

Waste Management

I Background information

General objectives of waste policy

The central objective of waste policy is to reduce the harmful health and environmental impacts of waste. In order to meet this objective, it is particularly important to:

- prevent the generation of waste
- promote reuse of waste
- promote biological recovery of waste and recycling of materials
- promote energy use of waste not suited for recycling
- ensure that the treatment and disposal of waste does not cause any harmful impacts

The main climate-related objective of waste policy is to reduce the greenhouse gas emissions generated by waste, particularly by reducing the methane emissions resulting from treatment at landfills. In order to reach the objective, the amount of landfilled biodegradable waste will be substantially reduced, while at the same time measures will be taken to increase the recovery rates of methane generated at landfills.

Overview of the Finnish Waste legislation

Finnish waste legislation covers all wastes except certain special types of waste such as radioactive wastes, which are covered by separate laws. The waste legislation is largely based on EU legislation, but in some cases includes stricter standards and limits than those applied in the EU as a whole. Finland also has legislation on some issues related to wastes that have not yet been covered by EU legislation. The negative environmental impacts of wastes are addressed in legislation on environmental protection. Taxes and fees payable in relation to wastes are generally included in legislation on taxation, although some fees are included in waste legislation. Other statutes covering specific economic activities also include certain controls related to wastes.

(More information on waste legislation:

<http://www.ymparisto.fi/default.asp?contentid=235661&lan=en&clan=en>).

The purpose of the Waste Act is to support sustainable development by promoting the rational use of natural resources, and preventing and combating the hazard and harm to health and the environment arising from wastes. In general, it requires the recovery of waste if this is technically and economically feasible, primarily in the form of material and secondarily as energy. There are also assigned general duties for producers, manufactures, importers and authorities to minimise generation of waste in all activities and to ensure that waste doesn't significantly hamper or complicate the organisation of waste management, or result in hazard or harm to health or the environment. The principle of producer responsibility is also an important instrument in Finland to minimise the generation of and to enhance recovery of certain types of wastes.

The objective of the Environmental protection Act is: to prevent the pollution of the environment and to repair and reduce damage caused by pollution, to safeguard a healthy, pleasant ecologically diverse and sustainable environment; to prevent the generation and the harmful effects of waste; to improve and integrate assessment of the impact of

activities that pollute the environment; to improve citizens' opportunities to influence decisions concerning the environment; to promote sustainable use of natural resources; and to combat climate change and otherwise support sustainable development.

According to Waste Act, MoE's task is to draw up a national waste plan. This strategic plan sets targets for the reduction of the amounts and harmful properties of waste, for waste recovery, for the prevention of risks to human health and the environment, for further development of waste management infrastructures and for supervision of waste transport. The national waste plan also presents the administrative and legal, economic and informative instruments to be used in implementation. It also includes a separate national waste prevention programme.

Current state of waste management

The state of waste management in Finland has improved considerably during the last ten years. This has been primarily due to changes in the EU waste legislation, which sets strict environmental and health requirements for waste management. In fact, the requirements will become even stricter in the future. There have also been substantial changes in the operating environment of waste management.

The number of plants recovering and treating municipal waste has multiplied during the last fifteen years. At the moment, a substantial number of waste incineration plants and other treatment facilities are at the planning stage in Finland.

Cooperation between municipalities in waste management in built-up areas has expanded considerably during the past decade. Most Finnish municipalities have given the task of carrying out waste management to waste treatment plants jointly owned by municipalities, which in turn purchase their services by subjecting private service providers to competitive tendering. Private companies are responsible for such matters as waste transport.

Companies offering a broad range of environmental services and plants recovering and treating waste have also been set up in the private sector.

The new requirements concerning landfill structures and the ensuing rise in cost have also had an impact on the development of waste management and have put more pressure on different players to make better use of waste generated as part of their production processes. Technological advances have also made it easier to recover waste and in many cases, the treatment and recovery of waste has become a profitable business. Despite tighter requirements and technological improvements, the use of waste as a substance or for energy generation has not progressed in accordance with the objectives of the revised National Waste Plan for 2005.

The introduction of producer responsibility systems for certain discarded products has also changed the operating environment of waste management. Nowadays, producer responsibility applies to discarded tyres, vehicles, electronic and electrical appliances, recycled paper, and partially also to packaging and packaging waste. A change in the Waste Act under which the waste management of used batteries would be made the responsibility of manufacturers is also under preparation.

In autumn 2007, working groups were appointed to prepare an overall revision of the waste legislation and to consider waste taxation and improvements in it.

II Prevention and minimization and environmentally sound management of hazardous wastes

Management of hazardous wastes

A total of 1.1 million tonnes of hazardous waste was generated in Finland during 2006 (contaminated soils and stones are excluded), of which some 76 % was taken to hazardous waste landfill sites, 13 % was recovered for its material or energy content, and 10 % incinerated.

Local authorities are responsible for the recovery and treatment of hazardous wastes generated in homes and in farming and forestry, except where the quantities of wastes are excessive. Hazardous wastes generated during other activities, such as industrial processes, are primarily the responsibility of waste holders.

Several Finnish firms specialise in the treatment and recovery of hazardous wastes. The most significant of these companies is the national hazardous waste facility Ekokem Oy, which is jointly owned by the State, local authorities and industry. Ekokem is equipped to deal with all the more common types of hazardous waste. Other hazardous waste reception facilities around Finland mainly specialise in the treatment of specific types of waste. Finnish industrial facilities typically treat a considerable proportion of the hazardous wastes generated during their own processes.

Hazardous wastes may only be disposed of at landfill sites specially equipped to deal with them. A total of 17 such hazardous waste landfill sites were in operation in 2004.

The packing and labelling of hazardous wastes, including labelling for the purposes of the documentation of transport shipments, is controlled according to special legislation. The incineration of hazardous wastes is controlled by Government Decree. International shipments of hazardous wastes are covered by the EEC Regulation on international waste shipments (EEC 259/93), which additionally prohibits the export of hazardous wastes to non-OECD countries.

Use of collected landfill gas

According to the Government Decision on Landfills, the biogas produced at closed landfills must be collected and recovered or treated. In addition, the competent authority can case-specifically require biogas collection at landfills which have been closed earlier, if there is the potential for any danger or harm to human health or the environment.

There were 33 landfill gas recovery plants operating at the end of 2005. The volume of the recovered biogas was 118.4 million m³, an 18% increase in the volume of the recovered biogas from the year 2004. The volume of recovered biogas used for the production of electrical and thermal energy was 70.3 million m³, producing 298.5 GWh. The greater use of the biogas from the Ämmässuo landfill in Espoo contributed to this increase.

The production of electricity from biogas is supported by 0.42 cents/kWh if electricity is produced at a minimum of 100 MWh.

Employment and Economic Development Centres (T&E Centres) can support the building of biogas plants of small-scale entrepreneurs economically. T&E Centres are supervised by the Ministry of Trade and Industry, Ministry of Labour and Ministry of Agriculture and Forestry.

UUMA inventory program concerning the use of alternative materials in soil construction

UUMA-inventory project (<http://www.environment.fi/default.asp?contentid=200628&lan=en>)

is a study for the development of product acceptance and usage control of alternative materials in soil construction. The Program was established in 2006, and ended in 2008. The purpose of the programme is to contribute to the use of alternative UUMA-materials in infrastructure construction with help of the development of UUMA-products, project delivery and product acceptance methodology, and markets.

UUMA-materials involve different types of alternative materials which nowadays are mainly deposited in landfills or used for secondary purposes like fills. UUMA-materials have been grouped into industrial by-products (like ashes, sludge, slag, gypsum), demolition waste and other materials of existing earth structures, different types of surplus soil materials from construction projects (including dredged mud), and contaminated soil.

Soil remediation

There are about 21 000 sites in the Finnish soil inventory. Of these, around 16 800 are potentially contaminated – based on knowledge of earlier or ongoing activities on these sites. The rest are either known to be contaminated or have already been remediated. The inventory was conducted for the first time in the early 1990's and a national database system on sites (with updating data) was taken into use in 2008. Until now 3 200 (at the moment 3500) sites have been remediated, and actions are taken on some 300 to 400 sites a year

Finland has a waste management system for orphan sites with the funding of EUR 3-4 million provided annually by the state budget. The Oil Pollution Compensation Fund allocates about EUR 2-3 million per year to the remediation of orphan sites polluted by oil. The SOILI programme, based on an agreement between the petroleum industry and public bodies in 1996, aims to remediate polluted decommissioned service stations. The application period for public funds ended in 2005. To date, remedial action has been taken at 380 sites and applications for 1400 sites have been submitted to the programme.

A 2007 decree on assessing the contamination of soil and remediation needs requiring risk assessments of soil contamination provides the basis for risk-based remediation measures. Remediation measures are mainly due to changes in land use and groundwater protection measures. Approximately EUR 1.2 billion is expected to be spent during the next 20 years for remediation of contaminated soils. About two third of the costs will be covered by the private sector and one third by the public sector. Abandoned industrial and harbour areas are the main targets.

III Environmentally sound management of solid (non-hazardous) wastes and sewage, in the context of integrated planning and management of land resources

Generation, recovery and treatment of waste in 2005

Almost 66 million tonnes of waste was generated in Finland in 2005. The figure does not include the manure used in agriculture and the cutting waste left in the forests. Of the waste generated, some 29% was recovered as material and 14% used as energy. The remaining 57% ended up at landfills or was treated using other methods.

The largest amounts of waste were generated in connection with mineral extraction (21 million tonnes) and construction (22 million tonnes). Of the mining waste, some 47% was wallrock, 47% tailings and 6% waste soil. The largest changes in the amount of waste in the sector have resulted from the changeover from opencast mining to underground mining. Waste soil accounts for almost 95% of the construction waste. In 2005, about 38% of all construction waste was recovered. Of the waste generated during housing construction (about 1.7 million tonnes; excluding waste soil) about 33% was used as materials. At the same time, about 27% was used as energy, while the remaining 40% ended up at landfills.

Industrial waste totalled almost 17 million tonnes. The largest industrial waste categories were wood and bark, slag generated in connection with metal processing and manufacturing of metal products, and chemical-industry waste, particularly gypsum. The recovery rate of industrial waste varies greatly between sectors. Pulp and paper industry, food industry and the manufacturing of wood products exceeded the 70% recovery target laid down in the National Waste Plan for 2005. However, oil and chemical industry and the manufacturing of basic metals fell substantially short of the target.

Almost 2.4 million tonnes of hazardous waste was generated in 2005. Most of that amount originated from the extraction of minerals, metal processing, manufacturing of metal products and construction.

Municipal waste is waste that is generated by households and similar waste generated in connection with industrial, service and other operations.

Households and the service sector are the largest source of municipal waste. In the period 2000-2006, the amounts of municipal waste have varied between 2.4 and 2.6 million tonnes. In 2005, the total was 2.48 million tonnes.

Towards a recycling society - National Waste Plan for 2016

Summary:

The aims and the principal steering measures required for meeting the aims are grouped under eight objectives. The objectives cover most sectors of waste management, including municipal waste management, and the waste management in industry, mineral extraction, construction, agriculture, trade and services. The aims concerning material efficiency also apply to activities carried out in society at large in a more general sense. Finland's national plan for preventing waste generation is incorporated in the National Waste Plan.

The Government decision on a national waste plan will be implemented within the Government's budgetary framework and productivity programme.

1. Preventing the generation of waste through improved material efficiency

Material efficiency of products will be promoted by incorporating material efficiency criteria in product standards, implementation provisions and criteria for ecolabels and public procurement. Material efficiency in different sectors will be improved through agreements between the Government and industry in the same manner as in energy-saving agreements. Motiva's material efficiency unit will assist in the promotion of material efficiency in companies, public administration and households.

Studies will be carried out on which natural resources should, from the point of view of the environmental policy, be subjected to economic steering. At the same time, the feasibility of such steering and the potential and impacts of harmful subsidies will also be examined. In the construction sector, support will be directed at renovation and the promotion of building maintenance. The revision of legislation will involve the clarification of the organisation and responsibilities of waste advisory services, while at the same time it will also be examined whether municipalities could assume responsibility for more extensive advisory services covering sustainable consumption, which would be in addition to the existing waste advisory services. The need for and chances of extending the scope of the household deduction so that households would be encouraged to make more use of repair services will be examined.

2. More efficient recycling

Quality and environmental compliance criteria will be drawn up for certain recycled materials. Recycled materials will be given priority in public construction and the use of waste-based fertiliser products will be promoted in landscaping and in agriculture by providing advice on the matter.

Studies will be carried out on the revision of waste taxation. The aim is to eliminate the deficiencies of the existing tax scheme and to create a steering model that will best promote the objectives of waste management. Permit conditions and guidelines for individual waste categories will also be used to encourage the recycling of industrial waste flows. Studies will be carried out on how to decrease the amount of construction waste and how to increase recycling of this waste category. Incentive-based waste charges will be introduced to make the sorting of municipal waste more efficient.

3. Promoting the management of hazardous substances from the waste point of view

Measures will be taken to promote the replacement of hazardous substances causing harmful impacts during their waste phase with less hazardous alternatives. Advisory services covering the sorting of hazardous waste will be made more effective. Safe use of recycled materials will be guaranteed. Steps will be taken to make the quality assurance and market surveillance of waste-based fertiliser products more effective. Cooperation between different authorities in the remediation of contaminated sites will be put on a more

efficient basis, while at the same time, more funds will be allocated to supporting remediation projects.

4. Reducing the harmful climatic impacts of waste management

Changes to the Government decision on landfills will be drawn up so that the restrictions on the landfilling of biodegradable waste can be put on a concrete basis. There will be more use of waste as energy, while at the same time it will be ensured that materials suitable for recycling are not incinerated in substantial amounts. Permit-based steering will be used for ensuring an adequate energy efficiency of waste incineration and efficient recovery of landfill gas. Measures will be taken to promote the construction of biogas plants so that manure and certain other types of waste can be utilised.

5. Reducing the health and environmental impacts of waste management

The health and environmental impacts of waste treatment will be minimised by paying more attention to occupational safety and the use of best available technology. Measures will be taken to ensure high standards of waste management at existing and future mines and in connection with ore enrichment. Additional guidelines concerning animal-based by-products, ash generated by waste incineration and waste management during emergencies will be provided. Municipalities will ensure that the collection of sludge in rural areas will be put on an efficient basis and that the collection capacity is sufficient.

6. Improving and clarifying the organisation of waste management

Division of labour between the municipalities, producer responsibility organisations, generators of waste and private waste management companies and the organisation of waste advisory services will be examined in connection with the overall revision of the Waste Act. Regional waste plans will be given a more prominent role and steps will be taken to ensure that enough land is reserved during land use planning for waste management. The need for developing the management of waste covered by producer responsibility will be assessed.

7. Developing expertise in the waste sector

Material efficiency and business will be promoted through private and public research and development funding. The chances of launching a technology programme will be assessed. Measures will be taken to ensure sufficient funding for research and development of steering measures of material efficiency. Measures will be taken to provide SMEs with more services allowing them to improve their waste management and material efficiency. The process of improving waste statistics and classification will continue. A programme for monitoring the implementation of the objectives of the National Waste Plan and its most important steering measures will be drawn up and the monitoring indicators selected.

8. Putting transfrontier waste shipments on a safe and well-managed basis

International action will be taken to combat illegal waste shipments and further measures will be taken to expand cooperation between authorities in the border control of waste shipments. The work on the international harmonisation of waste classification and the interpretation of waste shipment legislation will be continued.

The Finnish National Waste Plan for 2016, please see the detailed aims for waste management and specific measures to reach the :

<http://www.ymparisto.fi/download.asp?contentid=102639&lan=en>

<http://www.ymparisto.fi/default.asp?node=22682&lan=en>

National Biowaste strategy

Finland has a national strategy to reduce the amounts of biodegradable waste going to landfill, approved in 2004 by the Government. The strategy aims to reduce emissions of methane - a greenhouse gas. The biowaste strategy aims to reduce the amounts of biodegradable municipal waste ending up in landfill sites over the period 2006-2016. In 2006 the amounts of biodegradable wastes being disposed of in landfills should correspond to less than 75% of the 1994 level, while by 2016 the quantity should only amount to less than 35% of the figure for the benchmark year. Measures taken to help reach targets set will include more recycling, the wider use of biological waste treatment methods such as composting, and the increased use of wastes in energy production.

Producer responsibility programmes

Finland has producer responsibility schemes in place for several waste streams. Producer responsibility for recovery and disposal of used tyres was introduced already in 1996. The EC Directive of Packaging and Packaging Waste has been integrated into the national legislation based on shared responsibility between packagers and municipalities, and came into force in 1997. A Government Decision on the collection and recovery of waste paper was adopted in 1998. The EC Directives on End-of-life Vehicles based on overall producer responsibility and Waste Electric and Electronic Equipment have been implemented in the national legislation in 2004. The producer responsibility for batteries and accumulators (Directive 2006/66/EC) has been transposed into the national legislation in 2008.

Municipal waste charges

According to the Waste Act the waste holder or the previous holder is liable for costs arising from the waste (with the exception of producer responsibility schemes).

Municipal waste charges cover costs related to the establishment, maintenance, decommissioning and clean-up of waste treatment facilities, and the transportation of wastes. Waste charges are also intended to reduce the amounts of waste generated and the consequent risks, and to encourage waste recovery. Many municipalities set lower charges for sorted wastes and for wastes that can be recovered than for unrecoverable mixed wastes.

Waste charges are payable by waste holders. Rates containing detailed specifications are set by municipalities. Charges include transportation and waste treatment fees. In 2007 the average municipal waste treatment fee was €102 per tonne of waste (incl. VAT), with rates varying locally between €76 and €156 per tonne. The treatment fee for biowaste averaged €68 per tonne.

The charges from individual customers are mainly based on the number of collection containers/bags. The waste treatment facilities charge the waste transport companies mainly by weighing the load.

Landfill tax

The tax is levied on landfills that are

- operated by a municipality or another operator on behalf of a municipality; or
- kept mainly for landfilling wastes produced by others than the landfill operator itself.

The tax was introduced in 1996 and was 90 FIM/ton (approx. 15 EUR/ton). The tax was raised to 23 EUR/ton for the period 2003-2004 and to 30 EUR/ton from 2005 onwards. The following wastes are excluded from the tax:

- contaminated soil,
- de-inking waste from waste paper cleaning,
- desulphurisation waste and fly ash from power plants, and
- waste that is recovered in landfill structures or constructions that are necessary for groundwork, use, closure or after-care of the landfill.

Also such landfills that receive only soil or rock waste are excluded from the tax.

A working group has recently examined the need to amend the landfill tax. Their proposal is circulated for comments for the moment.

Waste charges and taxes, please see:

<http://www.ymparisto.fi/default.asp?node=18450&lan=en>

Sewage sludge

Sewage sludge treatment and application is covered by several legal regulations and strategic plans. Recycling of sludge has been increased from 58 % in 1992 to 90 % in 2005.

National Biowaste Strategy (2004) sets recycling target of 90 % in 2010 in applying composted or anaerobically digested sewage sludge as soil improving agent. 90 % target was achieved in 2005. The new National Waste Plan for 2016 sets target that 90 % of all sludge generated in rural areas would be treated in wastewater treatment plants and the remaining 10 % in biogas plants at farms.

Pre-treatment and disposal of sewage sludge require a permit according to Environmental Protection Act and Waste Decree. Additionally, the Decree of Environmental Impact Assessment defines the types of plants on which the assessment has to be performed. The role of authorities and the content of the assessment process are specified in the decree. Waste treatment plants are covered by the regulations of the Decree as follows: Physical/chemical treatment plants with a capacity of at least 100 t/d and biological treatment plants with a capacity of at least 20 000 t/a are covered.

Government Decree on Nitrates restricts application of nitrogen containing fertilizers including sewage sludge and gives guidelines for storage of manure.

Directive (86/278/EEC) on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture has been implemented into national law by the Government Decision.

The production, marketing, application, transport, import and export of fertilizer products are regulated by the Fertiliser Product Law. Applications for these actions are permitted by the Finnish Food Safety Authority. The operator has to keep recorded data on its operations and implement a self monitoring program. Ministry of Agriculture and Forestry Decree on fertiliser products and Ministry of Agriculture and Forestry Decree on the operations concerning fertiliser products and on their supervision from 2007 are complementing the Fertiliser product law.

Government decision on construction waste

The purpose of the Decision is to reduce the quantity and harmfulness of construction waste and increase its recovery. The Decision applies to construction planning and to construction and waste deriving from it.

It does not apply to construction sites where the quantity of resulting construction waste other than soil, rock and dredging waste is not more than 5 tonnes, or where the quantity of soil, rock and dredging waste deriving from it is not more than 800 tonnes. Similarly, it does not apply to packaging waste and contaminated soil waste.

The main implementor has to, in cooperation with the planners, contractors and other parties to the construction project, plan and implement the construction in accordance with the Waste Act, taking particular care to:

1. Minimize the generation of construction waste and separate useable objects and substances from it, reusing them as far as possible;
2. Use construction materials sparingly, replacing them as far as possible with waste suitable for construction purposes; and
3. Ensure that construction waste generated does not result in hazard or harm to health or the environment, or does not significantly hamper or complicate the organization of waste management.

Construction must be so planned and implemented and the construction waste so collected and transported that the recoverable waste and the following waste types are kept separate, or are separated from each other and other construction waste:

1. Concrete, brick, mineral tile, ceramic and gypsum wastes;
2. Non-impregnated wood wastes;
3. Metal wastes; and
4. Soil, rock and dredging wastes.

The construction waste holder must see to it that the construction waste is recovered if this is technically feasible and does not entail excessive additional cost compared with waste management organized otherwise.

Government Decree on the use of certain waste materials in soil construction (591/2006):

A permit or notification is required for the use of mineral wastes by establishments and undertakings in earth constructions. Notification procedure, which can substitute the permit procedure, concerns the recovery of certain wastes in earth construction (crushed concrete, fly and bottom ashes from power plants using coal, peat or wood). The aim of the notification procedure is to increase the use of certain waste materials in soil construction.

IV Radioactive wastes and their environmentally sound management (safe storage, transportation and disposal of radioactive waste)

Since per legislation spent fuel is considered as radioactive waste in Finland, the two nuclear power plants, the Loviisa and Olkiluoto NPPs, are the main generators of radioactive waste. At Olkiluoto and Loviisa sites there are interim storages for spent fuel as well as underground final repositories for medium and low level radioactive wastes. Disposal of low and intermediate level waste began in 1992 at Olkiluoto site and in 1997 at Loviisa site. The decommissioning waste is planned to be disposed in the existing repositories. Construction and operating licences have been granted to the operators by the Government.

Spent nuclear fuel from the Finnish NPPs is stored at the power plant sites until it will be disposed of. Spent nuclear fuel will be disposed of in tunnels to be situated at a depth of approximately 500 metres. The repository for spent nuclear fuel is planned to start operation in 2020's at Olkiluoto site. The decision-in-principle on geological disposal was made by the Government in 2000 and the decision was ratified by the Parliament in 2001.

V Case studies / good practices:

Environmental impacts of material flows caused by the Finnish economy (ENVIMAT)

The three year research project created a so called hybrid model to assess the relationships between environmental impacts and economic effects caused by the use of natural resources in Finland. Please see our response to the theme sustainable production and consumption.

More information: <http://www.ymparisto.fi/default.asp?contentid=317660&lan=en>

Material efficiency centre

A new material efficiency centre for Finland is part of Finland's programme to promote sustainable production and consumption and part of the national waste plan. The Ministry of the Environment and the Ministry of Employment and Economy has set up a material efficiency centre, which will provide services to business and advice for consumers and public sector organisations on various ways to improve material efficiency. More information http://www.motiva.fi/en/areas_of_operation/material_efficiency .

Finland applies **deposit-refund schemes for beverage-containers**, both refillable (re-use) and non-refillable (for recycling). It includes glass bottles, aluminium cans and plastic (PET) bottles, as well as crates. <in addition, a tax applies for non-refillable beverage containers for which there is no approved recycling scheme in place.

Finland implements **tax on lubricating oil**, which is paid by producers and importers. The prices of lubrication oils include oil waste charges of 5.75 cents per kilo. The income from

from these charges is used to cover the costs of managing oil wastes and cleaning up soils and groundwater contaminated with oil.

Waste prevention in the environmental permit procedure- guidebook 2004. The guide contains information about possibilities for preventing the generation of industrial waste with the aid of the environmental permit procedure. In the guide, waste prevention refers to activities that decrease the amount of waste or the hazardousness of the waste. Waste prevention concerns can be taken into account in each phase of the permit procedure. In the application phase, it is essential to collect all information needed. Before the permit-granting authority issues a decision, it can negotiate with the applicant about the possibilities for preventing the generation of waste. The permit decision can include conditions dealing with waste prevention. Conditions requiring monitoring can be evaluated with metrics for gauging waste prevention progress. The guide deals also with field-specific information related to waste prevention in the production of wooden products, in the textile industry, in electroplating, and in the food industry. The guide has been planned as a source of information and encouragement for permit granting authorities.

Tuotewiki-project:

- A tool to connect producers with consumers; a "Wikipedia" or internet-based encyclopedia for tracing the ecological footprint of products used daily.
- Anyone can easily add and check information on Tuotewiki. Producers, users, consumers – all of us - can become Tuotewiki content producers. Even a slight revision or a hint of information from the field is valuable and enlarges our understanding of the world and the products that we make and we use. In order to move towards a carbon-neutral planet, everyone, especially in the rich North, have to be able to change their ways of life and their consuming habits for more sustainable ones. For this change to take place we need information and tools. Tuotewiki is an easy way to discuss and share knowledge. It is an open database for everyone and for many different kinds of information about products. Although the main language of Tuotewiki is Finnish, there exists a few example pages in English as well'
http://www.tuotewiki.fi/wiki/Tuotewiki:Tuotewiki_%28in_English%29
- The system is set and maintained by Dodo, which is an environmental organisation (<http://www.dodo.org/english/>).
- Tuotewiki-project is carried out mostly by volunteers. In the steering group of the project, there are representatives from ia. the Ministry of the Environment, The Finnish Standards Association SFS, Finland Futures Research Centre, the Finnish Grocery Trade Association, VTT Technical Research Centre of Finland etc.
- The yearly budget is 5000 EUR. The project gets financial support ia. from the Ministry for Foreign Affairs/development area policy.
- Tuotewiki has been in use since 2007.

An information package drawn-up for enterprises in order to guide them to act materials efficiently in their operation:

- The publication is in Finnish 'Materiaalitehokas toiminta säästää luontoa ja rahaa. Elinkeinoelämän keskusliitto EK, 2008', published by The Confederation of Finnish Industries EK in 2008.

http://www.ek.fi/www/fi/tutkimukset_julkaisut/2008/materiaalitehokkuus_WEB.pdf

- The publication is an information package for enterprises explaining the term 'materials efficiency', its legal basis, information available, etc. It shows some ideas and several examples on how to introduce materials efficiency in practise:

Outokumpu Stainless Steel plant in Tornio aims at minimizing negative impacts of its operations on the surrounding environment as much as economically and technically possible (http://www.outokumpu.com/pages/Page_37209.aspx). Stainless steel itself is recyclable; almost all environmental impacts arise during the production, manufacturing and reprocessing stages of the material's lifecycle. The company uses recycled steel as a raw material to save natural resources. One of the side-products generated by the steel industry is slag. In order to reduce the amount of wastes, slag is turned into a product. Steel slag products are used as construction materials in buildings and roads. By developing a method to transforming slag into a product the amount of wastes deposited at landfills has diminished notably.

The agriculture and forestry machine manufacturer **John Deere Forestry Oy** has developed a harvesting machine that gathers up the logging wastes and slashes, feeds them into a baling machine and produces compressed 'logs of twigs'. Due to their compressed form they don't rot easily, and their storage in the woods can be longer than in conventional harvesting. This also means less losses of material in storing.

Stora Enso is an integrated paper, packaging and forest products company <http://www.storaenso.com/Documents/annual-report-2007-eng.pdf> .

The company is committed to sustainability. A unique method developed by Stora Enso and Chematur Engineering makes it possible to reuse the fillers, which are part of the residues from recover of used paper. Instead of being a problem and sent to landfills, fillers now have become valuable raw material for new paper

<http://www.storaenso.com/research/production-excellence/recycling/Pages/more-recycling-and-less-waste-to-landfills.aspx> .

Kemira's production plant for titanium dioxide pigments in Pori has developed a new technology to make raw material and new products from material previously discarded. (<http://www.kemira.com/en/responsibility/environmentalresponsibility/pages/default.aspx>) Ferrosulphate is a by-product of titanium dioxide production. Its uses include application in water treatment and the cement industry, fertilizers, soil enrichment etc.

Kenno Tech Oy (<http://www.kennotech.fi/en.php?k=10785>) is a company that has developed a method for reducing use of steel in supporting structures. By this sandwich-structure laser welding method developed up to 50 % weight savings is achieved. The method is fast and enables high quality joining of thin sheets. Compared to traditional welded structures, sandwich structures have ia. the following benefits: steel savings, weight saving (in moving applications enables lower energy consumption, provides easier assembly etc.), lower weight may also make derived benefits possible (such as lighter support structures or operating mechanisms), high stiffness and low thickness. All-metal sandwich structures are recyclable.

Durat (<http://www.durat.com/>) is a privately owned Finnish company. The leading principle of it is to unite design and recycling. The company collects plastic waste material in Scandinavia and turns it into high quality DURAT products using modern technology and flexible moulding systems. Continuous development work is done to expand recycling of plastic into new innovative products. New designs and patterns are created with possibilities of recycling. DURAT Design collection contains over 40 standard products for bathrooms. Architects and designers can also create their own customized surfaces for projects using DURAT sheet material, DURAT sinks and the DURAT colour palette. DURAT is a solid polyester based material used for custom made surfaces in public and private interiors. It contains recycled plastics and is itself 100% recyclable. DURAT is extremely durable and can be renewed by slight sanding. The material is very resistant to wear, humidity, and various kinds of chemicals.

Powerflute Oyj is a company which, through its wholly-owned subsidiary Savon Sellu Oy, operates a semi-chemical paper mill in Kuopio. It manufactures a specialised, high-quality grade of fluting called Nordic semi-chem fluting ("Powerflute™"). The fluting is made primarily from birch wood sourced from Finland and Russia and is used mainly to manufacture boxes for fresh and frozen produce. Other applications include packaging of electrical goods and agricultural products and heavy duty packaging for automotive products. Powerflute packaging products persevere with humid conditions keeping their inflexibility and strength properties. Therefore the packaging are of high-standard and durable, and they can be made lighter with less material.

<http://www.powerflute.fi/pages/home/corporate-information/environment.php> .

The Finnish company **Nokia** (<http://www.nokia.com/A41041089>) aims to minimise the environmental impact of their products throughout their operations, beginning with the extraction of raw materials and ending with recycling, treatment of waste, and recovery of used materials. To achieve this is by better product design, close control of the production processes, and greater material reuse and recycling. The environmental efforts focus on:

- Substance management. They work closely with their suppliers and require full declaration of the substances they use in their devices. Their work is based on the precautionary principle and they aim at continuously reducing the amount of substances of concern. They also explore the opportunities for using new, more environmentally friendly materials, such as bio plastics or recycled metals and plastics.
- Energy efficiency. They make sure their devices use as little energy as possible. They also work to reduce the energy consumption of their operations, and agree on energy efficiency targets with their key suppliers.
- Take back and recycling. They want to increase consumer awareness of recycling, offer superior recycling in all markets and promote the recycling of used devices through specific initiatives and campaigns. The backbone of Nokia's take-back program are the collection points of used devices in 5000 Nokia care centres in 85 countries.

Since 2001 Nokia has provided eco declarations of all its products. The Eco Declaration provides basic information on the environmental attributes of the product covering material use, energy efficiency, packaging, disassembly and recycling. Nokia works to minimise its environmental impact by thinking about the kind of material they use in packaging, by reducing the volume of material they use and by considering what happens to it after it's no longer needed. The weight and size of packaging affects not only materials but the

energy required to transport and store the products. The company has saved energy in logistics by reducing the amount of printed material inside the sales packages. Examples of innovative packaging include: Letterbox and Small Compact <http://www.nokia.com/A41039025> . In 2007, Nokia saved 15 000 tonnes of material by using smaller packaging. This also saved water. Over the years Nokia has been replacing plastic with paper-based material. They're also using more recycled packaging material. The Nokia Evolve 3110 pack in Europe uses 60 percent recycled content. Packaging is an area where savings are not only for the environment, but also for the company. From February 2006, when they first created smaller packaging until the end of 2007 they had shipped 250 million phones using this new compact packaging. This resulted in 5000 fewer trucks being needed to distribute Nokia's products around the world and created financial savings of 100 million euros.

Valtatie Oy is an asphalt construction company, which uses a technology that recycles the torn down old asphalt material (<http://cat.teho.net/software/valtatie/e-site/recycling/>, in Finnish). The technology is called Remix. By using the new technology, the amounts of asphalt wastes that were earlier landfilled can now be recycled in the construction process. This also diminishes the need for new material. In the process, the torn down asphalt can either be used at the site it was generated or making recycled asphalt at a station. In the Remix- technology the torn down asphalt is heated up, milled, transferred to a mixer to be mixed with new material, and spread back and compacted on the road.

In demolishing projects, the construction companies Skanska (<http://www.skanska.fi/fi/Utility-menu/In-English/>) and NCC (http://ncc.navigo.fi/en_GB/) have succeeded in diminishing construction wastes to be landfilled by thorough preplanning at the site, accurate operations at the site and regular monitoring of the operations. An example of a successful demolishing project took place in Espoo where a large commercial center was demolished. Almost all of the demolishing wastes generated were recycled. 75% of the concrete waste could be recycled at the site as soil construction material. The façade elements, construction bars and fluorescent lamps were recycled. 10% of the wastes generated were recycled as energy. Such wastes were ia. roofing felts, insulating materials, non-impregnated wooden materials, and electrical motors. Wastes that couldn't be recycled were ia. hazardous wastes (asbestos and PCB wastes) and mixed wastes.