2001 über das Inverkehrbringen und die Verwendbarkeit von Bauprodukten (Steiermärkisches Bauproduktegesetz 2000), Provincial Law Gazette No 50/2001, as amended in Provincial Law Gazette No 13/2010.

Site	Operator	Plant type	
		stationary	mobile
Klöch	*Austromobil GmbH & Co KG*		X
Deutschlandsberg	*Bauhof Deutschlandsberg GmbH*	X	
Seiersberg	*Blumen Eibinger Großhandel GmbH & Co KG*		X
St. Veit/Vogau	*BRS Bau- und Altstoff Recycling Süd*	X	
Traboch	*Eisl*		X
Gröbming	*Gröbminger Schotterwerk u. Steinbruch Maier GmbH*		X
Trofaiach	*Hebenstreit*		X
St. Georgen	*Heinrich Transporte & Erdbau*		X
Fohnsdorf, Kobenz	*Knittelfelder Bauschutt-Recycling GmbH*	X	
Großklein	*Kolar Erdbau GmbH*		X
Kalsdorf	*Krisper GmbH*		X
Maria Buch- Feistritz	*Leithäusl GesmbH*	X	
Naas	*Marko GmbH & Co KG*	X	
Frohnleiten	*Martinelli*		X
Rottenmann	*Paltentaler Split & Marmorwerke GmbH*		X
Schladming	*Pitzer Karl Gmbh*		X
Graz	*Pongratz Baugesellschaft mbH*		X
Bruck/Mur	*Riegerbauer Transport GmbH*		X
Feldkirchen bei Graz	*Schönberger GmbH*	X	
Weitendorf	*Saubermacher Dienstleistungs AG*	X	
Kapfenberg	*Schratter Transport GmbH*		X
Stein an der Enns	*Steiner Transporte und Erdbau GmbH*		X
Kainisch, Mürzhofen	*Strabag AG*	X	
Graz	*Teerag-Asdag AG*		X
Peggau	*Tieber GmbH*		X
Bruck/Mur	*Transbeton Lieferbeton GmbH*	X	
Unterpurkla	*Trummer Maschinenhandel Aufbereitung GmbH*		X
Heimschuh	*WML Bau GmbH*	X	

Table 18: Stationary and mobile treatment plants of demolition and construction waste in Styria (data from licensing notices, as at July 2009)

Recovery of demolition and construction waste and re-use of quality-assured recycled construction waste both represent a major contribution in implementing the sustainability principle. Thereof the central goals of recycling measures, such as protection of resources and landfill volumes, can be derived.

Via FA19D, the Province of Styria supports the internet platform "*Recycling-Börse-Bau*" (*RBB, Recycling Network Construction*, www.recycling.or.at, Figure 75), which is run by the recycling association. The *RBB* encourages recovery of mineral demolition and construction waste. It aims to bring together supply and demand for mineral recycled construction waste and excavated materials while at the same time not only trading these materials, but also providing information on who offers or needs which material on which site within which time. The target audience of the *RBB* are private and

public clients as well as their agents (architects, civil engineers, consultants), property developers, construction companies, recycling or transport companies and landfill operators.

Figure 75: Website of the *Recycling-Börse-Bau*

The climatic relevance of treatment (recovery or disposal) of construction waste has to be evaluated in the context of a comprehensive eco-balance of recycled construction waste. According to Kümmel (2000)[203], recyclates as concrete aggregate involve approx. the double input of primary energy (approx. 84 MJ/t) and show a three-fold increase in greenhouse gas potential (approx. 6 kg of CO_2 equivalents/t) compared with the supply of sand or gravel. In contrast, the positive effects – protection of resources and landfill volumes – cannot be neglected. Depending on the local situation and specific constraints, a change in energetic considerations may be observed. In particular treatment and re-use on site may reduce the energetic disadvantages of the recyclate. Integrated use may show different results (e.g. less heating losses if outer walls are made from recyclate compared to conventional concrete as a result of lower bulk density and consequent reduced thermal conductivity). With regard to situation and distribution of sand and gravel pits, additional transports may be required compared with recyclates under otherwise identical conditions. The energetic disadvantage of the recyclate is balanced after approx. 15 km in case of on-site treatment and after approx. 30 km in case of processing in stationary treatment plants.

The ecologic benefits of recycled construction waste are particularly important if the materials are used in correspondence with their technical properties. Depending on the given conditions and types of use, the energy input required for the supply of the secondary construction material goes up or down compared with the primary product. Clear saving potentials through recycling measures are observed for the use of resources and landfill volumes. Integrating the utilisation phase shows that possible disadvantages of the recycled products (e.g. an increased energy input is required if the life

[203] Kümmel, J.: Ökobilanzierung von Baustoffen am Beispiel des Recyclings von Konstruktionsleichtbeton. Dissertation, Universität Stuttgart, 2000.

span is included in the considerations) do not play a role, while the advantages described above remain applicable throughout the total life span.[203]

In Styria, 18 mass landfills for construction and demolition waste (Table 19) and 32 landfills for excavated soil (Table 20) were available in 2008 for the disposal of non-recoverable demolition and construction waste and excavated materials. As laid out in the amendments to existing regulations, in particular in the context of the amended Landfill Ordinance (deviations from state-of-the-art technology are no longer permitted for landfills for demolition and construction waste), three former landfills for demolition and construction waste have been operated as excavated soil landfills since 1 July 2009. Another landfill for demolition and construction waste was transformed into an inert waste landfill.

Municipality	Remaining capacities in m³	Operators of landfills for demolition and construction waste
Bruck/Mur	170,000	*Trans Beton GmbH.*
Großhart	55,707	*Weitzer Manfred*
Hartberg	1,000	*Stadtwerke Hartberg*
Kobenz	77,190	*Knittelfelder Bauschutt-Recycling GmbH*
Gamlitz	50,000	*BRS Bau- und Altstoff Recycling Süd GmbH*
Aigen/Ennstal	34,505	*Danglmaier Alfred GmbH***
Gaishorn	278,500	*Gebrüder Haider GmbH & Co KG + BAD*
Haus/Ennstal	44,200	*Hartweger Andreas Bauschutt & Recycling GmbH***
Kainisch	11,541	*Mitterndorfer Transport GmbH***
Frojach-Katsch	18,000	*Brem GmbH.*
Naas	33,506	*Marko GmbH & Co KG****
Hitzendorf	144,697	*Granit Bauunternehmung GmbH.*
Total	918,846	
Fisching	n/a	*BWG Zeltweg*
St. Marein/Mürztal	n/a	*Granit Bauunternehmung GmbH.*
Unterpremstätten	n/a	*Saubermacher AG*
Riegersberg	n/a	*Marktgemeinde Vorau**
Lassing	n/a	*Paltentaler Kies- und Splittwerk GmbH****
Langenwang	n/a	*Teerag Asdag AG*

*operated as inert waste landfill since 1 July 2009
** operated as excavated soil landfill since 1 July 2009
***mining plant

Table 19: Landfills for demolition and construction waste in Styria (data source: EDM, report of landfill operators, as at 1 January 2009)

Municipality	Remaining capacities in m³	Operators of excavated soil landfills
Oberaich	99,400	*Strabag AG*
Pernegg/Mur	27,426	*Asfinag*
Pirka	101,918	*Haindl*
Greinbach	5,500	*Gemeinde Greinbach*
St. Magdalena / Lemberg	27,239	*Gemeinde St. Magdalena am Lemberg*
Aich-Assach	50,417	*Hartweger Peter*
Spital/Semmering	172,498	*Teerag Asdag*
Hohenau/Raab	825	*Gemeinde Hohenau/Raab*
Naas	44,418	*Gemeinde Naas*
Naas	34,786	*Strobl GmbH.*
Gai	200,000	*Swietelsky Bau GmbH.*
Leoben	6,000	*Teerag Asdag*
Zettling	3,000	*Teerag Asdag*
Frohnleiten	18,000	*Teerag Asdag*
Total	**1,037427**	
Oberaich	n/a	*Schratter Transport GmbH*
Gratkorn	n/a	*Kanzelsteinbruch Denning*
Kalsdorf/Graz	n/a	*Krisper*
St. Lorenzen/Wechsel	n/a	*Gemeinde St. Lorenzen am Wechsel*
Wenigzell	n/a	*Maderbacher*
Vogau	n/a	*Fix Recycling*
Niklasdorf	n/a	*Schaffer-Hassmann Herbert*
Gröbming	n/a	*Trans Beton*
Pürgg-Trautenfels	n/a	*Leitner Erich*
Feistritz	n/a	*Gemeinde Feistritz/Anger*
Mortantsch	n/a	*Gemeinde Mortantsch*
St. Ruprecht/Raab	n/a	*Kleinhappl GmbH.*
Neuberg/Mürz	n/a	*Terrag Asdag AG*
Traboch	n/a	*Bernhard Haberl*
Parschlug	n/a	*Schratter Transport GmbH.*
Feldkirchen/Graz	n/a	*Schönberger GmbH.*
Irdning	n/a	*Marktgemeinde Irdning*
St. Peter/Judenburg	n/a	*Bernhard Honis*

Table 20: Excavated soil landfills in Styria in (data source: EDM, report of landfill operators, as at 1 January 2009)

3.17.3 Summary 2009

According to Vision 5 of the L-AWP 2005 the shares of recycled construction materials shall increase from 9% in 2000 to 30% by 2015, with defined quality criteria to be applied during the treatment of demolition and construction waste. Moreover, the use of recycled construction materials with approved quality shall be well established on the market.

At least 20% of construction wastes produced in Styria in 2008 were materially recovered; therefore meeting the target of a recovery quota of 30% by 2015 as defined in Vision 5 seems realistic. With regard to the quality of recycled construction materials, the guidelines formulated by the *Recycling Network Construction* and the Federal Waste Management Plan set validated standards. In 2009, only 8 of the 22 Styrian recycling companies for construction waste were members of the *BRV*; thereof only 7 member companies were also members of the *Austrian Association for the Protection of the Quality of Recycled Demolition and Construction Waste*.

Attempts to determine the actual recovery quota exhibits uncertainty: depending on the sources, it ranges from 20% (data from plant operators) to 60% (according to *BRV*). In any case measures to increase the recovery quota are required, in particular to meet the targets of the EU Waste Framework Directive, aiming to achieve a recovery quota of 70% for demolition and construction waste by 2020. In the same context, the re-use of demolition waste is to be supported.

Economic handling of available landfill resources as laid out in Vision 3 of the L-AWP 2005 has been implemented: The significant reduction of free landfill volumes on landfills for demolition and construction waste as at 1 July 2009 can be related to the criteria defined in the Landfill Ordinance 2008, whereafter individual landfill sites are no longer suitable for adaptation to comply with the strict requirements.

The **project "*Gipskartonplatten-Recycling*** – *Recycling of gypsum plaster boards*" shall be mentioned as an example for a successful project initiated by FA19D: in 2005, preparatory works were started and in a vacation work (www.abfallwirtschaft.steiermark.at > Publikationen) facts on the use of gypsum (plaster) boards in Austria were collected, because these materials are frequently used for renovation works. Within a diploma thesis performed at the University of Leoben a procedure was developed which allows obtaining gypsum fractions with approved quality from mixed construction wastes that can be re-used for the production of gypsum plaster boards (Figure 76). Support was provided by FA19D and the external project partners *KNAUF* (a producer of gypsum plaster boards) and *TRANSBETON* (a disposal company and operator of a landfill for demolition and construction waste) who are technically implementing the results of the diploma thesis. The project was awarded the innovation award “Phoenix 2008” of the *ÖWAV.*

Figure 76: Generation of a gypsum raw fraction from gypsum plaster boards; experiment performed in the context of the project "*Gipskartonplatten-Recycling*".

4 Waste volumes – development and outlook

According to the systematics of the Federal Waste Management Plan 2006, 508,175 t of municipal wastes, i.e. 421 kg/inhab/year, were produced in Styria in 2008. In comparison with estimates from 2005[204], stating that total municipal waste volumes would amount to approx. 460,000 t/year in 2008, the expected value was actually surpassed by 10%. The estimated residual waste volume amounted to approx. 141,000 t; this value was exceeded by only 5% in 2008 when an actual residual waste volume of 148,000 t was reached. While a share of 42% of residual and bulky waste was estimated, an actual collection volume of only 38% was reached.

Overall, municipal waste volumes between 2003 and 2008 increased by 18% (absolute) or 17% (per inhabitant), respectively. In 2008, the share of residual waste and street sweepings amounted to approx. 29.5% and has continuously decreased since 2003 (32%) due to separate collection of waste materials. In the same period, the total share of the separately collected recoverable fractions waste materials, biogenic waste and packagings increased from 55% to 59%. Taking into account all fractions, the total recovery quota amounts to approx. 70% of the total municipal waste volume (according to the systematics of the B-AWP 2006).

The Municipal Solid Waste Analysis uncovers further reduction potential for residual waste. On average, approx. 32% of residual waste (i.e. approx. 40 kg/inhab/year) are composed of the recyclable fractions paper, plastic, glass, metal, wood and biogenic waste (organic waste). The share of packagings in residual waste amounts to a total of approx. 16%.

To **estimate future waste volumes**, a regional specific model was used for the first time, which based on socio-economic indicators[205]. The “Model for municipal waste volume forecasts for Styria 2020“, which was developed for this purpose, aims to provide quantity-relevant forecasts of municipal waste flows at community and association levels until the year 2020 (Figure 77).

The model consists of two parts: an outlook on factors influencing the waste volumes and the actual estimate of waste quantities. Taking into account the quantitative development of indicators relevant for waste volumes, the following trends are clearly visible and have to be considered until the year 2020: i) smaller household sizes, ii) increasing urbanisation, and iii) possibly significant changes regarding working places. Rather insignificant changes are expected for total inhabitant numbers. Demographic development trends were adapted from the available regional estimate at community level; for economic indicators, trends were assumed and examined within a sensitivity analysis. Three scenarios were considered for the key indicator jobs: constant numbers, constantly increasing numbers (based on the period from 2001 to 2007), and declining numbers based on an age-related decreasing share of the economically active population.

[204] Styrian Provincial Government (ed.): Federal Waste Management Plan 2005. Graz, 2005.

[205] Beigl & Lebersorger, 2010.

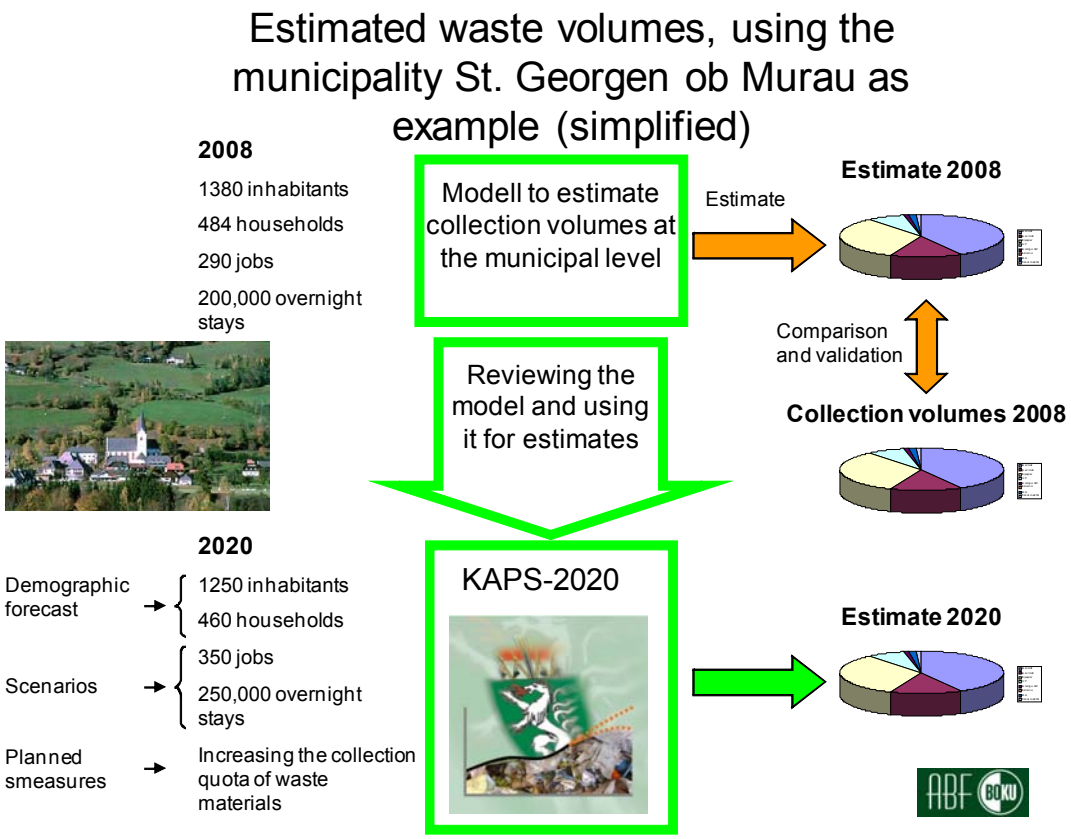

Figure 77: Estimated waste volumes, using the municipality St. Georgen ob Murau as example

The most probable trend scenario is a real economic growth rate of 1%, i.e. the expected volume increase of approx. 1.2% per year will be similar to that achieved in the period from 1997 to 2006 (Figure 78). Municipal waste volumes will reach 584,000 t/year. Dramatic volume increases stem from the scenarios which assume an identical or increased number of jobs and a real economic growth rate of 2%: in these cases, up to 670,000 t of waste per year are expected. Demographic data suggest, however, that these extreme scenarios are unlikely. On the other hand, a waste volume of 540,000 t/year is expected for 2020 in the case of stagnating economic growth. The individual factors have different effects on the final result of the estimate; therefore Table 21 summarises the assumed changes and their impact on municipal waste volumes in the year 2020.

Assumed change	Impact on municipal waste volumes 2020
50,000 (10%) more jobs	+5,000 - 6,000 t
real economic growth increased by 1% per year	+60,000 - 80,000 t
3 million more overnight stays	+2,500 - 3,000 t
domestic fuels reduced by 50%	+25,000 - 30,000 t

Table 21: Estimated effects of altered framework conditions and measures on waste volumes 2020[206]

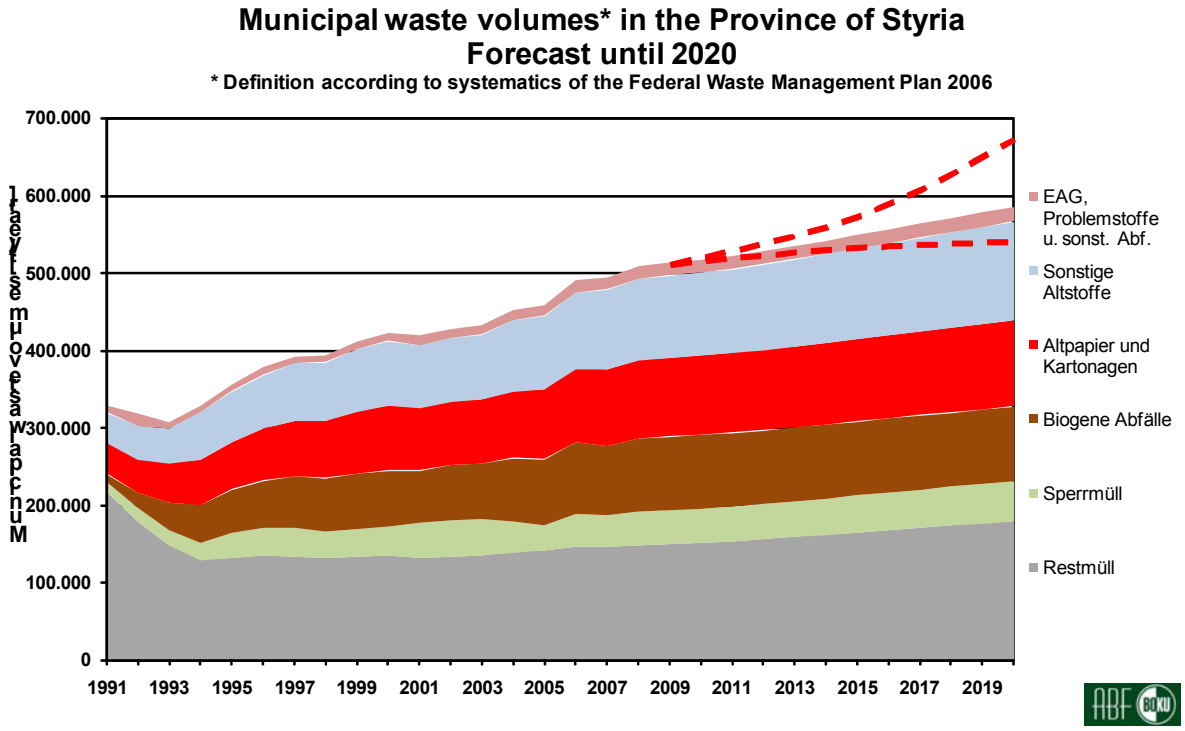

Figure 78: Waste volume estimates for Styria (trend scenario with 1% of real economic growth)

The effects of waste management-related measures on future collection volumes are of particular interest. Figure 79 compares different measures set in a trend scenario with 1% of economic growth. Higher intended collection quota for waste materials result in an increase of collection volumes by about 10% of waste paper, lightweight packagings and organic waste (yellow columns), respectively, assuming amongst others that all municipalities introduce a pick-up system for waste paper collection. For municipalities with currently low servicing degrees of organic waste containers and a small share of home composting, higher servicing degrees with regard to organic waste containers are assumed as scenario. Based on the assumption that domestic fuels are reduced by 50% and that the above-mentioned quantities are collected separately, slightly increased collection volumes can be expected.

[206] Beigl & Lebersorger, 2009.

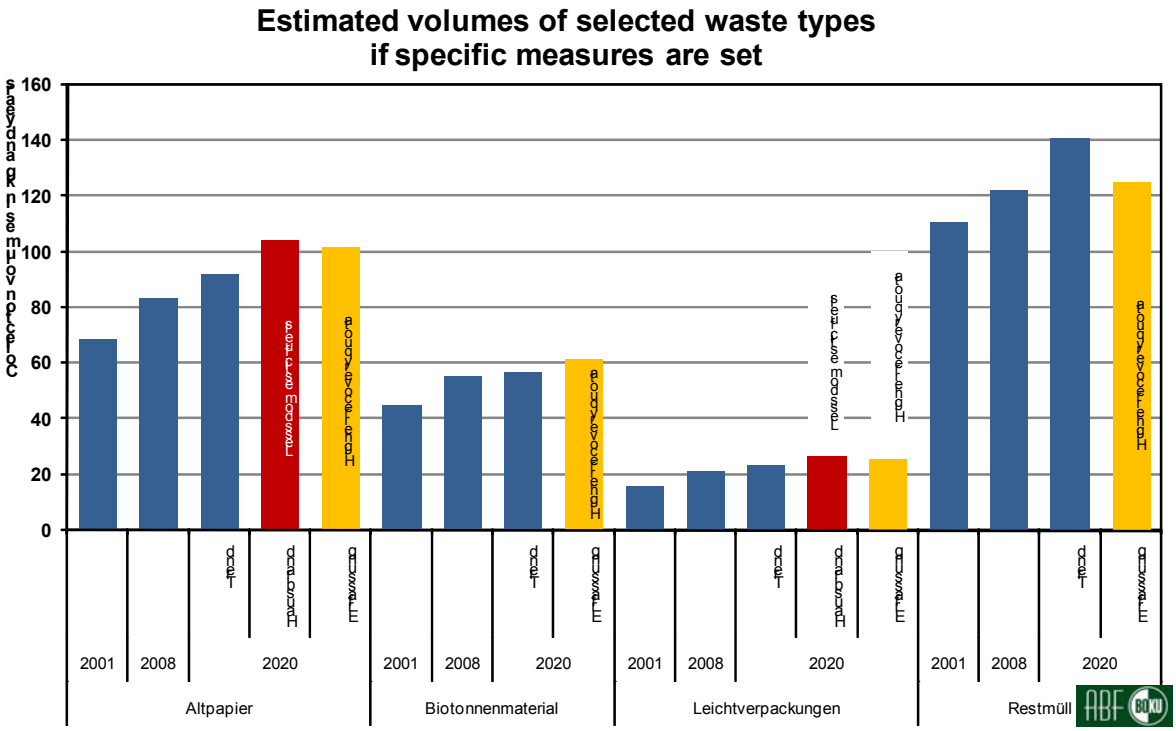

Figure 79: Estimated volumes of selected waste types if specific waste management-related measures are set, compared with the most likely trend scenario (real economic growth of 1%)[207]

A region-specific forecast[207] of waste volume developments shows that the increased waste volumes will not be distributed evenly (Figure 80). The most significant growth rates are expected for the surroundings of the City of Graz and for towns such as Gröbming, Zeltweg and Leibnitz. Growth rates in the cities are moderate while remarkable growth rates are expected for the region "*Thermenregion*".

[207] Beigl & Lebersorger, 2010.

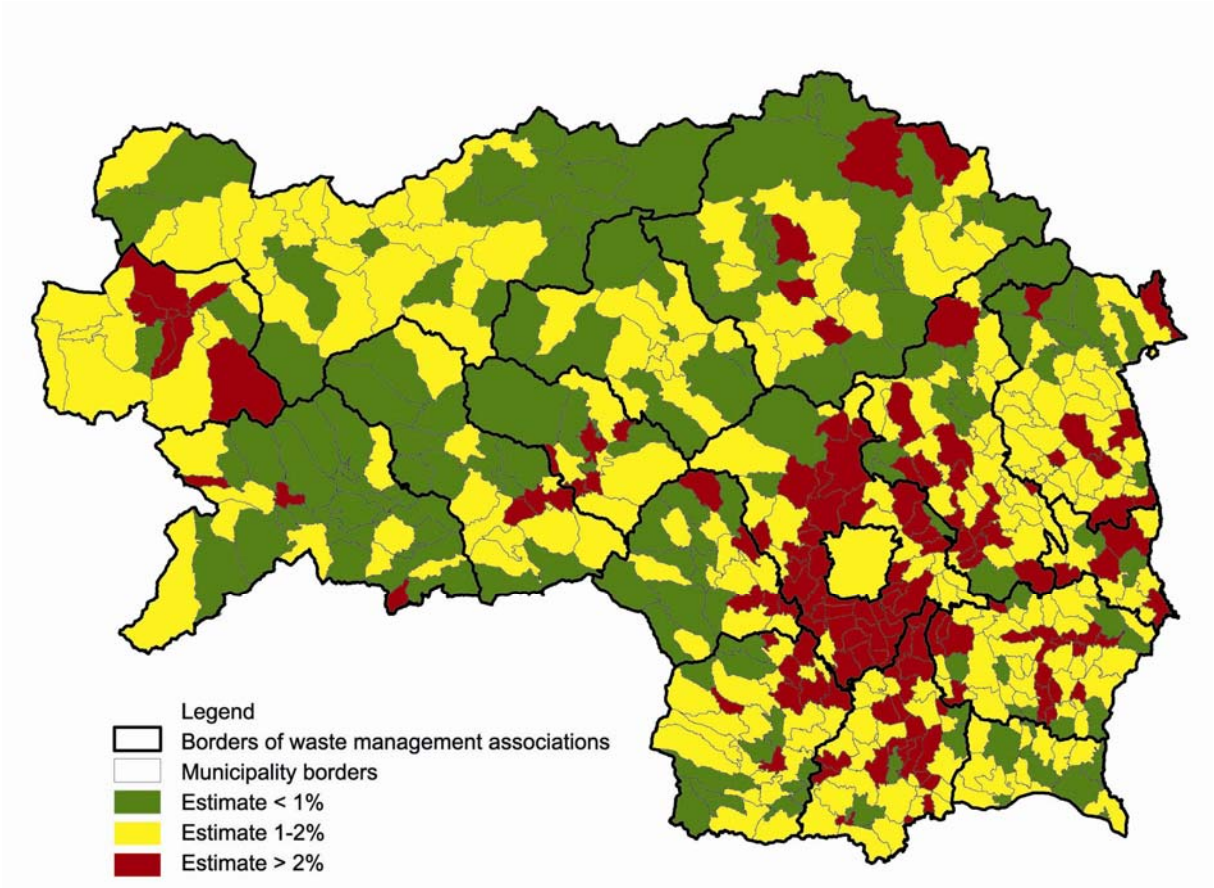

Figure 80: Estimate of waste volume increase in Styrian municipalities; red: municipalities with strong growth rates of >2% per year; yellow: municipalities with average growth rates; green: municipalities with growth rates <1% per year or expected decrease[208]

[208] Data from: Land Steiermark, LBD-GI; estimated data from: Beigl & Lebersorger, 2010.

5 Costs of municipal waste management

5.1 Disposal costs and revenues derived from waste materials

The following components add to the costs of municipal waste management:

- collection of waste within public waste disposal
- separate collection of waste materials and biogenic waste
- separate collection of problematic substances
- waste recovery and waste treatment
- construction, operation and maintenance of waste material collection centres (ASZ) and collection bays
- ASZ staff, including training
- measures for sustainable advice in environment- and waste-related matters
- measures and projects to promote sustainable waste and material flow management
- debt services for pertinent loans
- aliquot administrative costs of municipality and waste management associations
- creation of reserve funds for maintenance, reconstruction, or expansion
- removal of illegal disposals

These expenses can be opposed to revenues from the recovery of waste materials, such as

- waste paper
- flat glass
- waste cooking oils
- old clothes/shoes
- waste metals (ferrous scrap, non-ferrous metals)
- waste plastic (e.g. PE foils)
- waste wood

Revenues vary depending on the market situation. Packaging waste is subject to the Packaging Ordinance and must be transferred to the relevant collection and recovery systems.

Determination of the actual disposal costs proves to be extremely difficult because the services offered by the municipalities may vary considerable (e.g. disposal interval, pick-up service in remote areas, opening hours of waste material collection centres, bulky waste pick-up services, tree and bush cutting service, chaff service, waste consulting, promotion of measures for waste prevention such as *G'scheit Feiern* festivities, purchase and use of "dish mobiles", home and community composting).

Cost-specific key figures were determined representatively among 117 municipalities within the project *Steirischen Abfallspiegel 2009* (Table 22).

Residual waste		Min	**Median**	Max
Collection costs	€/container	77.7	**125.5**	198.6
Treatment costs	€/container	145.3	**164.6**	173.3
Total costs	€/container	238.9	**293.1**	356.6
Total costs	€/inhab/year	12.4	**22.8**	35.9
Biogenic waste				
Collection costs	€/container	51.4	**94.0**	158.5
Treatment costs	€/container	46.2	**70.4**	92.0
Total costs	€/container	103.1	**179.6**	316.4
Total costs *)	€/inhab/year	17.2	**25.2**	68.1
Waste paper				
Collection costs	€/container	53.3	**90.1**	145.9
Revenues	€/container	35.60	**49.5**	67.0
Total costs	€/container	12.0	**42.5**	99.0
Total costs	€/inhab/year	0.5	**2.6**	6.9
ASZ				
Personnel costs**)	€/hour	20.6	**57.3**	173.7
Running costs**)	€/hour	4.0	**28.8**	119.1
Revenues	€/inhab/year	0.6	**2.6**	9.9
Total costs	€/inhab/year	8.7	**16.8**	33.8

**) inhabitants serviced by organic waste containers*

***) personnel costs and running costs per opening hour*

Table 22: Cost-specific key figures – *Steirischer Abfallspiegel 2009* (data 2008)

In 2008, the costs for the collection and treatment of residual waste ranged from 239 to 357 Euro/t with a median of 293 Euro/t; the costs for treatment only amounted to an average of 164 Euro/t (median)[209]. Compared with the average of 151 Euro/t[210] determined for 2003, the costs for residual waste treatment have increased by 8.6%.

The municipalities were able to generate money (revenues and fees) from

- the recovery of waste paper
- the recovery of waste metals
- infrastructure fees in the context of the collection of waste electrical and electronic equipment
- the recovery of wastes received in waste material collection centres (e.g. waste wood, waste cooking oils, etc.)
- stand space cleaning

Figure 81 provides an overview of possible revenues. According to data from the *Steirischer Abfallspiegel 2009* these community **revenues** varied from 4.1 Euro/inhab/year to 12.4 Euro/inhab/year (**median: 7.7 Euro/inhab/year**) in 2008.

[209] INFA 2009; data collected from 117 municipalities.

[210] Styrian Provincial Government (ed.): Federal Waste Management Plan 2005. Graz, 2005.

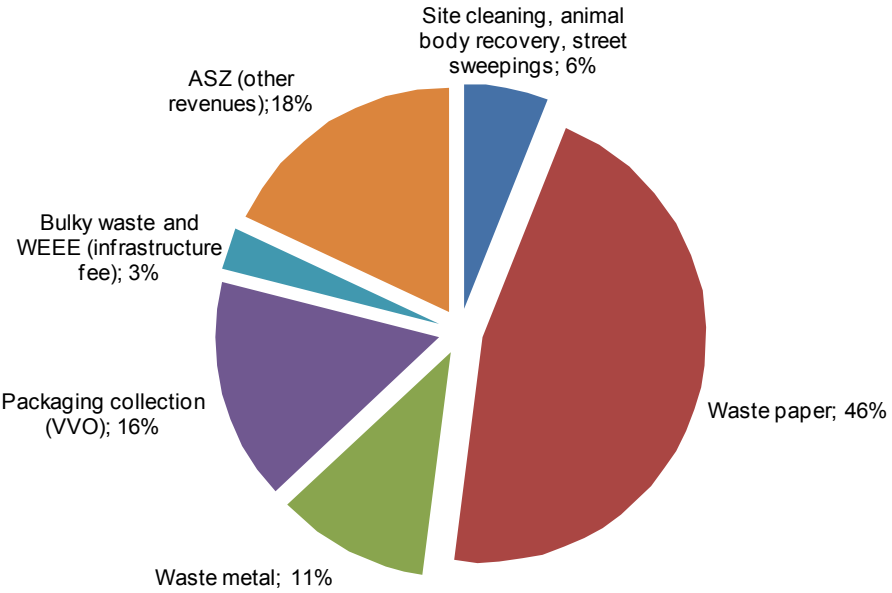

Figure 81: Origin of revenues and fees according to waste types and services

The actual amount of costs for collection and treatment of municipal waste depends on multiple factors (waste type, collection system, collection interval, collection container, regional structures, transport ways, treatment type, adjustment to current trends in case of revenues from recoverables). Costs are therefore hardly comparable; the same situation is observed for revenues.

5.2 Fees

Municipal waste management is financed through:

- fees and tariffs for the collection of municipal waste
- product-related charges, such as license fees for the collection and recovery of packaging waste
- revenues from the separate collection of waste materials (waste paper, waste metals, waste cooking oils and fats)
- and, to a minor part, general tax income which helps finance e.g. waste consulting and campaigns to raise public awareness in the field

The StAWG 2004[211] provides the legal basis for Styrian municipalities to levy fees for the use of disposal services and institutions as well as the treatment of municipal waste. The amount of the fee is either calculated according to the container volume provided and the number of disposals or weight-related (variable fee). In any case, a base rate must be defined in the Removal Order of the municipality. A separate tariff can be charged for additional services related to the collection of municipal waste. The fees can be determined in such a way that the expected annual revenue covers up to the double of the yearly expenses for the collection and treatment of municipal waste.

[211] Art 13 StAWG 2004

The amounts of waste-related fees payable to municipalities by the Styrian households differentiate significantly from each other and strongly depend on regional structures. The reference basis for the calculation of fees varies in relation to weight and volume. Collection intervals (number of disposals) are subject to seasonal and regional fluctuations, and extra fees are added to specific waste fractions to different extents. Even terms and description of individual categories (real property, payers of fees, etc.) are not always used in the same way. As a result of the differences mentioned above, a comparison of waste-related fees is hardly feasible.

The representative results of the evaluation performed within the project *Steirischer Abfallspiegel 2009* (Figure 82) suggest that 50% of all municipalities reach the break-even point with the waste-related fees they levy; 21% cover 95-100% of all costs, around 15% cover 100 to 105% of all costs, and approx. 35% of all municipalities achieve a cost recovery of below 105%.

According to the data collected in *Steirischer Abfallspiegel 2009* the **specific municipal disposal costs** range from 36.1 to 100.7 Euro/inhab/year (**median: 53.3 Euro/inhab/year**). The determined range for incomes from fees and revenues was between 37.9 and 100.9 Euro/inhab/year in 2008 (**median: 53.7 Euro/inhab/year**).

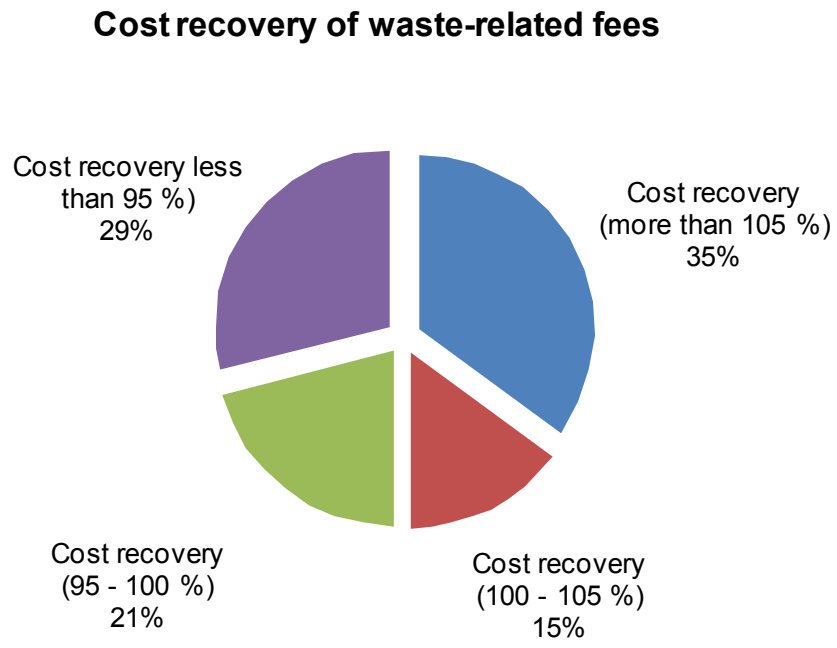

Figure 82: Cost recovery of waste-related fees

5.3 Expenses of FA19D

Aiming to meet the legal requirements in the field of waste management, the Province of Styria has over years financially supported municipalities and waste management associations in the following areas: i) improving the infrastructure to allow for separate collection of waste (waste material collection centres), ii) waste management-relevant projects on waste prevention and waste recovery and iii) information campaigns and other ways of raising public awareness, in particular by giving advice in waste-related matters.

The expenses of Specialised Division 19D for waste management-related measures from 1998 to 2008 are listed in Table 23.

Measures	Expenses in million EURO										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Waste management-related funding (infrastructure, training, etc.)	1.7	1.4	1.1	1.3	0.9	1.4	1.0	0.7	0.6	0.6	0.5
Waste consultants	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Waste management-related projects and studies	0.6	0.7	0.4	0.6	0.5	1.0	0.7	0.5	0.8	0.8	0.6
Non-profit institutions	0.4	1.2	0.5	1.2	1.7	1.8	1.9	1.5	1.4	1.0	1.0
Information and PR activities	0.1	0.2	0.6	0.4	0.5	0.2	0.2	0.7	0.3	0.3	0.4
Total	**3.1**	**3.8**	**2.9**	**3.8**	**3.9**	**4.7**	**4.1**	**3.7**	**3.4**	**3.1**	**2.9**

Table 23: Expenses of FA19D in million Euro (1998 - 2008)

5.3.1 Evaluation of funding of municipal waste management

To illustrate and monitor the financial resources allocated in the field of waste management from 1995 to 2007, FA19D requested to evaluate[212] the funding of municipal waste management relevant for the Province of Styria.

Aim of this study[212] was to examine the connections between the allocation of financial resources and the resulting developments related to waste management (effects on the reduction of residual waste volumes, increase of separately collected waste materials and stimuli for the recovery of these wastes, effects on separate collection and recovery of biogenic waste, effects with regard to sensibilisation of citizens). Moreover, the total investment volumes and economic incentives initiated as a result of funding were determined.

In October 2008 the final report[212] on the evaluation of funding of municipal waste management in Styria was completed. Its most important findings are summarised as follows:

[212] Quantum Institut für betriebswirtschaftliche Beratung GmbH: Evaluierung der Förderungen der kommunalen Abfallwirtschaft des Landes Steiermark. Unveröffentlichte Studie im Auftrag des Amtes der Steiermärkischen Landesregierung, FA19D, 2008.

1. Funding quantity and key areas of funding

- Total funding granted by FA19D (formerly FA1c) amounted to 13.2 million Euro in the evaluation period from 1995 to 2007.
- The average annual amount paid decreased from 3.45 million Euro per year (1989 to 1994) to 1.02 million Euro per year (1995 to 2007).
- Financial support focused in particular on
  - the establishment of waste material collection centres (ASZ) and collection cells for problematic substances (PSS) (5.6 million Euro.),
  - funding of waste consultants (4.1 million Euro),
  - funding of projects that are part of the initiative *G´scheit feiern* (1.2 million Euro.),
  - composting plants (0.9 million Euro) and
  - collection sites for animal bodies (0.4 million Euro).
  - A total funding volume of 1.0 million Euro was granted for further areas: waste management-relevant projects, organic waste containers, community composting facilities, equipment for composting, heating facilities for cooking waste, “dish mobile”, farm school milk, regional energy Styria.

2. Waste volumes in the evaluation period 1995 to 2007

The evaluation period from 1995 to 2007 is characterised by an average annual increase of total waste volumes of 4.42%.

Regardless of these considerably growing waste volumes, quantitative developments were achieved in the fields listed below. This was achieved thanks to an improved infrastructure for separate waste collection combined with intensive information campaigns and PR activities:

- Volumes of mixed household waste (residual waste) remained at an almost stable level: the average increase remained constantly at 0.94% per year from 1995 to 2007.
- The ratio between residual waste volumes and bulky waste was reduced from 4:1 to 3.5:1.

3. Effects of funding

- The primary **effects of waste management-related funding** are i) the maintenance and expansion of separate waste collection and ii) saving of residual waste treatment capacities of 417,000 tonnes. This means that landfill volumes, in particular for residual waste, were cut down by ~208,500 tons (50%).
- Total investments and turnovers of more than 47 million Euro were induced as **economic effects** of funding. On the other hand, more than 62 million Euro were saved in the field of residual waste treatment.
- Thanks to funding activities of FA19D, economic effects from investments and turnovers induced thereof (including multiplier effects) of approx. 60 million Euro were achieved. Including cost-saving effects, the overall economic effect surpasses 120 million Euro.

4. Evaluation

- The chosen type of funding – exclusively arranged as non-repayable grants – is most beneficial in terms of funding efficiency as well as funding effectiveness.

6 Public awareness, advice on waste and public relations

According to the distribution of functions of the Styrian Provincial Government, the central tasks of FA19D comprise active and target-group oriented information and PR activities in the field of waste and material flow management and sustainable development. Key factor for success is the offensive addressing of target groups to raise awareness and understanding when it comes to the implementation of measures aimed at the ecological and socially responsible development of waste and material flow management.

The most important instruments for public awareness, advice on waste and public relations are:

- **The four internet platforms**
  - www.abfallwirtschaft.steiermark.at (*AWIS, Abfallwirtschaftliches Informationssystem*)
  - www.awv.steiermark.at (platform for the Styrian waste management associations and the waste prevention initiative *G'scheit Feiern,* www.gscheitfeiern.at)
  - www.nachhaltigkeit.steiermark.at (Sustainability portal of the Province of Styria)
  - www.win.steiermark.at (*Wirtschaftsinitiative Nachhaltigkeit – WIN*, Business Initiative Sustainability)

  They provide the general public with comprehensive basic knowledge, current facts and figures in view of waste management (e.g. waste collection volumes), but also specific in-depth information (topic-oriented information leaflets, publications of studies, information on events, etc.). The page view numbers presented in Table 24 and Figure 83 illustrate the increasing interest of the public in waste-relevant information.

Platforms	Page views				
	2005	2006	2007	2008	2009
AWIS	646,722	732,773	1,085,563	1,704,438	2,062,852
Municipal waste management	0	0	0	0	972,398
Sustainability	295,514	398,759	443,849	661,455	895,830
WIN	184,107	235,580	363,298	705,895	997,222
Total	**1,126,343**	**1,367,112**	**1,892,710**	**3,071,788**	**4,928,302**

Table 24: Page views of information platforms run by FA19D

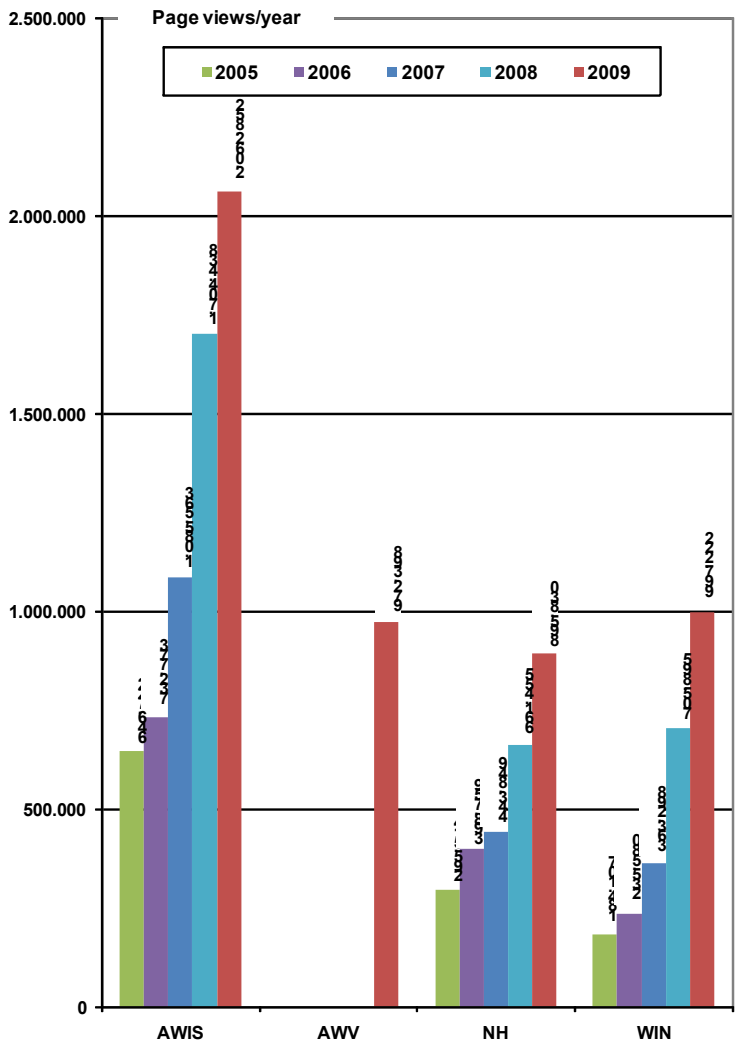

Figure 83: Page views of internet platforms run by FA19D

- **Information material**: At present, information leaflets on various topics related to the collection and treatment of waste and sustainable development as well as *WIN* are provided electronically via *AWIS* and partly in paper form. The same applies for the publication series of FA19D, information videos, and a *Leitlinie*.
- **Specific studies and projects**: The results of studies and projects are published electronically in AWIS, provided this complies with data protection regulations. Currently, 78 reports on specific projects and studies are available.
- **Advice on environment and waste**: Environment and waste consultants of the waste management associations are responsible for public relation activities in terms of qualitative and quantitative waste prevention.[213]
- **Prizes and awards**: The following prizes and awards are awarded by or in collaboration with FA19D, aiming to increase the motivation to implement waste management-related measures:

[213] cf. Chapter 3.2.2

- ***Goldener Müllpanther* (*Golden Waste Panther*) for municipalities, waste management associations and waste consultants**: "From practice – for practice" is the motto of the annual inter-communal experience exchange day (*ERFA*) organised by FA19D. It is intended to present interesting waste management-related issues to mayors, decision makers and environment and waste consultants of Styrian waste management associations and municipalities. As highlight of this event the *Golden Waste Panther* is awarded for successful activities in the field of waste management in the categories "Best waste management association", "Best municipality", and "Best waste consultant". In 2009, the *Golden Waste Panther* was already awarded for the forth time (Figure 84).

2006	Category	Prize winner
	Best waste consultant	Willibald Heuegger
	Best municipality	Marktgemeinde Hausmannstätten
	Best waste management association	Leoben
2007		
	Best waste consultant	Alfred Derler Dipl.-Päd. Walter Riedl
	Best municipality	Wörth an der Lafnitz
	Best waste management association	Liezen
2008		
	Best waste consultant	Gerhard Kerschbaumer
	Best municipality	Marktgemeinde Großklein
	Best waste management association	Leibnitz
2009		
	Best waste consultant	Gerhard Kerschbaumer
	Best municipality	Marktgemeinde Wettmannstätten
	Best waste management association	Radkersburg

Figure 84: *Golden Waste Panther Award* – laureates from 2006 to 2009

- **LA21 – Municipality**: Within the annual Styrian *Community Day (Gemeindetag)*, the new LA 21 (Local Agenda 21) municipalities and regions are presented and awarded

a prize. The laureate municipalities use the LA 21 logo to present their commitment to LA 21 processes and the results thereof. Moreover, the public's awareness towards LA 21 developments is evidenced by the logo.

- **TRIGOS – Corporate Social Responsibility Award**: This award is a federal initiative supported by a platform from industry and NGOs and organised at the Austrian level by *respACT*[214]. Since 2008 FA19D has participated in the regional TRGIOS Styria via the Business Initiative Sustainability. It thus provides an additional platform for Styrian companies to communicate their commitments in the field of sustainable economy to the public.
- **Energy Globe Styria Award**: Since 2008, this price has been awarded as regional version of the international Energy Globe Awards by the *Styrian Eco-Energy Network (NOEST)*, the *Provincial Energy Agency (LEV)* and FA19D via *WIN*.
- ***Holzbaupreis-Sonderpeis nachhaltiges Bauen –*** *Wood Awards Sustainable Building*: The Styrian *Wood Award* is awarded every two years to underline the aims defined in the Styrian Wood Charta, stating that the use of wood and wooden products shall increase significantly in Styria to maintain the added value for the Province. In the category "Sustainable building", the most suitable project is selected according to key figures and awarded the *WIN* Special Award. In 2005, this award has been given for the first time for sustainable building in the framework of the Styrian *Wood Award* by the Regional Economic Chamber of Styria, provincial guild *Holzbau.*

- **Initiatives and campaigns:**
  Styrian-wide initiatives and campaigns in cooperation with partners from media were launched to promote the following specific key topics:
  - ***Der große steirische Frühjahrputz - Aktion Saubere Steiermark* (*The big Styrian spring cleaning – for a clean Styria*)**: This campaign was initiated by the *Lebensressort* Styria, the ORF (Austrian broadcasting), the Styrian waste management associations and disposal companies and aims at raising awareness for the littering problem among the public. The initiative includes not only the actual "*Frühjahrsputz*", i.e. the removal of waste incorrectly disposed of in nature, but also offers comprehensive media information related to littering, a competition and open-door days in municipal waste material collection centres. The initiative was successfully performed in 2008 and 2009: In 2008, 20,000 persons including 7,000 pupils from 312 municipalities collected approx. 120,000 kg of waste with 40,000 distributed waste collection bags. In 2009, the number of participants had already increased to 33,000 including 17,000 pupils from 398 municipalities, who collected approx. 140,000 kg of waste with 60,000 collection bags.
  - ***Trennt's 07***: This campaign focused on the separation of waste, aiming to raise awareness for separate collection as prerequisite for successful recovery of waste and to reduce the number of misthrows.
  - ***G'scheit Feiern***: initiative for waste prevention during festivities (see Chapter 3.4.3).

[214] respACT - Austrian business council for sustainable development is based in Vienna and promotes corporate social responsibility and sustainable development in Austria.

- **Ecological footprint**: The ecological footprint is a measure of the individual's demand of the Earth's resources, which are converted into a normalised measure of land area called global hectares. The individual land area consumption is calculated depending on lifestyle-related data and is then compared with the global consumption of resources. To create awareness for the contribution of everybody's lifestyle to resource consumption, the information campaign "Ecological footprint" was initiated as pilot project in 2008. A specific Styrian ecological footprint was calculated by the Institute of Social Ecology. Simultaneously, training for "Footprint Coaches" and theme weeks for Styrian schools were offered by the Environmental Education Centre of Styria, referring to the Austrian footprint calculator (www.mein-fussabdruck.at) of the *BMLFUW* and to information materials provided by the platform www.footprint.at. (Figure 85).

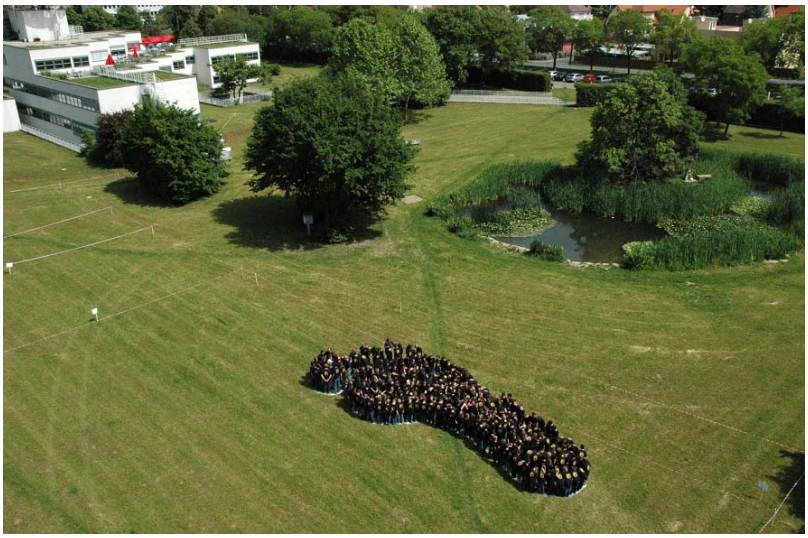

Figure 85: Project *The ecological footprint* 2008: 250 school children of Sporthauptschule Graz-Brucknerstraße form a footprint at the ORF Styria site.

7 Implementation of visions, strategies and targets by 2015

The L-AWP 2005 defined visions and strategies to implement sustainable waste and material flow management by 2015, considering visions as “picture of the future“ that should be reached within 10 years. These visions focus on the goals and principles of sustainable waste management as defined in the AWG 2002 and in the StAWG 2004, and take account of the targets laid down in the "Austrian Strategy for Sustainable Development". The requirements of the new EU Waste Framework Directive dating back to 2008 and the ÖSTRAT from the year 2009 were not yet considered in the L-AWP 2005.

The following chapter evaluates to which extents the visions and strategies defined in the L-AWP 2005 have been implemented to date. An overview of adjustments of visions and strategies by 2020 considering current developments and amended legal regulations is provided in Chapter 8.

7.1 Review of waste management-related visions

7.1.1 Vision 1 (L-AWP 2005) – Resources – recoverables – pollutants

“The transition from waste management to waste and material flow management is thoroughly embedded in the awareness of the public, the economy, and public administration.“

Background

Systematic control of material flows is one of the major goals of Styrian waste and material flow management. Adequate procedures for waste flows are initiated for recycling, material recovery, thermal recovery or disposal based on their relevant concentrations of recoverable and pollutants.

Consequently, waste management focuses on the creation of closed loop systems, aiming to obtain the maximum level of utilisation for natural resources. Protection of resources by waste prevention and waste recovery provides secondary raw materials and therefore helps fight the increasing shortage of resources. Additionally, it represents a major contribution to climate protection due to reduced greenhouse gas emissions (e.g. from production processes).

According to a forecast of the EU commission, resources stemming from the field of waste management are essential for the future resource supply of the EU market, which applies in particular for high-tech materials such as cobalt, platinum and titanium. Although only small quantities of these metals are usually used, an increased demand has been recorded due to their multiple fields of application for the production of high-tech products. [215]

At present, materials containing the above-mentioned components (such as WEEE, waste vehicles) are exported regardless of their strategic importance for future supply. According to media reports,

[215] Communication from the Council of 04 November 2008 “The raw materials initiative - meeting our critical needs for growth and jobs in Europe“ **[SEC(2008) 2741].**

inadequate procedures are applied during recovery of these wastes in developing countries, therewith violating fundamental goals and principles of waste management.

Implementation

The annual Styrian collection of waste-related data suggests that municipal waste volumes increased by 18% in the observation period from 2003 to 2008. Nevertheless, its **share of mixed municipal waste (residual waste)** was reduced from **31.3%** to **29.1%** thanks to the active support of the population.

In summer 2009, an **opinion poll** on waste and material flow management was carried out among Styrian citizens, municipalities and key companies[216]. It showed that re-use of resources by means of recycling and environmental protection in general are considered as very important issues. Moreover, 90% of the participants declared that waste management has a very high or high value and ranked the separation of waste as very important.

Within the scope of the 17 Styrian waste management associations, as many as 39 municipal waste consultants are responsible to communicate the transition from waste management to material flow management by means of highly visible PR activities.

In addition, the Styrian private disposal industry, represented by the Technical Unit Waste Management of the Regional Economic Chamber of Styria, supports the transition towards integrated material flow management from ecological and sustainable points of view. The companies involved participate in studies to determine flows of materials and pollutants.

FA19D supported the development of the software tool *STAN* (Figure 86), which is a relatively simple way to document and uncover material flows in companies, waste management associations and other institutions by material flow analysis. It enables the presentation of goods and material flow analyses according to *ÖNORM* S 2096[217] and was developed by Vienna University of Technology, Institute for Water Quality, Resource and Waste Management. The project was co-financed by the *BMLFUW*, the nine Austrian provinces and *voestalpine AG*. Potential users can download *STAN* free of charge via the website http://www.iwa.tuwien.ac.at/iwa226/stan.html.

[216] Brandstätter, C.: Abfallwirtschaft 2009. Unveröffentlichter Endbericht, bmm®, Graz, 2009.

[217] ÖNORM S 2096-1 „Stoffflussanalyse. Teil 1: Anwendung in der Abfallwirtschaft – Begriffe“. Ausgabe: 2005-01-01; und ÖNORM S 2096-2 „Stoffflussanalyse. Teil 2: Anwendung in der Abfallwirtschaft – Methodik“. Ausgabe: 2005-01-01.

Figure 86: *STAN* logo, freeware for material flow analysis (from German *STofffluss*ANalyse), issued by Vienna University of Technology, Institute for Water Quality, Resource and Waste Management.

Outlook

To date, the fundamental goal of sustainable waste management, i.e. decoupling waste volumes from economic growth, has not been reached. Likewise, the societal transition towards a "European recycling society" as claimed in the new EU Waste Framework Directive has as yet not been realised, seeing that resource consumption is constantly increasing. For both ambitious targets, a change in attitude would be required. Consequent application of material flow analysis is a particularly useful instrument to raise awareness for overall material flows related to products and services.

Taking into account the imminent global shortage of resources, the use of waste recoverables for the production of secondary raw materials shall be intensified ("*urban mining*"). Increasingly complex material combinations and valuable components of modern products necessitate the development and optimisation of recovery rates and an effective elimination of pollutants.

7.1.2 Vision 2 (L-AWP 2005) – Energy consumption and climatic relevance

"In the field of waste management, Styria has succeeded in reducing its share of climate-relevant gases as defined in the Kyoto Protocol (reference year 1990) by setting measures in the field of waste treatment as well as collection and transport logistics. Styria has replaced fossil energy sources by the energy potential of mixed municipal waste (residual waste) with adequate qualities to an extent of more than 60%. The emission of greenhouse gases from landfills has been reduced by more than 80% compared with the year 1990 and by more than 70% compared with the year 2003."

Background

Waste management-related greenhouse gas emissions in Austria almost complied with the target set out in the Climate Strategy[218] as early as in 2007 (see Chapters 2.2.5.2 and 2.2.5.3).

Implementation

In compliance with the treatment obligations laid down in the Landfill Ordinance 1996, municipal residual waste has been subject to mechanical-biological residual waste treatment (MBT) in Styria as from 1 January 2004, which represents a major contribution to climate protection. Pre-treatment of

[218] Anderl et al, 2009.

waste intended for landfilling resulted in a 70% reduction of waste volumes disposed of on Styrian landfills when comparing data from 2008 with 2003.

Residual waste that was not pre-treated had a gas formation potential of approx. 1.5 t CO_2 equivalents per tonne of residual waste[219]. Mechanical-biological pre-treatment – as obligatory since 1 January 2004 – reduced the gas formation potential during landfilling by approx. 90%[219] compared with residual waste.

In 2008, 46% of the overall residual waste volume delivered to Styrian splitting and MBT plants (residual waste from municipal and industrial collection) were thermally recovered.

Outlook

The literature[220] suggests that material recycling of municipally collected waste materials in Styria potentially helps saving additional climate-relevant emissions of up to 65,200 CO_2 equivalents per year. This value might increase by another 20% with the help of more consistent separate collection and recovery of valuable components that are at present contained in residual waste.

With regard to estimations of transport-related emissions in the field of Styrian waste management (collection and transport of waste to treatment plants), a calculation model (Styrian waste management model) was developed; for reasons of staff shortages the required specific data sets have not yet been integrated. The potential optimisation and savings of climate relevant emissions in the field of waste collection and waste transports remain to be determined within the area of applicability of the L-AWP 2010.

To support Vision 2, the **Technical Unit Waste and Waste Water Management within the Regional Economic Chamber of Styria** declared on 22 September 2009[221] that the main pillars of climate protection shall be integrated into corporate policy, applicable from waste collectors to waste processors.

This declaration represents a superordinate climate strategy for Styrian waste management, which shall be implemented by individual companies by specific measures and strategies in their respective fields of action. The pillars of climate protection are defined as follows in this declaration[221]:

- protecting and reusing resources through separate collection and recovery
- increasing efficiency through efficient logistics based on a high degree of regionality
- saving energy through energy efficiency in treatment plants and recovery of material flows
- creating awareness through PR activities, information as part of services and cooperation with economy, public administration and municipalities
- investing in new technologies and procedures by developing of and investing in innovative technologies.

[219] Schachermayer, 2009.

[220] de Hesselle, 2008; Hiebel und Pflaum, 2009.

[221] WK Steiermark, Fachgruppe Abfall- & Abwasserwirtschaft: Erklärung der Fachgruppe Abfall- & Abwasserwirtschaft der Wirtschaftskammer Steiermark zu Klimaschutz in der steirischen Abfallwirtschaft. Beschlussdatum: 22.09.2009.

7.1.3 Vision 3 (L-AWP 2005) – Landfill capacities

"Due to adequate and state-of-the-art pre-treatment, waste to be landfilled no longer represents a potential hazard for future generations. Thanks to the disposal of pre-treated mixed municipal waste (residual waste) Styria has succeeded in reducing landfill capacities by 75% compared with the year 1990 and by more than 55% compared with the year 2003. Economic handling of available landfill resources guarantees that the landfill capacities available in 2015 satisfy the landfill needs for the disposal of Styrian municipal waste backlogs for another 10 years."

Background

From 1990 to 2008, municipal waste volumes increased from 311,000 t/year to 508,000 t/year, i.e. by 63%.

Implementation

As a result of the Landfill Ordinance 1996 the consumption of landfill capacities experienced a sudden decrease from 843,000 t in 2003 to 195,000 t in 2004. In the following years (2004 - 2008), the waste quantity disposed of at mass waste landfills increased to 250,000 t (average increase of 5.8% per year). Since 2004, the annual consumption of mass waste landfill capacities has remained at a relatively constant level of approx. 200,000 m^3 per year.

Despite increasing waste volumes, the landfill capacity used in 2008 amounted to only 45% of the amount of waste that had been landfilled in 1990.

Assuming a restrictive constant consumption of annual landfill capacities, the mass waste capacities available in 2015 will be sufficient for a period of ten more years.

Outlook

With reference to given time requirements for the prospection, development and approval of new landfill capacities of about 10 years, preparatory works shall be performed in the area of applicability of the L-AWP 2010 to determine the need for new landfill capacities.

To guarantee sufficient long-term landfill resources, measures in the field of prevention, recovery and recycling of waste are required. Moreover it should be checked whether the revitalisation of landfills would facilitate the recovery of waste materials and energy sources from waste that has already been landfilled. This might allow obtaining available capacities on already approved landfill sites.

7.1.4 Vision 4 (L-AWP 2005) – Protection of soils

"The exclusive use of high-quality composts helps reduce further manifestations of pollutants in soil, in particular in agricultural areas and landscaping. This results in a significant reduction of annual pollutant quantities by more than 60% compared with the year 1990 regarding the application of waste compost and sewage sludges on agricultural areas, which represents a major contribution to the preservation of soil quality for future generations."

Background

In Styria, recovery of biogenic municipal waste is mainly achieved through composting. The Compost Ordinance defines thresholds of pollutant concentrations and other quality requirements for composts.

Currently, the amount of biogenic municipal waste used for anaerobic treatment in biogas plants is negligible. The remaining fermentation residue is mainly used for agricultural purposes as fertiliser.

Around two thirds of municipal sewage sludges are recovered by application to the soil: around 16% are applied directly, the rest is composted before application.

Implementation

The high quality requirements defined in the Compost Ordinance guarantee to preserve soil quality by application of compost.

In 2006, a Sewage Sludge Strategy, which amended the Sewage Sludge Ordinance, was developed by FA19D in cooperation with all involved administrative offices of the Province of Styria. In terms of direct application of sewage sludge to agriculturally used soils, the thresholds for pollutant concentrations were adjusted in the new Sewage Sludge Ordinance 2001 to the limits defined in the Compost Ordinance. The henceforth applicable limits were drastically reduced and currently amount to 14% - 60% of the former thresholds. Moreover, a central electrical sewage sludge register for a more efficient organisation of the legally required sewage sludge documentation is being implemented.

Outlook

To preserve soil quality in the future, care has to be taken with regard to wastes that are applied to the soil for purposes of improvement or fertilisation. This includes **fermentation residues from biogas plants, plant ashes from biomass heating plants, etc.**

7.1.5 Vision 5 (L-AWP 2005) – Material recovery

"Waste is materially recovered according to European and national requirements (e.g. Directive 2004/12/EC on Packaging). The amount of recycled construction materials derived from demolition and construction waste has increased from 9% (2000) to 30% (2015). Demolition and construction waste is recycled according to defined quality criteria, and the application of recycled construction materials with approved quality is well established on the market."

Background

Material recovery of waste has to comply with European and national regulations. As defined in the waste hierarchy according to the EU Waste Framework Directive 2008, material recovery is given priority against thermal recovery if it is ecologically useful and technically feasible. Separate collection of waste materials (waste glass, waste paper, waste metals, waste wood), biogenic waste, bulky waste, packaging waste and waste electrical and electronic equipment is a major prerequisite to achieve high recovery quotas of municipal waste.

Implementation

In Styria, residual waste as well as bulky waste and street sweepings are mechanically-biologically treated (MBT). Waste materials and packagings are either recovered materially, i.e. they replace primary raw materials in the production of goods (e.g. waste paper, waste glass, metals) or thermally (e.g. high-quality waste fuels are produced for cement industry from the lightweight fraction).

Separately collected biogenic waste ("organic waste") is mainly composted, i.e. materially recovered. Figure 87 illustrates that the share of materially recoverable fractions of total municipal waste volumes amounts to approx. 304,000 t or 61%, consisting of biogenic waste (31%) and waste materials and packagings (69%). Additionally, around 4% of waste materials are separated and recovered from MBT material. Therefore, the share of municipal waste suitable for material recovery amounts to 65% (46% of the MBT share are thermally recovered, so that a total recovery quota of 79% is achieved).

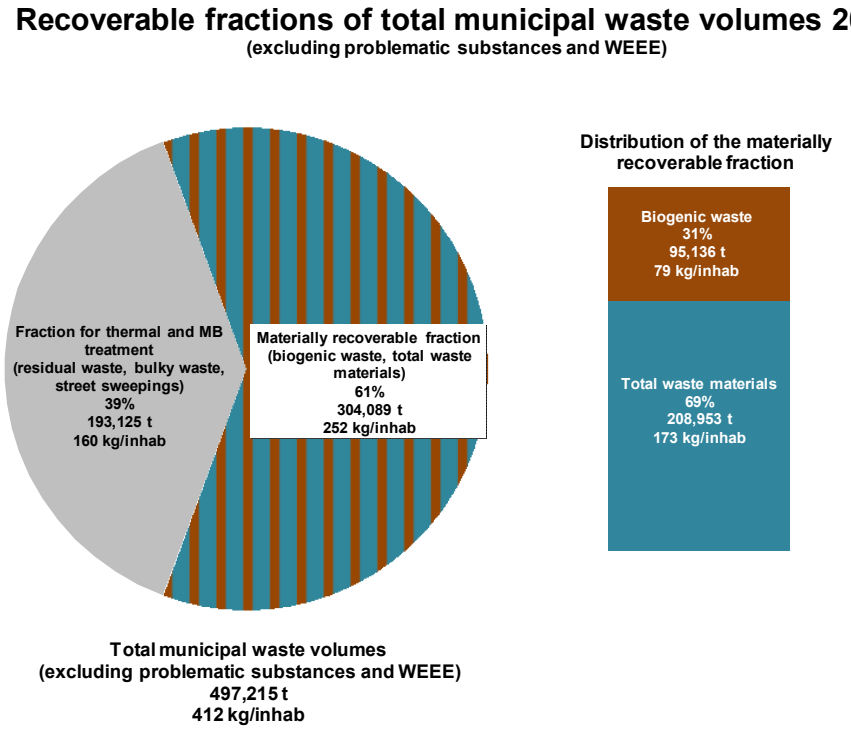

Figure 87: Share of recoverable fractions in total municipal waste volumes 2008, without problematic substances and WEEE

Regarding recovery quota of Styrian demolition and construction waste, available data are very uncertain. Depending on data sources, between 20% (acc. to plant operators) and 60% (acc. to *BRV*) of demolition and construction waste generated in 2008 were treated to obtain recycled construction materials with approved quality.

In terms of quality of the produced recycled construction materials, the corresponding guidelines of the *BRV* and the requirements laid down in the Federal Waste Management Plan are considered as standards by the recycling companies.

Outlook

With a recovery quota of demolition and construction materials currently amounting to at least 20%, achieving a recovery quota of 30% by 2015 can be considered a realistic goal. The EU Waste Framework Directive, however, has defined a minimum recovery quota for demolition and construction materials of 70% for the year 2020. This decision requires immediate measures to increase the current recovery quota. To define the actual scope of action, it is fundamental to improve the presently insufficient data on the recovery of Styrian demolition and construction waste.

7.1.6 Vision 6 (L-AWP 2005) – Sustainability and society

"The principle of sustainability (society - environment - economy) is deeply embedded in the awareness of the public, the economy and public administration. The Province of Styria is thoroughly committed to achieving the goals of sustainable development."

Background

The principle of sustainability has been defined as the key topic of Styrian waste management in the **L-AWP 2005,** which proclaims the further development towards **sustainable waste and material flow management**.

Sustainable waste management is oriented towards a sustained use of resources, **short transport routes**, **protection of regional structures** and **regional employment**, contribution to regional added value while considering the best possible ultimate disposal for pollutants, and minimising climate-relevant emissions.

In the practice, public procurement can contribute to sustainable development in the region by application of the best tenderer principle **and the definition of specific evaluation criteria.**

Implementation

FA19D performed numerous PR activities to create awareness among the public, such as a Fair Trade Day or *Aktion Saubere Steiermark – For a clean* Styria.

Within the sustainability campaign "*Nachhaltige Steiermark - Sustainable Styria*" in 2005, a series of leaflets was created (Figure 88). Ten different topics illustrate possible ways to achieve a sustainable lifestyle.

Figure 88: Leaflet of the sustainability campaign "*Nachhaltige Steiermark*"

In the **draft for calls for tenders** created by the umbrella organisation of Styrian waste management associations, the Technical Unit Waste and Waste Water Management within the Regional Economic Chamber of Styria and FA19D (www.abfallwirtschaft.steiermark.at >> Publikationen) recommend to apply the best tenderer principle in the field of waste management and to define sustainable tender criteria.

With repair services, Styrian socio-economic companies contribute directly to waste prevention while assuming key employment responsibilities. Beyond that, they supply second-hand products in particular for socially disadvantaged persons.

Styrian private disposal companies, represented by the Technical Unit Waste and Waste Water Management within the Regional Economic Chamber of Styria, are also thoroughly committed to ecological, social and economic sustainability.

Outlook

Overall, the social aspects of waste management are sometimes only moderately considered in Styria.[222] Presumably, only economic and ecologic parameters are taken into account for practical implementation. An increased integration of social components of waste management is therefore required in terms of sustainable development.

Waste management-related topics that will be considered increasingly in view of societal sustainability include:

- equal accessibility of collection centres

  Waste collection centres are often inaccessible for the disabled, for elderly or diseased persons with deficiencies resulting thereof, and persons with reading/writing deficiencies. To create waste collection bays that are accessible for the disabled, appropriate concepts will be developed for collection containers, orientation systems, labelling, locking systems, etc. that equally facilitate the use of collection infrastructure for all citizens.

- sustainable recovery of food waste

  Large quantities of edible food which can no longer be used economically are disposed of. Measures for the reasonable use of edible food waste shall be found and implemented.

- organisation of waste-related fees and tariffs

- socio-economic companies and waste management

  In the future, the repair services offered by socio-economic companies will represent major contributions to the enforced implementation to prepare for re-use, recycling and other types of material recovery of waste as defined by the EU Waste Framework Directive. This requires collection points for serviceable goods which are coupled to waste material collection centres. These goods can be treated in socio-economic companies to obtain second-hand products, which will subsequently be offered at favourable prices to socially disadvantaged citizens via a network of “re-use shops”.

In the field of official expert services related to waste management, not only state-of-the-art technology but also sustainability criteria shall be considered to an increasing extent.

[222] Gelbmann, U.; Klampfl-Pernold, H. & Moser, C.: Integration nachhaltiger Entwicklung in der steirischen Abfallwirtschaft. Unveröffentlichter Endbericht (Universität Graz) i.A. des Amtes d. Stmk. LReg. – FA19D, 2009.

7.1.7 Vision 7 (L-AWP 2005) – Sustainability and economy

"By applying the approaches of 'sustainable economy' and 'corporate responsibility', companies contribute significantly to safeguarding the Styrian economy. They meet the requirements of integrated environmental protection and evidently profit from their new corporate philosophy."

Background

Sustainability and particularly a focus on environmental protection represent considerable economic factors which cannot be ignored. This development is underpinned by the success of Styrian companies in the field of renewable energy and environmental technology with an annual turnover of 2.67 billion Euro and 13,400 employees[223]. Since 2005, ECO WORLD STYRIA has taken the economic initiative in the field of energy and environmental technologies in the Province of Styria. Furthermore, waste management-related research and development (e.g. development of machines and processing technologies for material flows) are well established in Styrian companies and research institutions.

Already in 2003, *CSR Austria* (*respACT* Austria as from October 2007[224]) introduced the CSR mission statement "Economic success – responsible actions", which is seen as the contribution of economy to implement the Austrian sustainability strategy. Corporate social responsibility is a management approach with specific target formulations, which aims to embrace social and ecological responsibility and successful business actions.

Implementation

The *WIN* initiative offers professional support to Styrian small- and medium-sized enterprises (SMEs) in the field of sustainable business (Figure 89).

WIN was founded in 2002 by the Province of Styria (Specialised Division 19D and Styrian Business Promotion Agency) and the Regional Economic Chamber of Styria (*WK*) as successor model of *Ökologische Betriebsberatung*. It aims at circulating the "concept of sustainable development" and implementing selected priority topics among Styrian businesses.

WIRTSCHAFTSINITIATIVE
NACHHALTIGKEIT

Figure 89: *WIN* logo

Measures such as the creation of an expert pool, support and advice in the field of resource management, energy and environmental technology, environment management, sustainability reports

[223] Data: Eco World Styria, Web: www.eco.at (October 2009).

[224] cf. Chapter 2.3.7.

and strategies as well as a variety of information offers help sensitise Styrian companies to issues related to sustainable development. Moreover, companies get support in terms of planning and implementing specific measures regarding environmental and climate protection and sustainable economy.

The measures implemented by the end of 2007 equal an investment volume of 9.1 million Euro and entail annual savings of 0.5 million Euro. The estimated investment volume of the planned measures surpasses 31 million Euro; if put into action, they will help save 3.6 million Euro per year.

The environment balance of *WIN*[225] prepared at the end of the second programme period 2008 suggests that measures to save raw materials and prevent waste have largely been implemented; the resulting environmental benefits may be considered a positive effect of *WIN*. Significantly fewer measures were, however, put into practice in the field of reduced energy consumption and climate protection. The desired environmental impacts depend on the actual degree of execution of the planned measures.

A close look at the Styrian disposal industry shows that the companies are committed to a sustainable use of resources, energy efficiency and climate protection. The positive effects on business, which can be achieved by continued promotion of ecological and sustainable development, were scientifically confirmed in a current study of waste fuels carried out at the Wegener Centre for Climate and Global Change[226].

Outlook

Continued encouragement will be provided for corporate social responsibility (CSR) that goes beyond the legal minimum so that it can become common economic practice on the long term. Suitable measures should be set in the future in particular to improve the traceability of corporate sustainable development, for instance by publishing sustainability or CSR reports.

To improve the *WIN* environment balance, the evaluation of the environmental impacts according to the database of actions shall in the future not be performed at the end of the corresponding programme period, but throughout the whole year. This is expected to result in a better illustration of the achieved environmental effects.

[225] Martinuzzi, A.; Tiroch, M.; Zwirner, W.; Windsperger, A. & Fischer, J.: Evaluation 2006/07 der Wirtschaftsinitiative Nachhaltigkeit. Kurfassung des Evaluationsberichts (WU Wien), Wirtschaftsinitiative Nachhaltigkeit, Graz 2009.

[226] Steininger, K.: Untersuchung der volkswirtschaftlichen Effekte des Einsatzes von aufbereiteten Abfällen als Ersatzbrennstoffe. Studie im Auftrag der Saubermacher Dienstleistungs AG. Revidierter Endbericht, Universität Graz, 2008.

7.2 Balance of waste management-related strategies by 2015

The strategies which have been formulated in the L-AWP 2005 are listed in Table 25 and assigned to the corresponding visions.

Visions	Strategies							
	1.	2.	3.	4.	5.	6.	7.	8.
V1: Resources – recoverables – pollutants	●		●			●		●
V2: Energy efficiency and climate relevance		●	●	●				
V3: Landfill capacities		●						
V4: Protection of soil	●	●						
V5: Material recovery		●						●
V6: Sustainability and society					●	●	●	
V7: Sustainability and economy			●					

Table 25: Visions and strategies according to the L-AWP 2005

7.2.1 Strategy 1 (L-AWP 2005) - Material Accountancy

For selected materials, a "material accountancy" is to be established. This register serves as a basis for material flow analyses in defined systems in order to guarantee the transition from waste management towards material flow management. What cannot be counted cannot be managed!

- **Sufficient information about selected flows of goods and materials within defined systems is available for pollutants and recoverables. With reference to the total anthropogenic mass flow, at least 70% of goods flows and 50% of material flows are quantified.**
- **"Material accountancy" is established as an education module in "Entrepreneur and Management Schools". It is an essential part of the corporate balanced scorecard system in more than 50% of all Styrian production companies. In waste disposal companies, material accountancy is realised to 100%.**

To establish material accountancy, numerous studies[227] on material flows, which are directly or indirectly linked with the treatment of waste, were performed. Waste treatment plants and treatment procedures are consequently evaluated by official waste management experts (FA19D) in view of the relevant material flows.

[227] e.g.: Obernberger et al., 2007. Hittinger, H. & Pichler, F.: Stoffflussbetrachtung: Quecksilber aus kommunalen steirischen Klärschlämmen. Studie (Hittinger & Pichler OEG), Amt d. Stmk. LReg. – FA19D, Graz, 2007. Schöller, G.; Oberleitner, C.; Fehringer, R.; Döberl, G. & Brunner P.H.: Rohstofflager – anthropogenen Lager – letzte Senken im Bundesland Steiermark. Endbericht (TU Wien), Amt d. Stmk. LReg – FA19D, Graz, 2006.

In Austria, data on material flows are collected by Statistics Austria; a comprehensive report has been presented in the study "*Materialflussrechnung 1960 bis 2006*"[228]. In the future, specific material flows and related indicators (sustainability indicators such as the direct material input, DMI) shall also be illustrated for Styria.

In the field of waste management, the Province of Styria systematically gathered material flow data only for the wastes which are collected at the municipal level. Since the total "waste flows" will in future be determined and evaluated via the EDM (electronic data management) system of the federal state, no additional measures are required from the Province of Styria. Material flows related to waste treatment, e.g. relating to soil or other environmental media, have to date been investigated in individual studies and remain to be systematically quantified. The result will help create decision bases in the field of waste management.

The *Waste Management Concept* (*Abfallwirtschafskonzept*, *AWK*) *plus* was developed as early as in 2003 as corporate tool, extending the legally defined minimum requirements of waste management concepts to a corporate controlling instrument. Application of *AWK plus* allows for better collection and illustration of main waste flow-related corporate data. Most importantly, it links these data with the costs of input and output flows. *AWK plus* trainings have already been offered by *WIN* and various training institutions. On the other hand, the significance of material accountancy as training module in Entrepreneur and Management Schools remains to be further improved in cooperation with the relevant institutions.

7.2.2 Strategy 2 (L-AWP 2005) – Waste treatment

Quality management in environment controlling must be established to maintain uniform standards in collection, transport, and treatment of waste (waste recovery and waste disposal) and to safeguard public interest. This is on the one hand intended to ensure equal competition for the economy and on the other hand to respect ecological needs and requirements.

- **Emissions of climate-relevant gases and pollutants from waste collection, transport, and treatment (recovery, disposal) and landfilling are documented for each field. They are optimised in a continuous management process and are documented by municipalities, waste management associations, and waste disposal companies. Waste management related emissions are to represent less than 1% of all anthropogenic emissions by the year 2015.**
- **Waste materials and biogenic waste collected as municipal waste are materially recovered according to waste management related targets. A general recycling rate of > 60% is reached and maintained if packaging waste is included in the calculation.**
- **The energy contained in municipal waste and sewage sludge is recovered thermally in waste incineration plants or as quality-assured refuse derived fuel in industrial firing plants (co-incineration) according to waste management related targets. During thermal recovery an energy efficiency of > 70% is reached by using process heat.**

[228] Petrović, B.: Materialflussrechnung 1960 bis 2006. Projektbericht. Statistik Austria (Bundesanstalt Statistik Österreich), Wien, 2008.

- **Thanks to material and thermal recovery of municipal waste including mechanical-biological residual waste treatment, the landfill volumes used in 2015 will amount to less than 20% of the reference value taken from the year 1990.**
- **Styria's concern to secure available landfill volumes on long term levels in compliance with the requirements defined in Art. 5 of EU Directive 75/442/EEC on Waste is considered when approving notifications for waste shipments into Styria. This guarantees that landfill capacities will be available for another 10 years from 2015 onwards.**
- **Documentation on non-hazardous waste volumes generated by trade and industry, including recovery and disposal pathways, is sufficient. Corporate waste volumes are controlled by means of sector-specific performance indicators.**
- **Waste generated by trade and industry (production residues, by-products) is frequently recovered as valuable secondary raw materials by other companies, respecting waste management related goals and principles. Online waste and recycling platforms contribute to this process.**
- **The corporate waste management concept is used as controlling instrument (AWK plus, extended waste management concept) by more than 50% of the companies that are legally obliged to do so. As such, it is a major element in the field of quality and environment management.**
- **In the field of private waste disposal, the number of certified waste disposal companies increased from currently 14 to 150 waste disposal companies (50% of the year 2005).**
- **In the field of composting biogenic waste by agricultural companies, all plant operators are members of a quality assurance system, guaranteeing the production of quality composts pursuant to the Austrian Compost Ordinance. Moreover, correct operation of compost plants and continuous and regular training programs for plant operators is ensured.**
- **In the field of agricultural co-fermentation of waste, all plant operators are members of a quality assurance system, guaranteeing the correct operation of fermentation plants, correct agricultural application of the produced biogas manure, and regular training programs for plant operators.**

Approved certifications guarantee uniform standards during the collection, transport and treatment of waste. As at September 2009, 29 Styrian disposal companies were certified as **Waste Disposal Companies (*EFB*),** and another 5 were certified according to the **Eco-Management and Audit Scheme (*EMAS*)**. Achieving an increase in the number of certified enterprises is desirable.

In Austria, the contribution of waste management to national greenhouse gas emissions amounts to 2.5%[229]. In Styria, pre-treatment of residual waste since 01 January 2004 helps avoid approx. 90% of greenhouse gas emissions formerly produced during landfilling (approx. 250,000 t of CO_2 equivalents per year). Moreover, material and thermal recovery of separately collected recoverables represent major contributions to climate protection. The highest increase of GHG emissions in the waste management sector is recorded for aerobic treatment of biogenic waste (composting)[229]. Potentials for reductions in this field are to be evaluated; saving potentials related to the collection and transport of waste with regard to climate-relevant emissions remain to be determined.

[229] M. Anderl et al.: 2009.

In Styria, the share of materially recoverable municipal waste amounted to as much as 65% in 2008. Moreover, 46% of the MBT share are thermally recovered, resulting in a total recovery quota of 79%. The residual waste share of waste materials and packagings, which are to be separately collected, is described in Chapter 3. The percentage of reusable municipal waste is estimated to reach up to 10%[230]. Improved collection of reusable and recoverable wastes might result in further increases of the re-use/recycling quotas.

In compliance with the targets defined in the L-AWP 2005, the plants for thermal waste recovery currently operating in Styria achieve energetic efficiency factors of approx. 80%. Around 46% of municipal waste (only fractions rich in calorific value) and approx. 20%[231] of municipal sewage sludge are thermally recovered.

In 2008, the consumption of landfill capacity amounted to 45% of the volumes that had been landfilled in 1990. The set target (reduction to less than 20% of the reference value taken from the year 1990) by 2015 could at the maximum be reached by drastic measures in the fields of waste prevention and continuously improved waste separation.

Presumably the currently available landfill volume of mass waste landfills will be used up by the year 2025 if the current development remains at a constant level. Prerequisite is that the federal state considers this fact when assuming its notification responsibilities.

Data on corporate waste volumes are not collected by the Province of Styria; in the future they will be documented according to the Waste Inventory Ordinance via the EDM system of the federal state.

The web-supported platform "*Elektronische Abfall- und Recyclingbörse – Electrical Waste and Recycling Platform*" was introduced in 2005 in a cooperation by *WIN* and the *Bundesabfall- und Recyclingbörse* (*Federal Waste and Recycling Platform*) of the Regional Economic Chamber of Upper Austria. As yet, the platform is not being used to a satisfying extent.

The use of the *AWK plus* tool in enterprises amounted to less than 50% in 2009. The legal requirement to provide an *AWK* does not only include waste treatment plants pursuant to the AWG 2002 but also all enterprises which were approved according to the Trade Law (*Gewerbeordnung*) 1994. Frequently, *AWKs* that only meet the minimum standards are established. By launching the programme *AWK plus*, *WIN* supports Styrian companies and other institutions in using their waste management concept as corporate controlling tool. Efforts in this area must be intensified to reach the defined targets.

In 2009, 29 Styrian private disposal companies were certified as Waste Disposal Company (*EFB*). Additional measures are required to increase this number to 150 as targeted in the L-AWP 2005.

The interest representation of compost plant operators, ***ARGE Kompost & Biogas – Consortium Compost & Biogas*****,** has introduced a voluntary quality standard for composting plants among its member companies. In the field of biogas plants, a pilot project for the assurance of quality standards was performed by the Specialised Divisions 17A and 19D from 2007 to 2008. Currently, the possibilities for permanent implementation of such a quality assurance system for biogas plants are being evaluated. Both compliance with the legal requirements and state-of-the-art technologies are

[230] B. Schleich (ARGE Abfallvermeidung, Ressourcenschonung und nachhaltige Entwicklung GmbH): Persönliche Kommunikation, 26.03.2010.

[231] Data base sewage sludge: 2007

regularly controlled for composting plants and biogas plants by the responsible authorities (FA 13A, district administration offices) in collaboration with the environment inspection of FA17C and other official experts of FA17A, FA17B and FA19D etc.

7.2.3 Strategy 3 (L-AWP 2005) - Environment management systems

The introduction of environment management systems and sustainable corporate strategies as basis for "Sustainable Business" is actively promoted and encouraged by the Province of Styria.

- **In the field of tourism, more than 20% of tourist enterprises meet the requirements for the Austrian Eco-label for tourist establishments, thus proving sustainable corporate strategies. Furthermore, they integrate sustainable corporate strategies into their public relations activities which are supported by the Province of Styria.**
- **More than 20% of Styrian companies with more than 20 employees have developed a corporate sustainability strategy, which is documented by the annual publication of a corporate sustainability report.**
- **More than 30% of Styrian companies with more than 100 employees have successfully introduced an environment management system (ISO 14000 or EMAS).**

Active support for the implementation of environment management systems and sustainable corporate strategies is granted within the *WIN* initiative. Still, the targets listed above have not been met.

As at 2009, 22 Styrian tourist enterprises have been awarded the Eco-label for tourist establishments (0.5% of the approx. 4,200[232] tourist establishments, including accommodation facilities and restaurants).

In the context of *WIN*, a total of 54 consultations for the programme “Corporate Sustainable Strategy“ have been performed since 2005, with 8 consultations for the part “Sustainability Report“. In comparison, the number of Styrian companies with 20 and more employees amounts to approx. 3,000.[232] In September 2009, 35 Styrian companies were listed in the EMAS register of the Environment Agency, which corresponds to approx. 7% of Styrian companies with 100 and more employees[233]. A comparable public register for ISO 14000 certifications does not exist, hence the exact number is unknown. Since 2005, 15 consultations on ISO 14001 have been performed and another 56 consultations were carried out on integrated management systems or the *WIN* management check.

Apparently, certification measures are not sufficiently accepted despite existing funding possibilities. Therefore, more focused inputs and an adapted plan of measures are required to implement these targets.

[232] As at 2007 according to Tafner, G.: Wirtschaft und Konjunktur 2007/08. Steirische Statistiken 5/2009, Amt d. Stmk. LReg, Fachabteilung 1C – Landesstatistik, Graz, 2009.

[233] Approx. 500 companies with 100 or more employees, as at 2007 according to Tafner, 2009.

7.2.4 Strategy 4 (L-AWP 2005) – Public relations – Waste Prevention

The transition of waste management associations towards regional competence centres for preventive environmental protection and sustainable development is to be encouraged.

- **At average Styrian level, waste management associations employ one trained environment and waste consultant per 20,000 inhabitants.**
- **Waste management associations support municipalities in establishing sustainable waste management concepts at municipal levels. These include systems of waste management related performance indicators, optimizing the tendering for services regarding collection and transport of municipal waste, and implementing cross-municipal regional projects (cooperation of municipalities).**
- **Waste management associations assist municipalities in educating and training staff for waste material collection centres and collection cells for problematic substances. Employees of these facilities receive one day of training in 2-year intervals.**
- **Waste management associations encourage measures in the field of waste prevention, aiming to support and network companies that offer repair services. The intended result is to increase the number of companies registered in the "Repair Guide" of the Styrian WIN initiative to more than 2,000.**
- **Measures for quality assurance in the field of separate collection are implemented; therefore the number of impurities is successfully reduced.**
- **Waste management associations have in-depth knowledge on regional flows of materials and goods as well as on a system of waste management related performance indicators with regard to recovery and disposal of municipal waste and sewage sludge from their regions.**
- **The Internet is used as an efficient and up-to-date means of communication for the PR activities of waste management associations. The annual report on waste management is published online by April 15 of the following year by waste management associations and is available for download.**
- **Waste management associations are the first regional contact address for questions on sustainable development. The environment and waste consultants communicate the contents of the Austrian Strategy for Sustainable Development, the Austrian Climate Strategy, the Provincial Waste Management Plan, the Federal Waste Management Plan, and Green Public Procurement to different target audiences, such as local politicians, schools, citizens, entrepreneurs, etc.**

Currently, 39 active environment and waste consultants are counted within the scope of action of Styrian waste management associations. Some managers of the Styrian waste management associations are also involved in giving advice on waste. In addition, waste consultants are employed by various Styrian municipalities. Overall, 53 Styrian environment and waste consultants are funded by FA19D (2008); on average they offer services for about 22,500 inhabitants, each. The quality of advice on waste and therefore the knowledge about material flows and waste management-related performance indicators largely depend on the involved actors. Support is granted by the umbrella association of the waste management associations. Usually, the practical approach of operative associations tends to be advantageous with regard to knowledge and experience.

The "*NAWIG* handbook" (www.abfallwirtschaft.steiermark.at >> Publikationen), prepared by FA19D in 2005, can be used as tool for the preparation of sustainable municipal waste management concepts.

Cooperations between municipalities in the field of waste management were and are implemented at the community level by the following cooperations: Gleisdorf and neighbouring municipalities (joint operation of the waste material collection centre Albersdorf-Prebuch/Gleisdorf), Leibnitz (joint acquisition of waste collection vehicles, negotiation of prices), the regional initiative Vordernbergtal and the *Wirtschaftsverband Übelbachtal* (collaboration in all community areas) in the context of the Regionext programme.

The required trainings for staff of waste material collection centres and collection cells for problematic substances are performed in regular intervals and supported by the FA19D.

The Municipal Solid Waste Analysis 2008 shows that the share of beverage composite materials, wood and problematic substances in residual waste decreased, whereas the share of organic waste, PET bottles, waste electrical and electronic equipment, glass and textiles increased. Currently, 18.7% of misthrows are recorded – therefore, further actions are still required.

The internet is comprehensively used for PR activities. The internet platform *Kommunale Abfallwirtschaft – Municipal waste management* (www.awv.steiermark.at) has been launched in 2009 in addition to *AWIS*. As at 2009, annual reports were not yet published online by all Styrian waste management associations.

The ambitious target to increase the number of enterprises registered in the "Repair Guide" of the *WIN* initiative to more than 2,000 has not been reached. As at 2009, 600 repair enterprises were registered, corresponding to not more than 30% of the target value for 2015.

Implementing Strategy 4 requires the continuous (possibly annual) training of waste consultants in the fields of sustainable development, climate protection, etc.

Close collaboration between the Styrian waste management associations and the regional partners of rural development Styria and Regionext is desirable (use of synergies, management of knowledge). Since the Styrian regional managements are key institutions and motors for regional development, they should also be involved in this cooperation.

7.2.5 Strategy 5 (L-AWP 2005) – Framework conditions for financial support

Support modalities in the field of waste and material flow management must be oriented towards the goals of sustainable development.

- **Sustainability criteria are an integral part of the funding guidelines of the Province of Styria. Meeting these criteria represents a basic requirement for the allocation of financial resources.**
- **Evaluation models for holistic evaluation (sustainability) of ideas and projects are developed and applied comprehensively.** .

In principle, the Province of Styria grants financial support if ecological and (micro-)economic aspects are respected; specific evaluation criteria have, however, not yet been implemented in all fields.

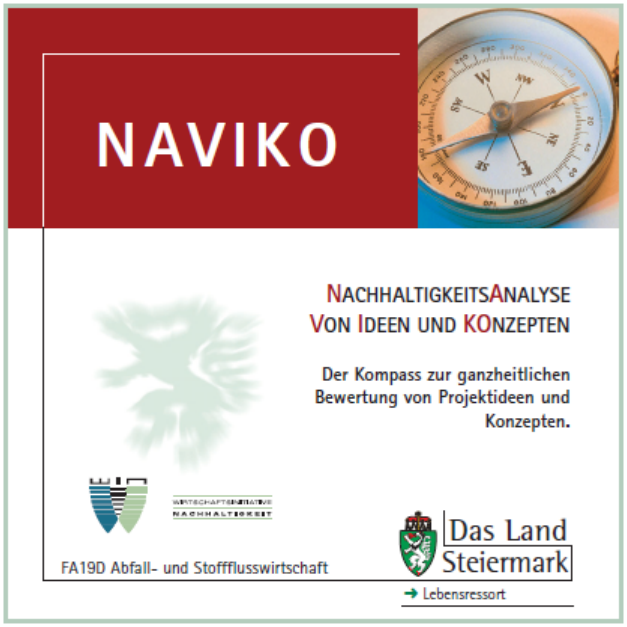

Figure 90: CD *NAVIKO*, by the Province of Styria

The sustainability compass ***NAVIKO*** (sustainability analysis of ideas and concepts, Figure 90, http://www.nachhaltigberaten.at/navikox/) represents a holistic evaluation model for projects and ideas, equally considering all aspects of sustainability. To date, this tool has not been adapted for specialised projects in the field of waste and material management, which are evaluated according to subject-specific criteria.

7.2.6 Strategy 6 (L-AWP 2005) – Information – Communication

Targeted information and qualification initiatives at all education levels including adult education create public awareness for the need for sustainable development. Already existing facilities are to be integrated into this process. Moreover, the required competences needed for active involvement in implementing this goal are to be established.

- **The need for sustainable waste and material flow management is thoroughly anchored in public awareness. More than 5% of the population actively participated or still participate in related projects and consortia (sustainable municipal waste management concept, local Agenda 21 processes [LA21], regional Agenda 21 processes [RA21], etc.).**
- **Qualified persons act as multipliers for communicating information in the fields of sustainable waste and material flow management and Green Public Procurement. This target is reached with the help of an education and training program supported by the Province of Styria, which is open for communal environment and waste consultants, company waste officers, municipality staff and teachers.**
- **Various information leaflets and publications can be downloaded from the website of the Province of Styria. These orientation guidelines provide citizens with useful information on sustainable development for different areas of life, in particular for the field of waste and material flow management.**

The necessity of sustainable development has been anchored in public awareness, mainly by implementing local and regional Agenda 21 processes (see Strategy 7).

At the federal level, an action plan for Green Public Procurement has been established[234]. Accordingly, public clients shall be supported in acquiring sustainable products and services. Among the administrative bodies of the Province of Styria, A2 – *Zentrale Dienste (Central services)* is responsible for implementing this ambitious goal and for giving advice in all related matters. A wide spectrum of education and training measures in the fields mentioned above has been made available for the target groups in question. To meet the role model responsibility of public authorities, training programmes for employees of the Provincial Government of Styria shall increasingly include principles of sustainability.

Various information leaflets and publications are available to the public on the four internet portals of FA19D.

7.2.7 Strategy 7 (L-AWP 2005) – Agenda 21 Processes – public participation

Agenda 21 processes must be implemented and coordinated as new political and corporate culture at regional, communal and business levels.

- **Public administration is aware of its leading role in implementing "sustainable business strategies". Therefore, Agenda 21 processes are intensified at communal and regional levels with the support of the Province of Styria. By 2015, more than 50% of the municipalities are expected to be involved in these processes.**

By the end of 2009, Styria counted 196 Agenda 21 municipalities; thereof 141 municipalities are part of agenda processes at the small-regional level or integrated into one of the 20 small regions, respectively (Figure 91 and Figure 92). 36% of Styrian municipalities are therefore involved in Agenda 21 processes. The huge success rate to date is mirrored in the fact that these Styrian LA21 municipalities represent around one third of all Austrian LA21 municipalities. Between 2008 and 2009, 70 new municipalities joined the LA21 initiative. Assuming a comparable development until 2015, the above-mentioned goal to obtain a participation rate of 50% will be met.

Implementation and coordination of Local Agenda 21 processes in Styria lie in the responsibility of *Landentwicklung Steiermark – Rural Development Styria*.

[234] Beschaffungsservice Austria/IFZ (Hrsg.): Österreichischer Aktionsplan zur nachhaltigen öffentlichen Beschaffung. Teile I und II. 2. Entwurf, Graz, 2009; http://www.ifz.tugraz.at/index.php/article/articleview/19/1/9/.

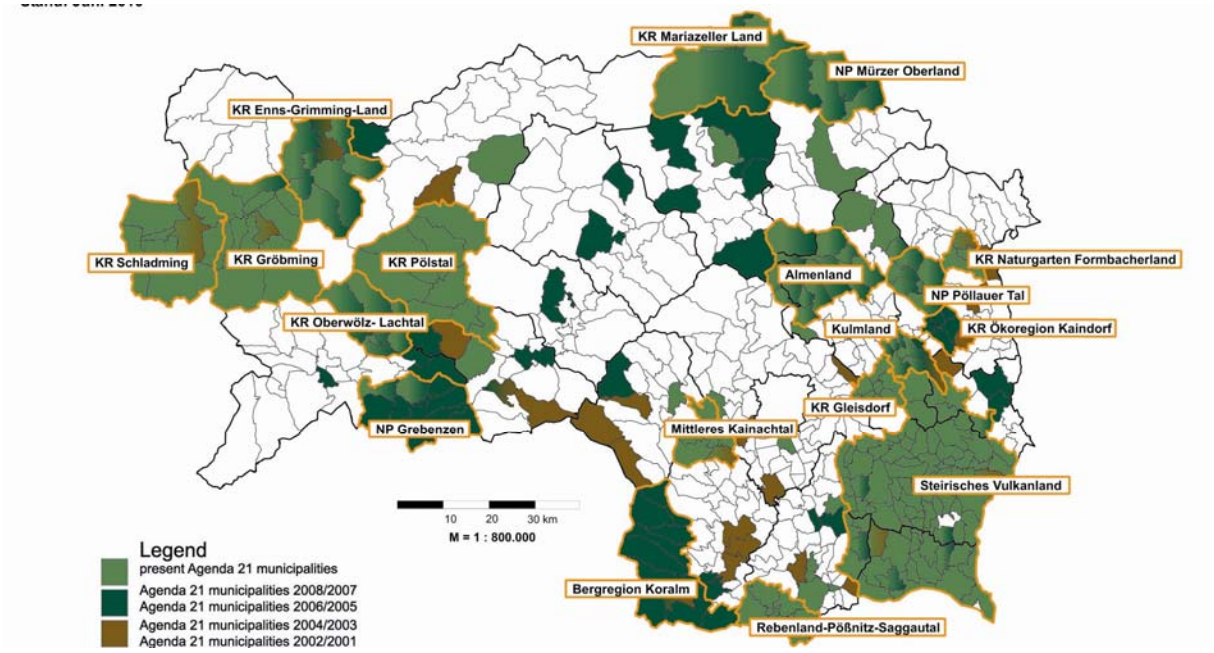

Figure 91: Local Agenda 21 municipalities in Styria

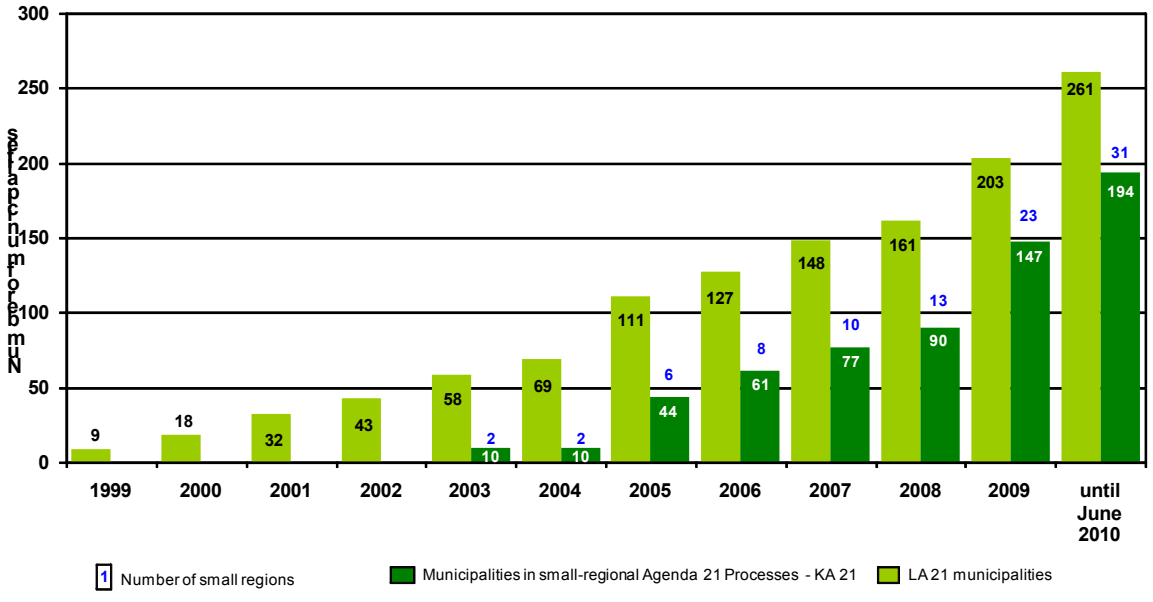

Figure 92: Number of municipalities involved in small-regional Agenda 21 processes and of Local Agenda 21 municipalities in Styria, 1999 - 2009

7.2.8 Strategy 8 (L-AWP 2005) – Sustainable building and renovation

In the field of sustainable building, public administration must act as a role model.

- ***Criteria for sustainable building are laid down in a strategy of the Province and serve as basis for the allocation of financial resources in the field of housing.***
- ***By 2015, more than 10% of all used construction materials originate from quality-tested recycled materials.***
- ***The use of renewable raw materials (such as wood, cellulose, straw) increased to > 20% in particular in the field of housing.***

In 2006 a cross-departmental project group of the Province of Styria developed the Strategy "*Nachhaltig Bauen und Sanieren in der Steiermark - Sustainable Building and Renovation in Styria"*. The strategy contained instructions on measures to be introduced in the field of subsidised housing; in the following year the development of corresponding planning guidelines was initiated. In autumn 2009 the guideline *Leitfaden für das Bauen in der Steiermark – Guideline on Building in Styria* was published, which contains guidelines in all fields of sustainable building, including basic assessment of needs, information on site selection and on the processes required for a building project. Moreover, it includes sustainability-related information on functionality, sophisticated design, rentability, common welfare and state-of-the-art realisation and use.

In the context of *WIN*, financial support in the field of Sustainable Building and Renovation is granted via the specific programme *WIN-Bau*.

An **Austria**-specific study[235] presented in 2006 shows that approx. 80% of demolition and construction waste are recycled, covering approx. 4% of all construction materials used. According to this study[235], the substitution potential of all construction materials used in Austria amounts to only 8%. **Styria**-specific data are currently not available; data on the recycling of demolition and construction waste and recycling of materials from structure removal remain to be collected.

No current data are available on the use of renewable raw materials in the field of housing. The emphasis on renewable raw materials is evidenced by Green subsidised housing and by the annual *Wood Award* Styria.

[235] Cresnik, G.: Die Substituierung mineralischer Rohstoffe durch Baurestmassen. Diplomarbeit TU Graz, 2006.

8 Adjustment of visions and strategies by 2020

The ultimate ambition of the new EU Waste Framework Directive (Directive 2008/98/EC) is to minimise adverse effects of waste generation and management to human health and the environment. Moreover, the consumption of resources shall be reduced and the practical implementation of the waste hierarchy shall be encouraged. The EU Waste Framework Directive shall decidedly contribute to creating a “recycling society” among EU citizens by waste prevention and re-use of waste as a raw material. Furthermore, the EU Waste Framework Directive mentions that economic tools can considerably contribute to implement the goals of waste prevention and waste management; ecological benefits may be maximised as a result of an enforced use of such economic tools. Therefore, the use of these instruments shall be supported at the qualified level.

A major part of these goals has already been defined in the L-AWP 2005. To meet the new key points defined in the new EU Waste Framework Directive at an early stage, however, strategic adjustments are required in some areas.

The focus of the EU Waste Framework Directive has been set in the following areas: i) resource protection by waste prevention and targeted waste management, ii) creation of a “recycling society“ and iii) increased use of economic instruments to reach the aforementioned goals. They all bear evidence that the Styrian way of sustainable material flow management pursued to date has to be continued. The elements listed above as well as the protection of resources and the environment have to be regarded as the main pillars in the sense of the concept of sustainable development.

Based on the in-depth review of visions and strategies as defined in the L-AWP 2005 presented in Chapter 7, Chapter 8 aims to illustrate the adjustments planned for the period from 2010 to 2020. Doing so, the targets that have not yet been reached and the framework conditions that have partly been changed in the meantime will be taken into account.

8.1 Vision 2020 – By 2020, Styria has assumed a leading role in sustainable resource management

"Satisfaction of human needs is inevitably linked with the production and processing of usable resources and materials. After use, the products and materials are available in the form of waste and can again be used as raw materials. The thoughtful use of resources is therefore integral part of a strategy for sustainable development."[236] (unofficial translation)

The transition from waste management to material flow management targeted in the L-AWP 2005 has been completed in so far as material flow management-related considerations have become the basic principle of provincial waste management. According to the targets laid down in the StAWG 2004, AWG 2002 and the new EU Waste Framework Directive, **the long-term goal is to develop Styrian waste management into sustainable resource management**. Hence, the protection of natural resources must become the central issue of waste and material flow management. In compliance with the StAWG 2004 and AWG 2002, the definition of resources is thereby not limited to **raw materials** but includes **environmental media** such as water, soil and air as well as **landfill volumes, energy** and **ecological systems**.

After all, effective climate protection depends on reduced consumption of resources. The new EU Waste Framework Directive aims at **waste prevention** and **increasing the service life of resources**, since the generation of waste in itself is already considered a loss of resources (even if the material resources are re-used, the preparations for re-use or recycling "cost" at least energy). According to the requirements of the EU Waste Framework Directive and the five-step waste hierarchy, the focus of waste management-related planning will increasingly shift towards **preparatory steps for re-use** and the **recovery of waste**.

Derived from the three pillars of sustainability (environment – society – economy), the following **three strategies to implement this vision** have been defined:

1. **Sustainable resource management for environmental protection**
2. **Sustainable resource management in society**
3. **Sustainable resource management in economy**

[236] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Hsg.): Beitrag der Abfallwirtschaft zur nachhaltigen Entwicklung in Deutschland. Teil Siedlungsabfälle. In: Umwelt 10, Sonderteil, Berlin, 2004, p. I-XXIV.

8.1.1 Strategy 1 – Sustainable resource management for environmental protection

Aim 1: Preventing harmful effects on humans and the environment

- Evidence shall be demonstrated that **state-of-the-art technology in treatment plants for municipal waste** is used; for this purpose 20% of all relevant plants shall be officially inspected per year (e.g. in the context of environment inspections).
- **Knowledge about potentially hazardous material groups** shall be continuously improved; every year at least one material flow-related study/investigation/survey shall be prepared and published.

Aim 2: Protecting the climate and preventing harmful emissions

- Data on available **resources and efficiency potentials for renewable energy in the field of biogenic waste** shall be collected by preparing and publishing at least one study by 2012.
- **Increasing the energy efficiency of waste treatment plants** in Styria shall be encouraged in accordance with funding made available by the Province of Styria (e.g. for biogas plants).
- The potential for a **reduction of greenhouse gas emissions in the field of biological waste treatment** in Styria shall be scientifically analysed; for this purpose at least one study shall be prepared and published by 2012.
- The continued **use of available energetic potentials of wastes** (e.g. landfill and sewage gas, energetic use of already landfilled waste) shall be supported by FA19D in particular by active collaboration in case studies and joint projects.
- Data on **emissions stemming from the collection and the transport of waste** shall be collected in collaboration with institutions of municipal and private disposal industry by 2013. They shall be evaluated in view of potentials for optimising waste transport logistics, the preparation of mobility management systems and the introduction of alternative drive system technologies.
- The **use of organic waste for the immobilisation of carbons and the generation of humus** in Styria shall be evaluated by 2015 in the context of a pilot project, and the potential shall be investigated.

Aim 3: Protecting resources (soil, landfill volume, raw materials, water, energy)

- To increase the recycling quotas, the **development of new recycling and sorting procedures** shall be strengthened by 2015 by actively supporting pilot projects under scientific guidance.
- FA19D actively promotes **knowledge management in the field of resource protection.** For this purpose studies (in particular life-cycle- or material flow-oriented considerations regarding “urban mining”, substitutability of raw materials by secondary raw materials, pollutant elimination) shall be prepared and published.

- To preserve soil quality for future generations, **pollutant quantities in soil** caused by wastes shall undergo an improved **monitoring process**. Electronic systems suitable for the documentation and tracking of relevant waste flows (sewage sludge, ashes from biomass heating stations and fermentation residues from biogas plants) shall be implemented by the end of 2010.
- FA19D shall actively contribute their **expertise** in the **preparation of proposals** for legal regulations and guidelines at the provincial and federal level.
- Actual data on the use of **recycling construction materials in Styria** shall be collected and evaluated by 2011.
- A preview on the estimated available **landfill capacities** by 2015 shall be prepared and evaluated by this date.

Aim 4: No increased risk potential related to the treatment of waste

- **Application of state-of-the-art technology in the field of waste management** shall be assured by participation of waste management experts (FA19D) in official approval procedures. Sustainability criteria shall be increasingly included in the evaluations.
- Care has to be taken that waste management experts are given the possibility to participate in **specific training programmes**.

Aim 5: Non-hazardous waste deposition

- Styria **supports knowledge-building to optimise treatment standards** for pre-treating mixed municipal waste.

8.1.2 Strategy 2 – Sustainable resource management in society

Aim 1: Increasing public awareness for the necessity to protect resources and avoid waste

- A high level of public knowledge in view of resource protection and waste prevention is desirable. Targeted **information and qualification initiatives** at all education levels shall be performed as campaigns, actions and pilot projects.
- **Consumption patterns allowing the protection of resources** are intended for all levels and shall be supported by encouraging FairTrade products, organic products and green mobility as well as initiatives for waste prevention.
- FA19D **actively promotes knowledge building**:
  - Up-to-date and more comprehensive intra-departmental **information systems** and measures to connect to other internet portals shall help increase the annual **page view numbers**.
  - Every year, 5 **information leaflets or brochures** shall be prepared and published, covering selected topics related to the prevention, recovery and collection of waste.

  - **Transfer of knowledge** from FA19D **to opinion leaders and multiplicators** shall be guaranteed by at least 10 contributions at relevant conferences per year.
- Waste management associations have one trained **environment and waste consultant** per 20,000 inhabitants (on Styrian average).
- Projects and initiatives that promote the use of **reusable packagings**, in particular at the regional level, shall be encouraged.

Aim 2: Implementing local and small regional Agenda 21 processes

- By 2015 more than 50% of the municipalities shall be involved **in Agenda 21 processes**. Execution and support of Agenda 21 processes are guaranteed in qualified form by the Province of Styria.

Aim 3: Separate collection as prerequisite for recovery and recycling

- Number and **design of collection containers** in public areas, collection bays and waste material collection centres shall be optimised and made more user-friendly. This task shall be performed in collaboration with municipal and private waste management industries.
  - By 2012 a concept to implement **barrier-free access** to the above-mentioned facilities shall be available to FA19D.
  - Data on **accessibility and utilisation** of collection facilities shall be collected in regular intervals by means of representative surveys and investigated for potential improvements.
  - An ideas competition shall be held to increase **attractivity and functionality** of collection facilities.
- Participation of municipalities in the field of separate collection of packaging waste shall remain possible.
- Waste management associations shall support municipalities in establishing the **annual waste balance report** as laid down in the Waste Inventory Ordinance and shall assist to determine potentials for logistic improvements. Province-specific results from EDM analysis shall be evaluated by FA19D.
- A quantifiable increase of the **collection quotas of separately collected waste fractions** by 2015 shall be achieved by means of adequate public relations activities (e.g. **waste separation campaigns** etc.).
- **Training documents** regarding **separate collection of reusable and repairable consumer goods** shall be available by 2011 for the employees of waste material collection centres.
- **Collection areas** for reusable and repairable consumer goods (e.g. waste furniture, waste electrical and electronic equipment) shall be available in all association areas by 2015.

- In Styria, at least one socio-economically operated **re-use shop** shall be available per RegioNext region by 2015 for trading of used (repaired) products.

Aim 4: Implementing the 'polluter pays' principle in society

- By 2012, **waste-related fees and tariffs shall be fully cost-covering** in Styria.
- Styrian municipalities and waste management associations refer to **key figures** to determine and implement potentials for optimisation. These figures shall be provided in intervals of 3 years by the Province of Styria.

8.1.3 Strategy 3 – Sustainable resource management in economy

Aim 1: Establishing material accountancy as basic tool for resource protection in companies

- For education and training of waste consultants in Styrian enterprises, a **training module in the field of material accountancy** shall be offered at least once a year for >100 employees by competent institutions for adult education.
- For **uniform illustration of waste flows** in companies and other institutions, the use of the free software *STAN* shall be advertised and encouraged by the Province of Styria.
- In the context of *WIN* the controlling tool ***AWK plus*** shall be provided and implemented at the corporate level.

Aim 2: Implementing sustainable resource protection in a traceable way and considering corporate social responsibility

- In the context of *WIN*, the certification of companies in the field of environment management systems shall be encouraged (EMAS, ISO 14001, *Umweltzeichen Tourismus*). Execution of at least five certifications per year is intended.
- The establishment of CSR and corporate sustainability reports is encouraged in the context of *WIN*. Preparation of at least five reports per year is desirable.

Aim 3: Preventing, reusing and recovering waste in production processes

- *WIN* shall encourage corporate consulting sessions to identify **optimisation potentials** (optimising internal material flows, evaluating emissions and waste management, increasing energy efficiency). At least 100 consulting sessions per year are desired.
- Companies shall be enabled to offer commercial or industrial production residues or waste materials of all kinds for re-use free of charge via the internet-supported platform ***Abfall- und Recyclingbörse*** – *Waste and Recycling Platform*)
- The current recycling quota for demolition and construction waste in Styria shall be determined by 2011 and evaluated with regard to the requirements of the EU Waste Framework Directive.
- Companies offering repair services shall have the opportunity to present themselves in the demand-oriented **repair guide** published by *WIN*.

9 Appendix

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Electrical and Electronic Equipment Ordinance, ***EAG-VO***), Federal Law Gazette II No. 121/2005 as amended by Federal Law Gazette II No. 496/2008.

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9.2 List of figures

9.3 List of tables

9.4 Supplementary tables

9.4.1 Energy units/conversion tables

Kleine und große Zahlen (SI-System)					
Wort (USA-System)	Wort (deutsch)	Zahl	Potenz	Zeichen	Vorsilbe
Quintillionstel	Trillionstel	0,000 000 000 000 000 001	10^{-18}fache	a	Atto
Quadrillionstel	Billiardstel	0,000 000 000 000 001	10^{-15}fache	f	Femto
Trillionstel	Billionstel	0,000 000 000 001	10^{-12}fache	p	Piko
Billionstel	Milliardstel	0,000 000 001	10^{-9}fache	n	Nano
	Millionstel	0,000 001	10^{-6}fache	µ	Mikro
	Tausendstel	0,001	10^{-3}fache	cm	Milli
	Hundertstel	0,01	10^{-2}fache	c	Zenti
	Zehntel	0,1	10^{-1}fache	d	Dezi
	Einfache	1	$10^{0} = 1$		
	Zehnfache	10	10^{1}fache	da	Deka
	Hundertfache	100	10^{2}fache	h	Hekto
	Tausendfache	1 000	10^{3}fache	k	Kilo
	Millionenfache	1 000 000	10^{6}fache	M	Mega
Billionenfach	Milliardenfache	1 000 000 000	10^{9}fache	G	Giga
Trillionenfach	Billionenfache	1 000 000 000 000	10^{12}fache	T	Tera
Quadrillionenfach	Billiarde	1 000 000 000 000 000	10^{15}fache	P	Peta
Quintillionenfach	Trillion	1 000 000 000 000 000 000	10^{18}fache	E	Eta

Einheiten für die Wärmemenge					
Bezeichnung	Wärmemenge	kJ	MJ	Wh	kWh
Kilowattstunde	1 kWh	3 600	3,6	1 000	1
Wattstunde	1 Wh	3,6	0,003 6	1	0,001
Megajoule	1 MJ	1 000	1	278	0,278
Kilojoule	1 KJ	1	0,001	0,278	0,000 278
Joule, Wattsekunde	**1 J = 1 Ws**	0,001	0,000 001	0,000 278	0,000 000 278

Tabelle 3

Einheiten für den Wärmestrom				
	J/s	kJ/h	W	kW
1 kW	1 000	3 600	1 000	1
1 kJ/h	0,278	1	0,278	0,000 278
1 W	1	3,6	1	0,001

Kumulierter Energieaufwand (KEA) verschiedener Energieträger

Ergebnisse berechnet mit GEMIS Version 4.13
Auszug aus http://www.iwu.de/datei/kea.pdf
*-Bezugsgröße: unterer Heizwert Hu; **- Der regenerative Anteil beinhaltet auch sekundäre Ressourcen, z.B. Restholz und Müll

Brennstoffe*	Kumulierter Energieaufwand (KEA) [kWh_{Prim}/kWh_{End}]			Treibhausgase CO_2-Äquivalent [g/kWh_{End}]
	Gesamt	nicht regenerativer Anteil	regenerativer Anteil**	
Heizöl EL	1,13	1,13	0,00	311
Erdgas H	1,14	1,14	0,00	247
Flüssiggas	1,13	1,13	0,00	272
Steinkohle	1,08	1,08	0,00	439
Braunkohle	1,21	1,21	0,00	452
Holzhackschnitzel	1,07	0,06	1,01	35
Brennholz	1,01	0,01	1,00	6
Holzpellets	1,16	0,14	1,02	43

Spezifische Emissionsfaktoren für CO_2-Emissionen und andere Treibhausgasemissionen, angegeben als CO_2-Äquivalente (in $kg/MWh_{Endenergie}$)

aus: Klimaschutz in Kommunen, Berlin 1997 (Reihe" Umweltberatung für Kommunen" des Deutschen Instituts für Urbanistik)

Energieumwandlungssystem	Spezifische Emissionsfaktoren CO_2 (nur Brennstoff)	Spezifische Emissionsfaktoren CO_2 (mit Prozesskette)	Spezifische Emissionsfaktoren CO_2-Äquivalent (CH_4 und N_2O eingerechnet)
Erdgas Wärmeerzeuger	199	211	224
Heizöl (Leicht) Wärmeerzeuger	267	299	301
Steinkohle-Wärmeerzeuger	333	351	381
Braunkohle Heizwerk (> 10 MW)	353	436	448
Braunkohle-Brikett-Ofen	340	650	681
Strom aus dem deutschen Netz (1995)	655	712	739

Quelle: GEMIS 2.1, Berechnungen des ifeu 1996

Heizwert verschiedener Brennstoffe

nach: „Erneuerbare Energien verstärkt nutzen", Bundesministerium für Wirtschaft, 1994, S. 70

Brennstoff		Heizwert
Biomasse		
	Stroh	14,3 MJ/kg = 3,97 kWh/kg
	Schilfarten	14,5 MJ/kg = 4,03 kWh/kg
	Getreidepflanzen	15,0 MJ/kg = 4,17 kWh/kg
	Holz	16,0 MJ/kg = 4,45 kWh/kg
	Biogas	22,0 MJ/m^3 = 6,12 kWh/m^3
fossile Energieträger		
	Braunkohle	20,0 MJ/kg = 5,56 kWh/kg
	Steinkohle	32,0 MJ/kg = 8,90 kWh/kg
	Heizöl	42,0 MJ/kg = 11,70 kWh/kg
	Erdgas	30,0 MJ/m^3 = 8,34 kWh/m^3

Brennstoffeigenschaften nach: Dubbels Taschenbuch Maschinenbau, 18. Auflage, 1995, S. L81 ff.									
Brenn-stoff	Dichte (kg/l)	Brenn-wert Ho (MJ/kg)	Heizwert Hu (MJ/kg)	Masse % C pro kg %	Masse C pro Liter (kg/l)	Kg CO_2 nach Verbren-nung (kg CO_2/l)	Heizwert Hu (kWh/kg)	Heizwert Hu (kWh/l)	Kg CO_2 pro kWh (kg/kWh)
Methanol	0,79	22,30	19,60	35,50	0,30	1,09	5,45	4,32	0,25
Flüssiggas	0,58	50,00	46,00	82,00	0,48	1,74	12,79	7,42	0,24
Benzol	0,88	42,00	40,20	92,30	0,81	2,97	11,18	9,82	0,30
Benzin	0,76	46,70	42,50	85,00	0,65	2,37	11,82	8,98	0,26
Dieselöl	0,84	45,90	43,00	85,90	0,72	2,63	11,95	9,98	0,26
Heizöl EL	0,84	45,50	42,70	85,90	0,72	2,65	11,87	9,97	0,27
Heizöl L	0,88	44,80	42,00	85,50	0,75	2,76	11,68	10,27	0,27
Heizöl M	0,92	43,30	40,70	85,30	0,78	2,88	11,31	10,41	0,28
Heizöl S	0,97	42,70	40,20	84,90	0,82	3,02	11,18	10,84	0,28
Braun-kohle-brikett			20,60	68,00		2,49	5,73		0,44
Stein-kohle-brikett			31,50	90,00		3,30	8,76		0,38

Spezifische CO_2-Emissionen verschiedener Energieträger (nach GEMIS)			
Energieträger	kg CO_2/MWh	Faktor	kg CO_2/kWh
Erdgas	199	1,00	0,20
Ottokraftstoff	259	1,30	0,26
Dieselkraftstoff	264	1,33	0,26
Heizöl (leicht)	267	1,34	0,27
Heizöl (schwer)	281	1,41	0,28
Steinkohle	333	1,67	0,33
Braunkohle	353	1,77	0,35
Strom	655	3,29	0,66

9.4.2 Average annual population numbers since 1981 according to Federal Provinces[237]

Average annual population numbers since 1981, according to Federal Provinces

Year	Austria	Federal Province								
		Burgen-land	Carinthia	Lower Austria	Upper Austria	Salzburg	Styria	Tyrol	Vor-arlberg	Vienna
1981	7.568.710	270.202	536.630	1.432.534	1.271.856	442.611	1.189.892	587.650	305.447	1.531.888
1982	7.574.140	270.522	537.917	1.436.157	1.276.751	446.122	1.188.852	591.498	306.689	1.519.632
1983	7.561.910	269.962	539.407	1.433.246	1.278.008	449.141	1.184.830	594.971	307.088	1.505.257
1984	7.561.434	269.649	540.370	1.433.536	1.279.740	452.206	1.182.809	597.965	307.799	1.497.360
1985	7.564.984	269.535	540.769	1.434.868	1.281.563	455.112	1.180.519	600.666	309.043	1.492.909
1986	7.569.794	269.256	541.320	1.436.889	1.283.251	457.811	1.178.046	603.764	311.237	1.488.220
1987	7.574.586	269.294	542.036	1.438.705	1.284.242	460.383	1.174.915	606.930	313.196	1.484.885
1988	7.585.317	269.548	542.561	1.441.117	1.286.332	463.041	1.171.986	610.307	315.419	1.485.006
1989	7.619.566	270.153	543.912	1.449.494	1.292.553	468.160	1.170.189	615.430	320.470	1.489.205
1990	7.677.850	271.133	546.363	1.463.790	1.304.058	476.289	1.170.631	621.280	326.594	1.497.712
1991	7.754.891	272.951	550.042	1.479.187	1.320.567	484.807	1.174.524	628.284	331.930	1.512.599
1992	7.840.709	274.943	555.231	1.495.408	1.337.961	493.732	1.181.085	636.210	336.160	1.529.979
1993	7.905.632	275.958	558.935	1.508.220	1.350.814	501.215	1.185.486	642.893	338.640	1.543.471
1994	7.936.118	276.908	560.216	1.515.446	1.357.804	505.238	1.186.122	647.854	340.471	1.546.059
1995	7.948.278	277.689	561.281	1.520.637	1.360.967	507.454	1.185.830	651.639	341.951	1.540.830
1996	7.959.016	277.703	561.703	1.523.536	1.362.597	509.157	1.185.066	655.528	343.135	1.540.591
1997	7.968.041	277.368	561.280	1.525.554	1.363.843	510.501	1.184.310	659.288	344.354	1.541.543
1998	7.976.789	276.973	560.972	1.528.805	1.365.441	511.107	1.183.702	662.471	345.766	1.541.552
1999	7.992.323	276.486	560.821	1.532.920	1.368.299	512.049	1.183.146	665.773	347.443	1.545.386
2000	8.011.566	276.083	560.129	1.537.266	1.371.579	513.853	1.182.684	669.479	349.257	1.551.236
2001	8.042.293	276.331	559.745	1.542.033	1.375.473	515.949	1.185.275	673.595	351.356	1.562.536
2002	8.082.121	276.497	559.179	1.547.023	1.380.561	516.764	1.188.561	677.060	353.635	1.582.841
2003	8.118.245	276.481	558.319	1.552.896	1.385.088	517.908	1.190.339	680.705	355.621	1.600.888
2004	8.169.441	277.387	558.431	1.562.913	1.391.321	520.745	1.194.368	685.505	358.521	1.620.250
2005	8.225.278	278.466	559.093	1.574.536	1.397.572	523.356	1.198.543	690.668	361.391	1.641.653
2006	8.267.948	279.590	559.453	1.584.525	1.402.281	525.300	1.201.495	695.296	363.389	1.656.619
2007	8.300.954	280.577	560.118	1.593.032	1.405.535	526.570	1.203.770	698.377	365.155	1.667.820
2008	8.336.549	282.172	560.579	1.601.183	1.409.123	528.276	1.206.206	702.063	366.777	1.680.170

Source: STATISTICS AUSTRIA, Statistics of population numbers.- Revised results for 2001 to 2007. Prepared on: 27.05.2009.

The average annual population is calculated as arithmetic mean value of the average values of every quarter according to this formula:
Annual average = population number on 1 January + 2 times 1 April + 2 times 1 July + 2 times 1 October + 1 January of the following year) divided by 8.

Source: STATISTICS AUSTRIA, Statistics of population numbers. Revised results for 2001 to 2007. Prepared on: 27.05.2009.

[237] Statistics Austria: Statistics of population numbers. – Revised results for 2001 to 2007. Prepared on: 27.05.2009.

9.5 Classification of waste

Zuordnung	Bezeichnung gemäß "Abfallerhebung"	GTIN	ÖNorm SNr.	spez.	g	Bezeichnung gemäß ÖNorm S2100
Land	**Gemischte Siedlungsabfälle (Restmüll)**	9008390024010	**91101**			**Siedlungsabfälle und ähnliche Gewerbeabfälle**
Land	**Sperrige Siedlungsabfälle (Sperrmüll)**	9008390024225	**91401**			**Sperrmüll**
Land	kommunale Garten- und Parkabfälle	9008390026045	92102			Mähgut, Laub
Land	kommunale Garten- und Parkabfälle	9008390026076	92105			Holz
Land	Friedhofsabfälle	9008390026168	92116			Friedhofsabfälle
Land	Bioabfall getrennt erfasst (Biotonne)	9008390024072	92401			Mischungen von Abfällen der Abfallgruppen 924 und 921, die tierische Anteile enthalten, zur Kompostierung
Land	**Biogene Siedlungsabfälle (Bioabfall)**					**Biogene Siedlungsabfälle (Bioabfall)**
Land	**Straßenkehricht**	9008390024249	**91501**			**Straßenkehricht**
Land	Nichteisenmetalle	9008390016541	35315			NE-Metallschrott, NE-Metallemballagen
Land	Papier, Verpackungen, Drucksorten	9008390012345	18718			Altpapier, Papier und Pappe unbeschichtet
Land	Flachglas	9008390013748	31408			Glas (zB Flachglas)
Land	Verbundglas	9008390014691	31465			Glas- und Keramik mit produktspezifischen Beimengungen
Land	Altholz	9008390011805	17201			Holzemballagen und Holzabfälle, nicht verunreinigt
Land	Textilien	9008390023440	58107			Stoff- und Gewebereste, Altkleider
Land	Altspeiseöle und -fette	9008390010730	12302			Fette (zB Frittieröle)
Land	Kunststoffe	9008390022429	57108			Polystyrol, Polystyrolschaum
Land	Styropor	9008390022429	57108			Polystyrol, Polystyrolschaum
Land	Altmetall - Eisenschrott (ohne KFZ)	9008390016121	35103			Eisen- und Stahlabfälle, verunreinigt
Land	**Verwertbare Siedlungsabfälle (Altstoffe)**					**Verwertbare Altstoffe**
Land	Altfenster	9008390024164	91206			Baustellenabfälle (kein Bauschutt)
Land	Asche	9008390013380	31305			Kohlenasche
Land	Asche	9008390013410	31306			Holzasche
Land	Rechengut	9008390024690	94701			Rechengut
Land	Silofolien	9008390022610	57119			Kunststoffolien
Land	Sonstige Abfälle - nicht einzeln angeführt	k.Z.m.	k.Z.m.			Sonstige Abfälle - nicht einzeln angeführt
Land	Sperrmüll (Wiederverwertbar)	9008390025987	91402			heizwertreiche Fraktion aus aufbereitetem Sperrmüll, nicht qualitätsgesichert
Land	Windeln	9008390025116	97104			Abfälle, die nur innerhalb des medizinischen Bereiches eine Infektions- oder Verletzungsgefahr darstellen können, gemäß ÖNORM S 2104
Land	**Sonstige Abfälle**	**k.Z.m.**	**k.Z.m.**			**Sonstige Abfälle**
Land	Betonabbruch	9008390014240	31427			Betonabbruch
Land	Bauschutt	9008390013762	31409			Bauschutt und/oder Brandschutt (keine Baustellenabfälle)
Land	Aushubmaterial		31411*			Bodenaushub [nur mit Spezifikation 29,30,31,32,33]
Land	Baustellenabfälle	9008390024164	91206			Baustellenabfälle (kein Bauschutt)
Land	Eternit (asbesthältig) - 31412	9008390100417	31412		g	Asbestzement
Land	**Baurestmassen**					**Baurestmassen**
Land	**Abfälle - landesgesetzliche Bestimmungen**					
Bund	**Papier - Verpackungen / Drucksorten**	**9008390024136**	**91201**			**Verpackungsmaterial und Kartonagen**
Bund	Leichtfraktion - Verpackungen	9008390024188	91207			Leichtfraktion aus der Verpackungssammlung
Bund	Metalle - Verpackungen	9008390016145	35105			Metalle Verpackungen (ARGEV)
Bund	Glas - Verpackungen	9008390014769	31468			Weißglas (Verpackungsglas)
Bund	Glas - Verpackungen	9008390014790	31469			Buntglas (Verpackungsglas)
Bund	**Verpackungsabfälle**					**Verpackungsabfälle**
Bund	Altreifen	9008390023037	57502			Altreifen und Altreifenschnitzel
Bund	Altreifen (LKW)	9008390023037	57502			Altreifen und Altreifenschnitzel
Bund	Altreifen mit Felge	9008390023037	57502			Altreifen und Altreifenschnitzel
Bund	Altreifen mit Felge (LKW)	9008390023037	57502			Altreifen und Altreifenschnitzel
Bund	Altreifen (Traktor)	9008390023037	57502			Altreifen und Altreifenschnitzel
Bund	Altreifen mit Felge (Traktor)	9008390023037	57502			Altreifen und Altreifenschnitzel
Bund	**Sonstige Abfälle**	**9008390023037**				**Sonstige Abfälle**
Bund	Fahrzeugbatterien	9008390016602	35322		gn	Bleiakkumulatoren
Bund	Gerätebatterien	9008390016800	35338		gn	Batterien, unsortiert
Bund	Mineralische Altöle	9008390019559	54102		g	Mineralische Altöle
Bund	Altmedikamente	9008390019344	53501			Arzneimittel, nicht wassergefährdend, ohne Zytostatica
Bund	Altmedikamente	9008390019504	53510		g	Arzneimittel, wassergefährdend, schwermetallhaltig (zB Blei, Cadmium, Zink, Quecksilber, Selen), Zytostatica und unsortierte Arzneimittel
Bund	**Altmedikamente**					**Arzneimittel**
Bund	Problemstoffe - nicht einzeln angeführt	k.Z.m.	k.Z.m.			Problemstoffe - nicht einzeln angeführt
Bund	**Problemstoffe**					**Problemstoffe**
Bund	Elektrokleingeräte	9008390025567	35230		g	Elektro- und Elektronik-Altgeräte – Kleingeräte mit einer Kantenlänge kleiner 50 cm, mit gefahrenrelevanten Eigenschaften
Bund	Elektrokleingeräte	9008390025574	35231			Elektro- und Elektronik-Altgeräte – Kleingeräte mit einer Kantenlänge kleiner 50 cm
Bund	**Elektrokleingeräte**					**Elektrokleingeräte**
Bund	Großgeräte (exkl. Kühlgeräte)	9008390025543	35220		gn	Elektro- und Elektronik-Altgeräte – Großgeräte mit einer Kantenlänge größer oder gleich 50 cm, mit gefahrenrelevanten Eigenschaften
Bund	Großgeräte (exkl. Kühlgeräte)	9008390025550	35221			Elektro- und Elektronik-Altgeräte – Großgeräte mit einer Kantenlänge größer oder gleich 50 cm
Bund	**Großgeräte (exkl. Kühlgeräte)**					**Großgeräte (exkl. Kühlgeräte)**
Bund	Gasentladungslampen	9008390016824	35339		gn	Gasentladungslampen (zB Leuchtstofflampen, Leuchtstoffröhren)
Bund	Bildschirmgeräte inkl. Bildröhrengeräte	9008390025536	35212		g	Bildschirmgeräte, einschließlich Bildröhrengeräte
Bund	Kühl- und Gefriergeräte	9008390016237	35205		g	Kühl- und Klimageräte mit FCKW-, FKW- und KW-haltigen Kältemitteln (zB Propan, Butan)
Bund	Kühl- und Gefriergeräte	9008390016244	35206		g	Kühl- und Klimageräte mit anderen Kältemitteln (zB Ammoniak bei Absorberkühlgeräten)
Bund	**Kühl- und Gefriergeräte**					**Kühl- und Gefriergeräte**
Bund	**Elektro- und Elektronikaltgeräte**					**Elektro- und Elektronik-Altgeräte**
Bund	Altfahrzeuge (Autowracks)	9008390016213	35203		gn	Fahrzeuge, Arbeitsmaschinen und -teile, mit umweltrelevanten Mengen an gefährlichen Anteilen oder Inhaltsstoffen (zB Starterbatterie, Bremsflüssigkeit, Motoröl)
Bund	Altfahrzeuge (Autowracks)	9008390016220	35204			Fahrzeuge, Arbeitsmaschinen und -teile, ohne umweltrelevante Mengen an gefährlichen Anteilen oder Inhaltsstoffen
Bund	**Altfahrzeuge (Autowracks)**					**Fahrzeuge, Arbeitsmaschinen und -teile…..**
Bund	**Abfälle - bundesgesetzliche Bestimmungen**					

* nur mit einer Spezifikation zu verwenden
k.Z.m. = keine Zuordnung zu einer Schlüsselnummer möglich, Abfälle müssen zukünftig ggf. detailliert erfasst werden

9.6 *Municipal data on waste for Styria, in tonnes*

Abfalldaten der Steiermark in Tonnen pro Jahr

Zuordnung	Bezeichnung gemäß "Abfallerhebung"	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Gesamt
Land	Gemischte Siedlungsabfälle (Restmüll)	238.616,0	216.490,0	178.671,2	148.018,1	128.887,0	131.057,7	133.949,2	133.501,1	131.070,4	133.053,9	134.071,9	131.276,5	132.509,7	134.588,8	138.550,8	140.676,5	146.359,0	145.785,3	148.052,6	2.825.285,7
Land	Sperrige Siedlungsabfälle (Sperrmüll)	7.261,0	13.296,0	17.595,1	19.452,4	22.768,3	32.747,0	36.312,8	36.568,6	33.959,0	36.432,1	37.420,2	45.602,7	47.906,0	46.606,6	39.771,9	33.584,5	42.008,9	41.666,5	43.058,6	634.018,1
Land	Bioabfall getrennt gesammelt (Biotonne)	1.163,0	9.761,0	19.558,0	35.416,8	48.401,0	52.726,6	57.546,3	59.706,0	62.449,0	54.585,6	56.797,1	53.358,3	56.189,4	56.224,6	59.393,5	59.983,9	62.661,8	63.225,6	67.859,0	937.006,6
Land	Viktualienmarkt-Abfälle																				0,0
Land	kommunale Garten- und Parkabfälle							534,0	3.528,0		12.890,4	12.280,1	10.279,4	11.561,7	13.200,6	19.497,2	21.598,2	27.224,4	22.973,2	24.601,7	180.166,9
Land	Friedhofsabfälle						3.261,9	3.027,5	3.432,4	7.169,1	3.237,4	3.495,2	3.492,5	3.454,7	2.790,0	2.919,9	2.826,6	2.817,8	2.814,9	2.675,5	47.415,3
Land	Biogene Siedlungsabfälle (Bioabfall)	1.163,0	9.761,0	19.558,0	35.416,8	48.401,0	55.988,5	61.107,8	66.666,4	69.618,1	70.713,4	72.572,4	67.130,3	71.205,8	72.215,2	81.810,6	84.408,7	92.704,0	89.013,7	95.136,2	1.164.588,8
Land	Straßenkehricht	0,0	5.384,0	11.299,9	4.202,8	2.977,0	3.468,0	4.305,8	2.345,0	2.562,7	2.561,7	2.672,9	4.513,1	3.127,4	3.274,8	4.713,2	4.289,7	4.003,3	2.065,1	2.014,0	69.780,4
Land	Nichteisenmetalle									5,7	5,4	15,8	5,4	6,5	11,7	1,5	91,5	16,1	10,9	36,6	207,1
Land	Papier, Pappe, Kartonagen																				0,0
Land	Flachglas									99,0	178,7	199,4	263,4	437,3	381,3	425,6	510,4	667,2	707,0	981,2	4.850,5
Land	Verbundglas						0,2			0,5		4,6		4,6	8,1	3,6	8,0	8,2	2,4		40,2
Land	Altholz						209,0	522,1	5.991,0	6.363,0	11.493,8	13.218,3	9.773,0	10.759,1	11.328,5	17.944,7	19.319,6	20.262,8	23.007,2	23.979,7	174.172,1
Land	Bekleidung																				0,0
Land	Textilien	770,0	814,0	1.161,2	922,9	1.888,4	2.543,3	2.291,5	2.722,1	2.875,9	2.654,5	2.825,8	2.758,5	2.607,3	2.954,2	2.916,7	2.528,5	2.471,4	2.552,5	2.934,7	43.193,3
Land	Speiseöle und -fette						398,9	642,6	654,6	727,5	771,9	953,4	1.074,9	1.044,6	1.075,9	1.163,5	1.008,1	1.099,1	1.202,2	1.047,0	12.864,1
Land	Kunststoffe	929,0	1.295,0	1.228,2	784,0													126,2	149,2	228,0	4.739,6
Land	Styropor									1,2	4,5	7,3	6,8	6,6	9,1	4,4		16,6	20,0	25,8	102,4
Land	Metalle/Eisenschrott (ohne KFZ)	6.905,0	12.603,0	14.396,9	15.134,8	20.522,8	12.969,0	14.560,6	15.238,2	14.862,6	14.416,8	15.138,9	15.154,3	15.466,9	14.342,8	14.300,5	13.513,5	13.270,2	12.499,1	12.042,0	267.338,0
Land	Verwertbare Siedlungsabfälle (Altstoffe)	8.604,0	14.712,0	16.786,3	16.841,7	22.411,2	16.120,4	18.016,8	24.606,0	24.934,2	29.522,3	32.360,7	29.036,8	30.333,1	30.109,1	36.765,2	36.984,2	37.937,8	40.150,5	41.275,0	507.507,3
Land	Altfenster							7,0	10,1			27,1	4,2		0,2	1,7	3,2	4,6	4,0	7,5	69,6
Land	Asche								33,2	33,0		22,0	9,6	3,5	11,6	6,3	7,0	0,0	3,4	7,6	137,2
Land	Rechengut							310,9	188,1		296,4	1.079,9	1.717,3	676,5	1.113,1	1.009,5	1.174,6	1.564,3	623,3	2.567,1	12.321,3
Land	Silofolien							3,4		61,5	164,3	224,2	289,7	336,8	497,1	536,0	715,4	749,8	711,7	888,2	5.178,1
Land	Sonstige Abfälle - nicht einzeln angeführt		3.810,0	771,1	5.750,7	8.161,4	1.023,8					3.066,9	7.699,4	6.124,9	5.985,1	7.436,4	4.623,1	2.340,7	5.110,5	4.545,4	66.479,3
Land	Sperrmüll (Wiederverwertbar)						53,8	35,2	25,8	14,2	2,4	2,5	0,8				64,8		7,8	6,5	214,0
Land	Windeln									392,6	427,0	395,3	394,9	478,1	452,1	702,2	703,0	784,5	809,0	899,8	6.438,5
Land	Sonstige Abfälle	0,0	3.810,0	771,1	5.750,7	8.161,4	1.077,7	356,6	257,2	501,4	890,2	4.847,9	10.115,8	7.619,8	8.059,2	9.692,1	7.291,3	5.443,9	7.269,7	8.922,1	90.838,0
Land	Betonabbruch									22,4				1.068,2	60,5	343,5	339,0	751,0	1.685,0	373,1	4.642,7
Land	Bauschutt							6,1	13.842,6	18.675,1	19.300,2	25.247,1	11.829,1	17.938,8	10.939,0	16.635,6	22.320,4	23.334,1	24.875,3	23.613,3	228.556,7
Land	Aushubmaterial									40,0			7.071,6	15.100,0	337,0	17.934,8	8.202,7	39.939,6	16.161,8	3.668,7	108.456,2
Land	Baustellenabfälle								95,8	34,6	159,4	49,4	81,5	391,0	912,2	290,9	130,1	170,7	125,2	62,4	2.503,2
Land	Baurestmassen									151,3		167,0	11.884,3	1.359,2	378,4	3.718,1	2.446,8	3.538,6	2.548,7	2.157,5	28.349,9
Land	Baurestmassen	0,0	0,0	0,0	0,0	0,0	0,0	6,1	13.938,4	18.923,4	19.459,6	25.463,5	30.866,5	35.857,2	12.627,1	38.922,9	33.439,0	67.734,0	45.396,0	29.875,0	372.508,7
Land	Abfälle - landesgesetzliche Bestimmungen	255.644,0	263.453,0	244.681,6	229.682,5	233.605,8	240.459,4	254.055,0	277.862,7	281.569,1	292.633,0	309.409,5	316.541,7	328.559,0	307.480,8	350.326,7	340.671,9	396.190,9	371.346,8	368.333,5	5.664.526,9
Bund	Papier - Verpackungen / Drucksorten	32.601,0	40.177,0	43.227,8	51.344,9	57.806,3	61.350,3	67.382,0	71.477,2	73.451,0	80.147,5	83.264,2	81.160,7	81.985,8	82.227,7	86.152,7	90.507,0	94.444,7	99.335,0	101.194,3	1.379.257,0
Bund	Leichtfraktion - Verpackungen					11.611,2	16.523,2	16.187,0	16.300,2	17.304,6	17.549,3	19.056,7	19.420,4	19.500,1	21.284,0	22.382,8	23.770,7	24.688,0	25.199,7	25.709,4	296.486,4
Bund	Metall - Verpackungen						6.117,6	6.319,8	6.346,9	6.575,0	6.267,6	6.283,5	5.936,2	6.089,9	5.751,4	5.848,3	5.761,6	5.734,0	5.675,5	5.655,3	84.361,8
Bund	Verbundverpackungen																				0,0
Bund	Glas - Verpackungen	21.370,0	25.034,0	27.369,9	28.791,0	30.075,3	28.858,0	30.616,2	29.640,0	29.560,1	29.203,8	29.086,5	29.251,5	28.763,7	29.441,2	29.343,7	30.735,9	32.566,4	34.232,6	35.120,2	559.060,0
Bund	Verpackungsabfälle	53.971,0	65.211,0	70.597,7	80.135,9	99.492,8	112.849,2	120.505,1	123.764,2	126.890,6	133.168,2	137.710,9	135.768,8	136.338,5	138.704,3	143.727,5	150.775,4	157.433,1	164.442,8	167.678,2	2.319.165,1
Bund	Altreifen						235,6	255,5	378,1		548,6	390,1	996,4	478,5	434,4	568,2	701,4	582,6	448,4	610,9	6.628,7
Bund	Altreifen (LKW)								0,9		14,5	56,6	42,8	238,4	44,0	30,2	19,3	23,8	15,9	27,0	513,4
Bund	Altreifen mit Felge							0,9	12,9		26,2	93,5	235,0	104,9	86,7	140,3	221,2	90,5	283,4	106,2	1.401,8
Bund	Altreifen mit Felge (LKW)										0,5	9,6	12,5	3,0	11,3	2,6	36,8	4,0	3,1	13,0	96,4
Bund	Altreifen (Traktor)										0,5	9,8	7,9	11,5	14,7	24,7	14,6	9,7	10,8	16,4	120,5
Bund	Altreifen mit Felge (Traktor)											6,6	0,6	1,2	2,0	15,9	0,8	1,1	0,3	2,3	30,8
Bund	Sonstige Abfälle	0,0	0,0	0,0	0,0	0,0	235,6	256,4	391,9	0,0	590,3	566,2	1.295,2	837,5	593,1	781,9	994,1	711,7	761,9	775,8	8.791,5
Bund	Fahrzeugbatterien						350,7	514,1	565,8	584,3	610,2	685,2	779,9	698,2	725,9	652,3	593,2	581,1	532,1	420,6	8.283,7
Bund	Mineralische Altöle						340,1	439,2	468,4	482,1	531,4	566,5	809,2	556,1	548,1	550,9	546,0	670,0	699,6	735,4	7.943,0
Bund	Altmedikamente						76,4	99,7	95,2	92,7	93,6	100,2	105,4	97,7	97,2	95,6	95,1	117,0	97,4	92,4	1.355,7
Bund	Gerätebatterien						66,5	94,2	88,2	89,0	84,4	90,4	116,5	95,0	117,0	107,6	114,6	116,5	108,9	109,8	1.398,6
Bund	Problemstoffe - nicht einzeln angeführt	1.564,0	2.424,0	2.430,7	2.482,0	2.735,7	1.606,7	1.696,4	2.015,8	1.564,4	1.656,9	1.725,2	2.180,5	2.042,9	1.773,2	1.818,4	1.899,3	1.928,0	1.890,6	2.172,0	37.607,0
Bund	Problemstoffe	1.564,0	2.424,0	2.430,7	2.482,0	2.735,7	2.440,6	2.843,6	3.233,5	2.812,5	2.976,5	3.167,5	3.991,5	3.489,9	3.261,4	3.224,8	3.248,2	3.412,6	3.328,6	3.530,2	56.597,9
Bund	Elektrokleingeräte						7,4	30,4	67,2	99,8	137,9	229,1	209,2	336,2	355,8	457,4	909,7	1.360,5	1.623,6	1.998,0	7.822,1
Bund	Grossgeräte ausgenommen Kühlgeräte								12,9		20,2	81,5	100,0	88,2	188,8	99,2	271,5	1.690,7	1.836,5	1.933,2	6.322,6
Bund	Gasentladungslampen (Leuchtstoffröhren)						10,7	16,8	12,1	13,3	18,4	19,6	21,1	20,6	21,6	24,2	43,0	34,5	36,2	42,4	334,4
Bund	Bildschirmgeräte inkl. Bildröhrengeräte									73,8	347,4	393,4	477,4	484,0	470,8	711,4	825,0	1.303,6	1.548,1	1.695,3	8.330,2
Bund	Kühl- und Gefriergeräte							10,5		160,0	561,1	580,7	564,4	604,9	615,7	683,0	991,9	1.620,2	1.492,7	1.621,1	9.506,4
Bund	Elektro- und Elektronikaltgeräte	0,0	0,0	0,0	0,0	0,0	18,1	57,8	92,2	346,9	1.085,0	1.304,3	1.372,1	1.533,9	1.652,7	1.975,2	3.041,1	6.009,5	6.537,1	7.290,0	32.315,8
Bund	Altfahrzeuge (Autowracks)						1.269,9	2.230,2	2.898,0	1.974,6	2.305,1	2.078,3	2.407,9	2.393,7	2.655,2	2.077,5	1.982,2	1.805,6	1.004,2	546,8	27.629,3
Bund	Abfälle - bundesgesetzliche Bestimmungen	55.535,0	67.635,0	73.028,4	82.617,9	102.228,6	116.813,3	125.893,1	130.379,8	132.024,7	140.125,1	144.827,2	144.835,5	144.593,5	146.866,7	151.786,9	160.041,0	169.372,5	176.074,6	179.821,0	2.444.499,7
	Gesamtabfälle in der Steiermark	311.179,0	331.088,0	317.710,0	312.300,5	335.834,4	357.272,7	379.948,1	408.262,6	413.593,7	432.758,2	454.236,6	463.377,2	473.152,5	454.347,5	502.113,6	500.712,9	565.563,4	547.421,4	548.154,5	8.109.026,6

* sind gemäß der Novelle der Abfallverzeichnisverordnung vom BGBL. II Nr. 89/2005 vom 6.04.2005 nicht zu verwenden

9.7 Municipal data on waste for Styria, in kg/inhab/year

Abfalldaten der Steiermark in Kilogramm pro Einwohner

Jahresdurchschnittsbevölkerung (Statistik Austria)		1.170.631	1.174.524	1.181.085	1.185.486	1.186.122	1.185.830	1.185.086	1.184.310	1.183.702	1.183.146	1.182.684	1.185.275	1.186.561	1.190.339	1.194.368	1.198.543	1.201.495	1.203.770	1.206.208	
Kompetenz	**Bezeichnung gemäß "Abfallerhebung"**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Gesamt**
Land	Gemischte Siedlungsabfälle (Restmüll)	203,8	184,3	151,3	124,9	108,7	110,5	113,0	112,7	110,7	112,5	113,4	110,8	111,5	113,1	116,1	117,4	121,8	121,1	122,7	2.360,2
Land	Sperrige Siedlungsabfälle (Sperrmüll)	6,2	11,3	14,9	16,4	19,2	27,6	30,6	30,9	29,7	30,8	31,6	38,5	40,3	39,2	33,3	28,0	36,0	34,8	35,7	532,8
Land	Bioabfall getrennt gesammelt (Biotonne)	1,0	8,3	16,6	26,9	40,8	44,5	48,6	50,4	52,8	46,1	48,0	45,0	47,3	47,2	49,7	50,0	52,2	52,5	56,3	787,1
Land	Viktualienmarkt-Abfälle	0,0			0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Land	kommunale Garten- und Parkabfälle							0,5	3,0		10,9	10,4	8,7	9,7	11,1	16,3	18,0	22,7	19,1	20,4	150,7
Land	Friedhofsabfälle						2,8	2,6	2,9	6,1	2,7	3,0	2,9	2,9	2,3	2,4	2,4	2,3	2,3	2,2	39,9
Land	**Biogene Siedlungsabfälle (Bioabfall)**	**1,0**	**8,3**	**16,6**	**29,9**	**40,8**	**47,2**	**51,6**	**56,3**	**58,8**	**59,8**	**61,4**	**56,6**	**59,9**	**60,7**	**68,5**	**70,4**	**77,2**	**73,9**	**78,9**	**977,7**
Land	**Straßenkehricht**	**0,0**	**4,6**	**9,6**	**3,5**	**2,5**	**2,9**	**3,6**	**2,0**	**2,2**	**2,2**	**2,3**	**3,8**	**2,6**	**2,8**	**3,9**	**3,6**	**3,3**	**1,7**	**1,7**	**58,8**
Land	Nichteisenmetalle									0,00	0,00	0,01	0,00	0,01	0,01	0,00	0,06	0,01	0,01	0,03	0,2
Land	Papier, Pappe, Kartonagen	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,0
Land	Flachglas									0,06	0,15	0,17	0,22	0,37	0,32	0,38	0,43	0,56	0,59	0,81	4,1
Land	Verbundglas						0,00			0,00		0,00		0,00	0,01	0,00	0,01	0,01	0,00	0,00	0,0
Land	Altholz						0,18	0,44	5,06	5,38	9,71	11,18	8,25	9,05	9,52	15,02	16,12	18,96	19,11	19,88	145,8
Land	Bekleidung	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,0
Land	Textilien	0,66	0,69	0,98	0,78	1,59	2,14	1,93	2,30	2,43	2,24	2,39	2,33	2,19	2,48	2,44	2,11	2,06	2,12	2,43	36,3
Land	Altspeiseöle und -fette						0,34	0,54	0,55	0,61	0,65	0,81	0,91	0,88	0,90	0,97	0,84	0,91	1,00	0,97	10,8
Land	Kunststoffe	0,79	1,10	1,04	0,66	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,12	0,19	4,0
Land	Styropor										0,00	0,00	0,01	0,01	0,01	0,01	0,00	0,01	0,02	0,02	0,1
Land	Metalle/Eisenschrott (ohne KFZ)	5,90	10,73	12,19	12,77	17,30	10,94	12,29	12,87	12,56	12,19	12,80	12,78	13,01	12,05	11,97	11,27	11,04	10,39	9,98	225,0
Land	**Verwertbare Siedlungsabfälle (Altstoffe)**	**7,3**	**12,5**	**14,2**	**14,2**	**18,9**	**13,6**	**15,2**	**20,8**	**21,1**	**25,0**	**27,4**	**24,5**	**25,5**	**25,3**	**30,8**	**30,9**	**31,6**	**33,4**	**34,2**	**426,2**
Land	Altfenster							0,01	0,01			0,02	0,00		0,00	0,00	0,00	0,00	0,00	0,01	0,1
Land	Asche								0,03	0,03		0,02	0,01	0,00	0,01	0,01	0,01	0,00	0,00	0,01	0,1
Land	Rechengut							0,26	0,16		0,25	0,91	1,45	0,57	0,94	0,85	0,98	1,30	0,52	2,13	10,3
Land	Silofolien							0,00		0,05	0,14	0,19	0,24	0,28	0,42	0,45	0,60	0,82	0,59	0,74	4,3
Land	Sonstige Abfälle - nicht einzeln angeführt		3,24	0,65	4,85	6,88	0,96					2,62	6,50	5,15	5,03	6,23	3,96	1,95	4,25	3,77	55,8
Land	Sperrmüll (Wiederverwertbar)						0,05	0,03	0,02	0,01	0,00	0,00	0,00		0,00	0,00	0,05	0,00	0,01	0,01	0,2
Land	Windeln									0,33	0,36	0,33	0,33	0,40	0,38	0,59	0,59	0,85	0,67	0,75	5,4
Land	**Sonstige Abfälle**	**0,0**	**3,2**	**0,7**	**4,9**	**6,9**	**0,9**	**0,3**	**0,2**	**0,4**	**0,8**	**4,1**	**8,5**	**6,4**	**6,8**	**8,1**	**6,1**	**4,5**	**6,0**	**7,4**	**76,2**
Land	Betonabbruch									0,0				0,9	0,1	0,3	0,3	0,6	1,4	0,3	3,9
Land	Bauschutt							0,0	11,7	15,8	16,3	21,3	10,0	15,1	9,2	13,9	18,6	19,4	20,7	19,6	191,6
Land	Aushubmaterial									0,0			6,0	12,7	0,3	15,0	6,8	33,2	13,4	3,0	90,6
Land	Baustellenabfälle								0,1	0,0	0,1	0,0	0,1	0,3	0,8	0,2	0,1	0,1	0,1	0,1	2,1
Land	Baurestmassen									0,1		0,1	10,0	1,1	0,3	3,1	2,0	2,9	2,1	1,8	23,8
Land	**Baurestmassen**								**11,8**	**16,0**	**16,4**	**21,5**	**26,0**	**30,2**	**10,6**	**32,6**	**27,9**	**56,4**	**37,7**	**24,8**	**311,9**
Land	**Abfälle - landesgesetzliche Bestimmungen**	**216,4**	**224,3**	**207,2**	**193,7**	**196,9**	**202,8**	**214,4**	**234,6**	**237,9**	**247,3**	**261,6**	**268,7**	**276,4**	**258,3**	**293,3**	**284,2**	**329,7**	**306,5**	**305,4**	**4.763,8**
Bund	Papier, -Verpackungen / Druckseiten	27,8	34,2	36,8	43,3	48,7	51,7	56,9	60,4	62,1	67,7	70,4	69,5	69,0	69,1	72,1	75,5	78,6	82,5	83,9	1.159,1
Bund	Leichtfraktion - Verpackungen					9,8	13,9	13,7	13,8	14,6	14,8	16,1	16,4	16,4	17,9	18,7	19,8	20,5	20,9	21,3	248,8
Bund	Metall - Verpackungen						5,2	5,3	5,4	5,6	5,3	5,3	5,0	5,1	4,8	4,9	4,8	4,8	4,7	4,7	70,9
Bund	Verbundverpackungen			0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Bund	Glas - Verpackungen	18,3	21,3	23,2	24,3	25,4	24,3	25,8	25,0	25,0	24,7	24,6	24,7	24,2	24,7	24,8	25,8	27,1	28,4	29,1	470,3
Bund	**Verpackungsabfälle**	**46,1**	**55,5**	**59,8**	**67,6**	**83,9**	**95,2**	**101,7**	**104,5**	**107,2**	**112,6**	**116,4**	**114,5**	**114,7**	**116,5**	**120,3**	**125,8**	**131,0**	**136,6**	**139,0**	**1.949,0**
Bund	Altreifen						0,2	0,2	0,3		0,5	0,3	0,8	0,4	0,4	0,5	0,6	0,5	0,4	0,5	5,6
Bund	Altreifen (LKW)								0,0		0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0	0,0	0,0	0,4
Bund	Altreifen mit Felge							0,0	0,0		0,0	0,1	0,2	0,1	0,1	0,1	0,2	0,1	0,2	0,1	1,2
Bund	Altreifen mit Felge (LKW)										0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Bund	Altreifen (Traktor)										0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Bund	Altreifen mit Felge (Traktor)											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Bund	**Sonstige Abfälle**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,2**	**0,2**	**0,3**	**0,0**	**0,5**	**0,5**	**1,1**	**0,7**	**0,5**	**0,7**	**0,8**	**0,6**	**0,6**	**0,6**	**7,4**
Bund	Fahrzeugbatterien						0,30	0,43	0,48	0,49	0,52	0,58	0,66	0,59	0,61	0,55	0,48	0,48	0,44	0,35	7,0
Bund	Mineralische Altöle						0,29	0,37	0,40	0,41	0,45	0,48	0,68	0,47	0,48	0,48	0,46	0,56	0,59	0,51	6,7
Bund	Altmedikamente						0,06	0,08	0,08	0,08	0,08	0,08	0,09	0,08	0,08	0,08	0,08	0,10	0,09	0,08	1,1
Bund	Gerätebatterien						0,06	0,08	0,07	0,06	0,07	0,06	0,10	0,08	0,10	0,09	0,10	0,10	0,09	0,09	1,2
Bund	Problemstoffe - nicht einzeln angeführt	1,33	2,06	2,05	2,09	2,31	1,35	1,43	1,70	1,32	1,40	1,46	1,64	1,72	1,49	1,52	1,58	1,60	1,57	1,80	31,7
Bund	**Problemstoffe**	**1,3**	**2,1**	**2,1**	**2,1**	**2,3**	**2,1**	**2,4**	**2,7**	**2,4**	**2,5**	**2,7**	**3,4**	**2,9**	**2,7**	**2,7**	**2,7**	**2,8**	**2,8**	**2,9**	**47,6**
Bund	Elektrokleingeräte						0,01	0,03	0,06	0,08	0,12	0,19	0,18	0,28	0,30	0,39	0,76	1,13	1,35	1,86	6,5
Bund	Grossgeräte ausgenommen Kühlgeräte								0,01		0,02	0,07	0,08	0,07	0,18	0,09	0,23	1,41	1,53	1,80	5,3
Bund	Gasentladungslampen (Leuchtstoffröhren)						0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,04	0,03	0,03	0,04	0,3
Bund	Bildschirmgeräte inkl. Bildröhrengeräte									0,06	0,29	0,33	0,40	0,41	0,40	0,60	0,69	1,08	1,29	1,41	7,0
Bund	Kühl- und Gefriergeräte							0,01		0,14	0,47	0,49	0,48	0,51	0,52	0,57	0,83	1,35	1,24	1,34	7,9
Bund	**Elektro- und Elektronikaltgeräte**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,1**	**0,3**	**0,9**	**1,1**	**1,2**	**1,3**	**1,4**	**1,7**	**2,5**	**5,0**	**5,4**	**6,0**	**27,0**
Bund	**Altfahrzeuge (Autowracks)**						1,1	1,9	2,4	1,7	1,9	1,8	2,0	2,0	2,2	1,7	1,7	1,5	0,8	0,5	**23,2**
Bund	**Abfälle - bundesgesetzliche Bestimmungen**	**47,4**	**57,6**	**61,8**	**69,7**	**86,2**	**96,5**	**106,2**	**110,1**	**111,5**	**118,4**	**122,5**	**122,2**	**121,7**	**123,4**	**127,1**	**133,5**	**141,0**	**146,3**	**149,1**	**2.054,2**
	Gesamtabfälle in der Steiermark	**265,8**	**281,9**	**269,0**	**263,4**	**283,1**	**301,3**	**320,6**	**344,7**	**349,4**	**365,8**	**384,0**	**390,9**	**398,1**	**381,7**	**420,4**	**417,8**	**470,7**	**454,8**	**454,4**	**6.817,9**

* sind gemäß der Novelle der Abfallverzeichnisverordnung vom BGBL. II Nr. 89/2005 vom 6.04.2005 nicht zu verwenden

9.8 List of Abbreviations

ARA	**A**ltstoff **R**ecycling **A**ustria AG – Waste Material Recycling Austria
ASZ	**A**ltstoff**s**ammel**z**entrum – Waste Material Collection Centre
AWG	**A**bfall**w**irtschafts**g**esetz, Waste Management Act
AWIS	**a**bfall**w**irtschaftliches **I**nformations**s**ystem - Waste management-related information system
AWV	**A**bfall**w**irtschafts**v**erband - Waste Management Association
B-AWP 2006	Federal Waste Management Plan 2006
BGBl.	**B**undes**g**esetz**bl**att – Federal Law Gazette
BMLFUW	**B**undes**m**inisterium für **L**and- und **F**orstwirtschaft, **U**mwelt und **W**asserwirtschaft - Federal Ministry of Agriculture, Forestry, Environment and Water Management
BRV	Österreichische **B**austoff**r**ecycling**v**erband - Austrian Association for Recycling of Demolition and Construction Waste
CSR	Corporate Social Responsibility
DepVO	**Dep**onie**v**er**o**rdnung – Landfill Ordinance
EAG	**E**lektro**a**lt**g**eräte/Elektro- und Elektronikaltgeräte – Waste Electrical and Electronic Equipment, WEEE
EAK-Austria	Coordination Office for Waste Electrical and Electronical Equipment Austria GmbH
EDM	Electronic data management
EU	European Union
FA	**F**ach**a**bteilung - Specialised Division
FA19D	Specialised Division 19D Waste management and material flow management
i. d. F.	in der Fassung; as amended in
IPPC	integrated pollution prevention and control
IVU	integrierte Vermeidung und Verminderung der Umweltverschmutzung
JI-CDM	Joint Implementation - Clean Development Mechanism
chap.	chapter
KEK	**K**leinregionale **E**ntwicklungs**k**onzepte – small regional development concepts
kg/inhab/year	kilogramme per inhabitant per year
kJ/kg	Kilojoule/kilogramme
L-AWP 2005	Provincial Waste Management Plan 2005
L-AWP 2010	Provincial Waste Management Plan 2010
LGBl.	Provincial Law Gazette
l	Liter
Mio.	Millionen
MBA	**m**echanical-**b**iological waste **t**reatment
MVA	**M**üll**v**erbrennungs**a**nlage - waste incineration plant
NAP	National Allocation Plan
NSTRAT	Österreichische Strategie zur Nachhaltigen Entwicklung
ÖSTRAT	gesamtösterreichischen Nachhaltigkeitsstrategie von Bund und Ländern
ÖWAV	**Ö**sterreichischer **W**asser- und **A**bfallwirtschafts**v**erband - Austrian Water and Waste Management Association
PPP	Private-Public-Partnership
PSS	**P**roblemstoff**s**ammel**s**telle - Collection cell for problematic substances
RL	Richtlinie - Directive
RoHS	**R**estriction **o**f **h**azardous **s**ubstances
StAWG	**St**eiermärkisches **A**bfall**w**irtschafts**g**esetz - Styrian Waste Management Act
STAWIKO 95	**St**eiermärkisches **A**bfall**wi**rtschafts**ko**nzept 1995 - Styrian Waste Management Concept 1995
Stmk.	Steiermark - Styria
t	tonne
t/year	tonnes/year
Tab.	Table
GHG	**g**reen**h**ouse **g**as
TKV	**T**ier**k**örper**v**erwertung - animal body recovery
DM	**d**ry **m**atter
V.EFB	**E**ntsorgungs**f**ach**b**etrieb - Waste Disposal Company

VerpackVO	**Verpack**ungs**v**ero**o**rdnung
VO	**V**ero**o**rdnung
VÖEB	**V**erband **Ö**sterreichischer **E**ntsorgungs**b**etriebe - Association of Austrian Waste Disposal Companies
WIN	**W**irtschafts**i**nitiative **N**achhaltigkeit - Business Initiative Sustainability

9.9 Contact adresses

Federal institutions

Federal Ministry for Agriculture, Forestry, Environment and Water Management, Stubenring 1,
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Specialised Division 7A – Gemeinden und Wahlen (Municipalities and Elections)
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Specialised Division 10A – Agrarrecht und ländliche Entwicklung (Agricultural Legislation and Rural Development)
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Specialised Division 10B – Landwirtschaftliches Versuchszentrum
8047 Graz-Ragnitz, Ragnitzstraße 193
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Specialised Division 10C – Forstwesen (Forstdirektion)
8020 Graz, Brückenkopfgasse 6
Tel.: (0316) 877-4528, fa10c@stmk.gv.at

Specialised Division 13A – Umwelt- und Anlagenrecht (Environment and Plant Legislation),
8010 Graz, Landhausgasse 7
Tel.: (0316) 877-2482, fa13a@stmk.gv.at

Specialised Division 17A – Allgemeine technische Angelegenheiten (General Technical Issues)
8010 Graz, Landhausgasse 7
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Fachstelle Energie - Landesenergiebeauftragter
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Specialised Division 17B – Technik und Sachverständigendienst (Engineering and Expert Witnesses)
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Specialised Division 19D – Abfall- und Stoffflusswirtschaft (Waste and Material Flow Management),
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Waste Management Associations

Dachverband der Steirischen Abfallwirtschaftsverbände (Umbrella Organisation of Styrian Waste Management Associations), Feldkirchner Straße 96,
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Referat für Abfallwirtschaftscontrolling, 8010 Graz, Kaiserfeldgasse 1/IV,
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AWV Deutschlandsberg
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AWV Knittelfeld,
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AWV Murau,
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Interest representations

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Wirtschaftskammer Steiermark (Regional Economic Chamber of Styria)
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Organizations and Institutions

ARGE Müllvermeidung (ARGE Waste Prevention)
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ÖWAV – Österreichischer Wasser- und Abfallwirtschaftsverband (Austrian Water and Waste Management Association)
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office@iswa.at, www.iswa.at

V.EFB - Verein zur Verleihung des Zertifikates eines Entsorgungsfachbetriebes
1030 Wien, Lothringerstrasse 12/4, Tel.: (01) 532 62 83
wolfgang.buechler@vefb.at, www.vefb.at

Recycling companies

Altstoff Recycling Austria AG (ARA)
License contracts, system financing, system communication
Mariahilfer Straße 123, A-1062 Wien
Tel.: (01) 599 97-0, Fax: (01) 595 35 35
www.ara.at

Austria Glas Recycling GmbH (AGR)
Collection and recovery of glass packagings
Obere Donaustraße 71, A-1020 Wien
Tel.: (01) 214 56 00-0, Fax: (01) 214 49 08
www.agr.at

UFH Elektroaltgeräte System Betreiber GmbH,
1060 Wien, Mariahilfer Straße 37-39
Tel. (01) 588 39-33, Fax (01) 588 39-94
info@ufh.at, www.ufh.at

www.abfallwirtschaft.steiermark.at

WIRTSCHAFTSINITIATIVE NACHHALTIGKEIT

www.win.steiermark.at

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www.gscheitfeiern.at