Natural resources in Switzerland

environment

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Raw materials from waste

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Recycling saves resources: production of high-grade steel from scrap metal at a Swiss steel factory in Emmenbrücke (Lucerne).
Photo: FOEN / AURA, E. Ammon

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Waste collection point in Lugano (Ticino): the separate collection of recyclables is a major prerequisite for efficient recycling.
Photo: AURA

Waste management policy on track

Thanks to the implementation of numerous new environmental provisions, since the mid-1980s Switzerland has achieved a transition from waste disposal to environment-friendly recycling and waste treatment. One of the main success factors here is the ban on the disposal of untreated waste in landfills. Due to the shortage of suitable sites for landfills in our densely populated country, and in response to the negative impacts of direct disposal of mixed waste in landfills, the relevant authorities focused on combustion technologies at an early stage. Previous problems such as the high levels of pollutant emissions from waste incineration plants have meanwhile been largely rectified with the aid of advanced technologies. While elsewhere it will be necessary to treat polluted seepage water and landfill gases for many years to come, waste incineration plants in Switzerland now function as efficient power plants that produce clean heat and electricity. Around half this energy comes from renewable resources that can no longer be used for other purposes.

Following the transition to a systematic management of resources, Switzerland is now taking the next major step – one which the waste management industry will not be able to take on its own. To significantly reduce the environmental impacts caused by the immense flows of goods, it will not suffice for ecological optimisation to be implemented only at the end of the production chain. To achieve sustainable development, it is necessary to ensure that goods and services are made more environmentally and socially compatible throughout their entire useful life. This commences with the extraction of raw materials and includes all relevant processes from refinement and manufacture through to utilisation and disposal.

The stronger focus by trade and industry on energy-efficient products that protect natural resources to the greatest possible extent has to go hand in hand with less wasteful consumer behaviour and a more conscious lifestyle that in its turn is oriented on the objective of sustainability.

Gérard Poffet, Vice Director, FOEN

www.environment-switzerland/mag2009-3-01

The transition from dis

Measured in terms of pollution caused throughout the entire life cycle of goods and services, waste disposal in Switzerland is only of minor ecological relevance today. To improve our ecological footprint still further, it is therefore essential to focus more strongly on product design and to promote recycling, explains Hans-Peter Fahrni, head of the FOEN Waste and Raw Materials Division, in an interview with "environment".

environment: How has the Environmental Protection Act influenced the ecological impact of waste management in Switzerland?

Hans-Peter Fahrni: Prior to the introduction of the Environmental Protection Act, municipal waste incineration plants, landfills and a number of poorly conceived recycling plants produced high levels of emissions that polluted the air, the soil and groundwater. In the meantime, we have achieved progress in most areas, and the environmental impacts of waste treatment and disposal have decreased sharply. Thus, for most pollutants, emissions from modern waste-to-energy plants barely reach one-tenth of the limit values specified in the Ordinance on Air Pollution Control. Thanks to the high technical standard of waste disposal plants, they contribute little to the overall pollution of the environment. However, old landfills are still a source of significant pollution. Numerous sites still need to be cleaned up since they are now contaminating groundwater and rivers. For example, polychlorinated biphenyls (PCBs) are escaping from the La Pila landfill (near Hauterive, Fribourg) into the Sarine river as a consequence of the disposal of condensers there many years ago.

In Kölliken (Aargau) and Bonfol (Jura), entire hazardous waste sites are now being dug up and undergoing remediation at a cost of several million Swiss francs. Three decades ago, waste was deposited at these sites in accordance with the legal provisions applicable at the time. Do we now have to anticipate that the landfills currently in use will also have to be emptied in 30 years' time on ecological grounds?

No, because we have meanwhile greatly reduced the risks to the environment. Waste destined for landfills is analysed for specified chemical parameters in order to ensure that material containing toxic, reactive and readily soluble substances is not deposited. In Bonfol and Kölliken, the requirements that applied at that time to landfill sites were inadequate and those regarding the quality of hazardous waste were almost non-existent. Today, the main problems to be overcome in such sites concern organic chemical waste such as solvents, distillation residues and paint or dye sludges. These contain harmful, and in many cases carcinogenic, substances that are persistent and contaminate the groundwater. Nowadays, such waste is always incinerated, either in waste-to-energy plants or, in the case of particularly problematic substances, in ad hoc high-temperature incinerators. At temperatures up to 800°C all organic-chemical pollutants are destroyed and leave only harmless inorganic substances. Switzerland has also adopted this strategy for the disposal of municipal waste. Since 2000, no combustible waste may be deposited in landfills; instead it is incinerated in waste-to-energy plants. The resulting bottom ash is far less problematic in landfills than mixed waste. In addition, progress has been made in the area of landfill technology, for example with respect to improved sealing methods.

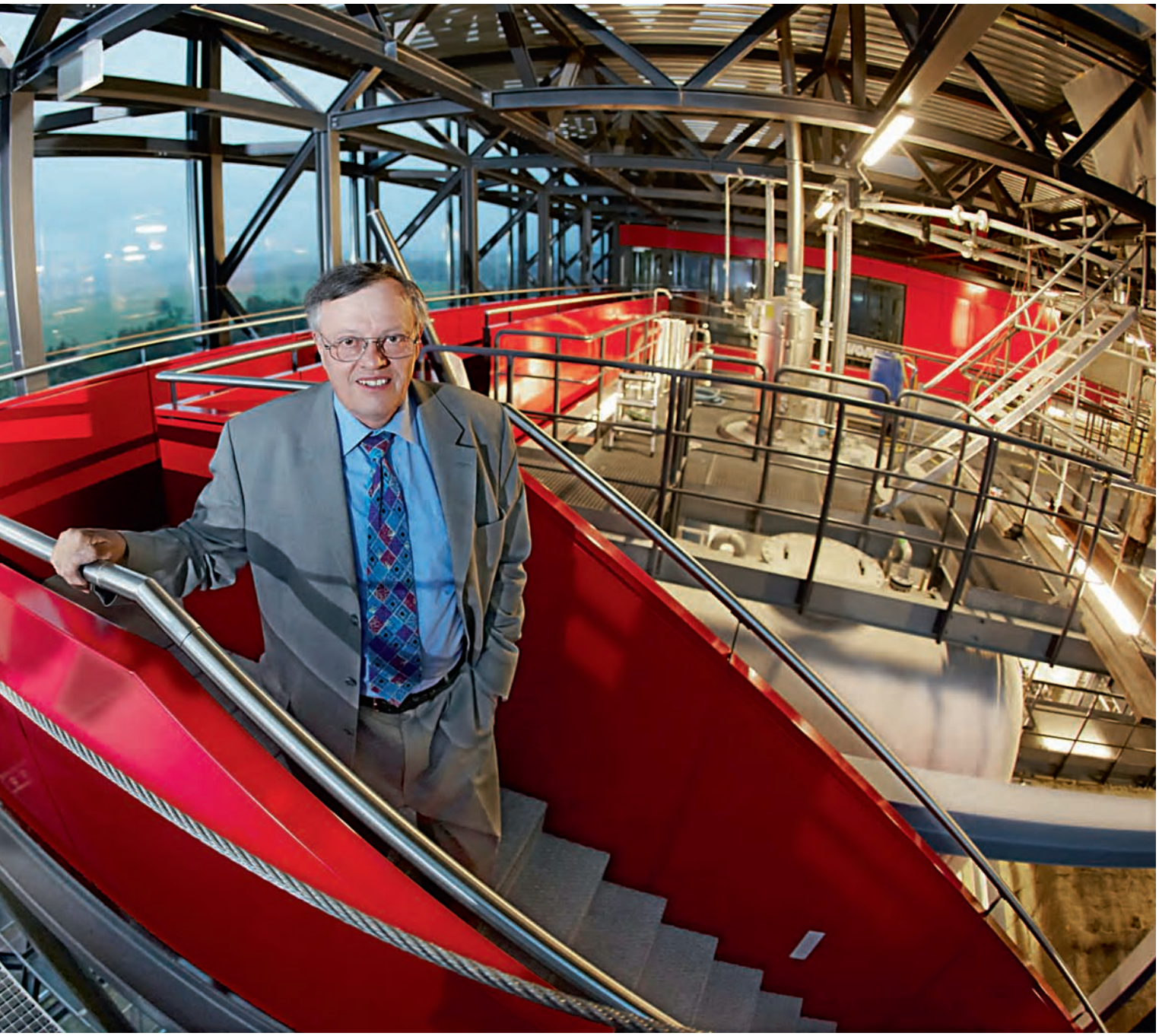
Does this mean we will not need to use landfills in the future? Will it be possible to recycle or incinerate all waste material?

The ban on the disposal of combustible waste in landfills and the increased recycling of construction waste have already greatly reduced the quantities of deposited material. Thanks to the recently developed dry removal of bottom ash it will be possible to also recover small pieces of metal scrap from waste incineration slag. Even if we could extract the mineral fraction from the slag, there will still be residue that needs to be disposed of in landfills. Construction waste also contains materials that cannot be readily recycled. Bricks, for example, are not frost-resistant when they are broken and are therefore unsuitable for reuse. And many components made of asbestos cement have to be taken out of circulation completely after a building has been demolished since asbestos fibres are a serious health

posal to recycling

Hans-Peter Fahrni, head of the FOEN Waste and Raw Materials Division, at the flue gas purification facility of the waste incineration plant in Thun. Waste is now processed in efficient high-tech plants, so the burden on the environment is very low.

Photo: FOEN/AURA, E. Ammon



hazard. So there are limits when it comes to the recycling of materials.
Materials resulting from the remediation of contaminated sites account for a large proportion of waste in landfills. These include soils polluted with lead and antimony from bullets in shooting ranges, which are often located in groundwater protection zones. This material has to be removed and processed. Since the excavated material still contains residue of heavy metals after it has been treated, it needs to be disposed of at a location where there is no risk of contamination of groundwater. We will therefore still need landfills in the future.

A few years ago, a Dutch company excavated 108 000 tonnes of slag deposited by the waste-to-energy plant in Basel at the Elbisgraben landfill site near Liestal (canton of Baselland), and extracted 4300 tonnes of metals. Could our landfills be the raw materials mines of the future?

This applies to a greater extent to older landfills than to new ones, since metals contained in slag are now extracted as a matter of routine. However, the largest quantities of raw materials are not found in landfills but in buildings, in infrastructure for traffic and energy, in industrial plants and equipment, in cars and various other goods. It is estimated that in the USA around half the volume of reusable copper is to be found in infrastructure such as power cables and telephone lines, engines, etc.

And how can we recover these materials?

As long as the infrastructure is still in use, the raw materials are immobilised. The decisive factor here is to ensure that they are not lost after the facility or product has reached the end of its useful life. For example, after demolition of a building, copper wires should not be left in the ground. The steel used for reinforcing concrete can also be readily recycled. To make efficient use of these materials, knowledge about the processed quantities of raw materials is required, and in order to recover these resources we need suitable processes and processing facilities. We have to move away from a disposal concept to a recycling one.

The prices of raw materials fell sharply at the end of 2008 due to the global economic crisis. How will this affect the recycling of resources?

In Switzerland, around 50 per cent of household waste and a large proportion of construction waste are now recycled. This is done not only for economic reasons, but also and above all on ecological grounds. For example, the production of metals from ores is extremely energy-intensive, causes high levels of pollution and is often carried out under socially questionable conditions. The daily fluctuations in metals prices on the commodity markets do not adequately reflect these production conditions, since the burden of related follow-on costs is normally passed on to the community.

Since ecologically speaking we want to do the right thing irrespective of market trends, we need legislation that ensures that scrap metal, paper, glass, PET and batteries are still recycled even when prices are less attractive.

“Since ecologically speaking we want to do the right thing irrespective of market trends, we need legislation that ensures that scrap metal, paper, glass, PET and batteries are still recycled even when prices are less attractive.”

When does recycling no longer make sense from the government’s point of view?

If a high-grade plastic like PET is used in large quantities, is clearly recognisable for consumers and can be sorted and processed without undue effort, then recycling makes good sense. However, plastic items in household waste are often soiled, are made from a broad variety of types of plastics, or are bound to other materials such as paper, cardboard or aluminium. All this makes sorting and processing costly. Here the FOEN favours treatment in waste-to-energy plants instead of separation, which would cost many times more. In Germany, where plastics are also separated from other waste, most of the sorted material is ultimately used as an alternative fuel in power plants and blast furnaces. Separate collection of these waste fractions were introduced many years ago in Germany, since at that time large quantities of combustible municipal waste were still ending up in landfills. Switzerland, too, can make use of the high calorific value of plastic packaging in its waste-to-energy plants, while avoiding costly separation and collection processes.

Thermal processing alone leads to losses of valuable materials. Since the use of sewage sludge and processed animal waste for fertilisation purposes and

as animal feed is no longer permitted, they end up in cement factories and the phosphorus they contain is lost. What is Switzerland's strategy here?

Phosphate mines with high-quality phosphates are fairly scarce. The remaining deposits of phosphates often contain harmful heavy metals such as cadmium. In order to utilise the phosphates as fertiliser without negative effects for the soil, these metals have to be removed. It is therefore clearly important to use phosphates in a provident way. Our goal is to process waste that is rich in phosphorus in order to minimise the risks associated with BSE and micro-pollutants, but without loss of nutrients. This calls for special equipment that thermally processes the residual phosphate-containing waste separately, e.g. pyrolysis facilities in cement factories or special incinerators for sewage sludge, animal meal and bone meal. What is left is phosphorus-rich ash that can be turned into fertiliser. Here we are talking about steps towards ecological optimisation, which due to pressure of time we were unable to realise in the initial search for disposal solutions when the direct use of the cited types of waste was banned for public health reasons.

Why are quantities of waste still increasing despite the long-since propagated uncoupling of economic output from consumption of resources?

In many market segments (e.g. electronic devices), the circulation of goods is characterised by a short service life. On average, we use a mobile phone for 12 to 18 months, and most people replace their computer after 4 years in order to ensure that the latest software will function properly. The trend in monitors, MP3 players and digital storage media shows that devices are becoming ever lighter, consuming less electricity and require ever fewer materials. Miniaturisation may be positive for the environment, but it also results in sharply falling prices, which in turn encourage consumption and consequently offset or even reverse some of the achieved gains in terms of ecological efficiency.

Can legal provisions governing waste disposal influence the consumption of resources for the production of goods?

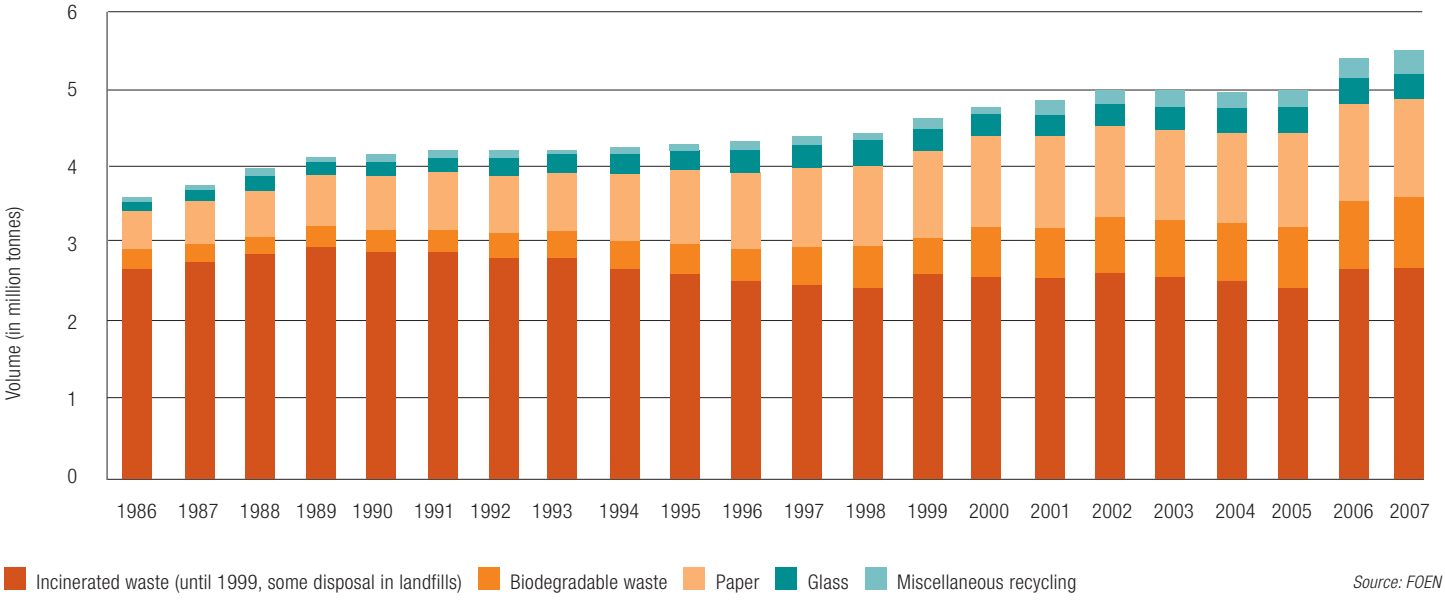
When compared to the environmental pollution caused over the full service life of a product, disposal in modern waste treatment plants now has little relevance. As a rule, it is the extraction of raw materials necessary to produce the goods that causes the highest level of pollution, while their further processing is of less relevance. The period of use primarily becomes relevant if a product requires energy for its operation, e.g. electricity or fuel. From the point of view of ecological optimisation, we therefore consider not only the end of the chain, but also (and increasingly) all phases in the useful life of products and services.

Can a government stipulate the use of ecological products only?

Little can be achieved solely through legal provisions and product requirements. However, an appropriate procurement policy in the public

Constant enhancement of ecological efficiency: since the mid-1980s, the quantities of recycled and processed waste have risen sharply. At that time, some municipal waste was deposited in landfills without being treated, whereas today it is all first incinerated in waste-to-energy plants.

CHRONOLOGICAL DEVELOPMENT OF QUANTITIES OF MUNICIPAL WASTE FROM 1986 TO 2007



Source: FOEN

sector can certainly have a strong leverage effect. With a market volume of several hundred billion euros per annum in Europe alone, governments can pave the way for environment-friendly and socially acceptable products.

The concept of sustainable production and consumption is also of interest in the economy. Whether out of conviction or for image reasons, numerous companies now want to make their purchases on the basis of ecological and social criteria. Here, major distributors – with whom we are in close contact – can play an important role.

In the view of the FOEN, providing consumers and clients with adequate information is also a decisive factor. When making purchases, people need to know which ecological benefits a given product offers so that they can make their choice consciously. Certificates of origin, information about transport (e.g. air freight), as well as ecological and social labels such as the various "bio" awards, the Forest Stewardship Council (FSC) label for timber products and the Max Havelaar label, can be useful indicators. Above all, it is essential to educate and win over consumers.

In your view, what are the main challenges facing future state regulation on waste management?

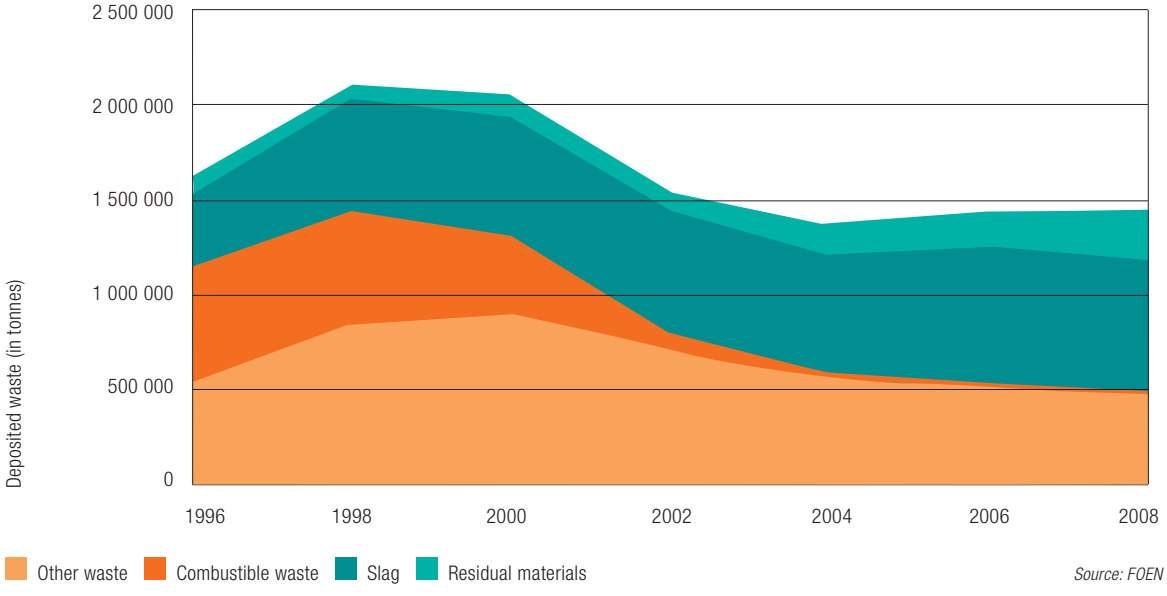
Waste management must never again be primarily based on the cheapest means of disposal. Otherwise we could find ourselves facing the same kinds of threats to the environment as in the past. We have to maintain high technical and organisational standards over the long term, and ensure that the same rules apply to all market participants.

Further ecological optimisation can be achieved through greater energy efficiency in waste-to-energy plants and increased extraction of scarce raw materials contained in waste. To achieve these objectives, collection points must be conveniently located and the costs of waste management should not be too high, otherwise the risk of environmental pollution will increase due to more people resorting to illegal means of disposal. Closer co-operation between municipalities could result in greater efficiency and thus cut costs.

Interview: Beat Jordi

www.environment-switzerland.ch/mag2009-3-02

WASTE DEPOSITED IN BIOACTIVE LANDFILLS AND IN LANDFILLS FOR STABILISED RESIDUES FROM 1996 TO 2008



Source: FOEN

As a consequence of the ban on combustible waste, no more municipal waste has been landfilled directly since the beginning of 2000. This has led to a sharp decrease in the amount of residues landfilled.

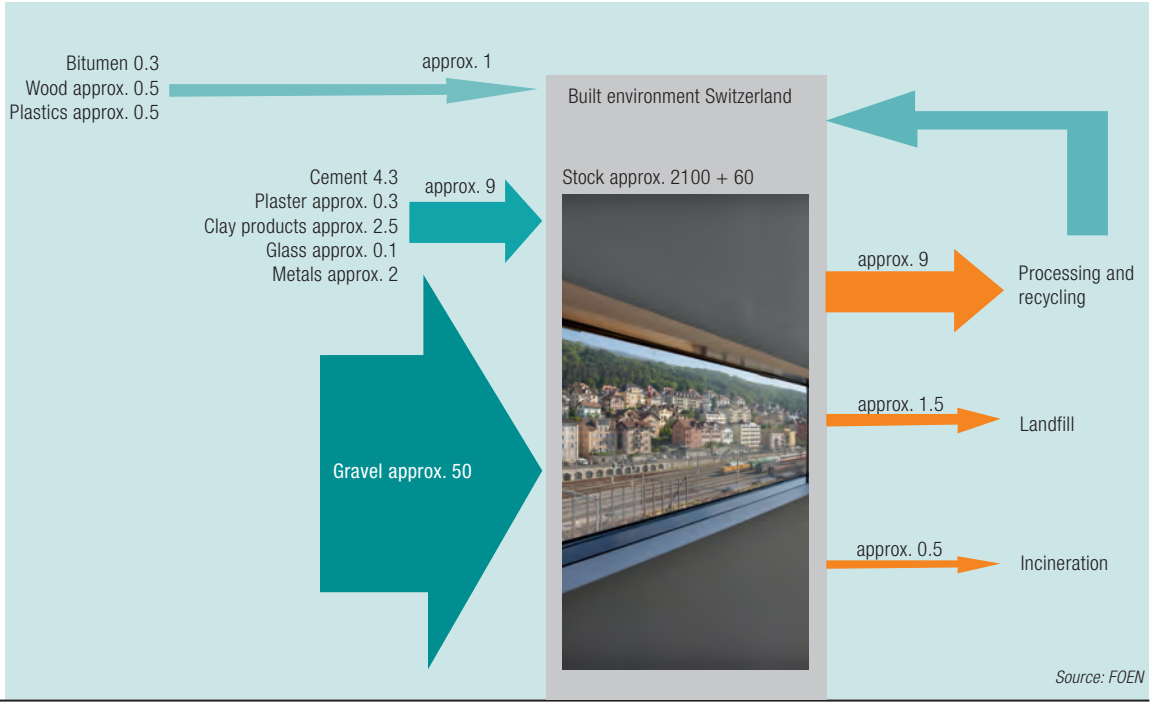
The built environment is our largest reserve of raw materials

The construction, use and demolition of buildings and other man-made structures account for more than half the country's energy requirements. They represent an immense reserve of raw materials, and their potential is still inadequately exploited today. But there is more to sustainable architecture than just the recovery of building materials.

Since 2004, Neuchâtel boasts a new architectural landmark, namely the Federal Statistical Office (FSO), situated directly adjacent to the town's railway station. This filigree glass and steel high-rise has redefined the urban landscape of the southern foothills of the Jura. The tower of the FSO is joined to the lower, elongated office building via a service bridge. This pioneering project, which was completed in 1998, has set new standards in sustainable architecture throughout the country. It paved the way for the sustainable redevelopment of the area around the railway station, aptly renamed "Ecoparc", which is now nearing completion.

Thanks to the use of unconventional technology, the energy consumption of the new FSO complex is only a fraction of that normally encountered in office blocks of similar size and function: it requires less than one-fifth of the average consumption for office buildings cited in a 1999 study by the Swiss Federal Office of Energy. As a result of its numerous special features, in

ESTIMATED MATERIAL FLOWS IN CONSTRUCTION (2005), excluding excavated material, in million tonnes



Careful management of the immense quantities of raw materials from disused buildings and other man-made structures can make a valuable contribution towards the protection of resources.

2006 the tower was the first new construction in Switzerland to be awarded the "Minergie ECO" label, which recognises energy-efficient, ecological and healthy construction methods.

Wherever possible, the architects (Büro Bauart) utilised renewable resources as building materials. The elegant north face is literally a façade: behind the steel and glass, cemented wood panels form a comprehensive support structure. Thus 70 per cent of the weatherproof north façade consists of wood, and the material used for insulation is recycled paper (Isofloc).

But sustainable architecture goes much further than the careful selection of renewable and ecological building materials. To achieve a favourable overall energy balance for the FSO complex, it is essential to ensure that optimal public transport is available so the 550 employees of the FSO can get to work without having to use their car.

Site steeped in history. The "Ecoparc" complex is being developed on a site that is steeped in history. In order to create space for the construction of the railway station in the middle of the 19th century, an imposing terrace had to be hewn out of the limestone slope. In the mid-1980s, an area of attractive development land that was no longer required by Swiss Federal Railways (SBB) was freed up, and its ready accessibility made it highly suitable for lively public use.

"In my view, sustainability also means integrating a building into its surroundings so that their particular character and history remain visible," explains Büro Bauart architect Willi Frei. The entrance located above a high support wall is supported by pillars, and the view through the columned hall extends to the steep contours of the slope. "This means we can clearly see that the plateau interrupts the natural topography and was man-made," says Willi Frei.

Shaping the landscape. Robin Quartier from the FOEN's Urban and Construction Waste Section also firmly believes that sustainable construction has to begin well before the choice of building materials or energy-efficient design. "One of the main challenges

The new administration complex of the Swiss Federal Statistical Office (FSO), located next to the railway station in Neuchâtel, is a prime example of sustainable architecture. Its ideal location with direct access to public transport services, the choice of building materials and use of innovative technologies with low energy consumption are all intended to minimise environmental impacts throughout its entire useful life. *Photos: FOEN/AURA E. Ammon*

facing us today is the lack of space for the disposal of excavated material and building rubble." Here the figures speak for themselves: "For a single-family house with a basement and an excavation depth of three metres, around 300 cubic metres of excavated material are produced, and 30 truckloads are required for its removal."

The reuse of the excavated material from the site of the FSO complex also posed a major problem. Efforts were made well in advance to find ways to reuse the stony material in the immediate vicinity and thus avoid the need to transport it over lengthy distances. "We studied a variety of options, but in the end it was found that transport by road was the best solution in ecological terms since we were able to deliver the material to a nearby quarry," explains Willi Frei.

If the excavated material is not suitable for turning into gravel, creativity is required when it comes to landscaping. As Robin Quartier points out, "Carefully planned landscaping concepts can create space for attractive biotopes or leisure-time activities. For example, playgrounds do not always have to be flat." Neuchâtel, too, can boast of past examples of creative landscaping using excavated material. The rocks that were removed for the construction of the railway station in the 19th century were used for the purpose of reclaiming the lakeside Beaux-Arts quarter.

Creative reuse of mineral waste. A great deal of mineral waste also results when buildings are demolished – around 10 million tonnes a year in Switzerland. The capacities for disposal in landfills have almost been exhausted and from now on need to be reserved for non-recyclable material.

"Building materials are a valuable resource that we need to use economically," says Robin Quartier. This applies not only to gravel and sand extracted from natural sites, but also to building materials already in use. Roads, infrastructure facilities and buildings effectively represent a reserve stock of building materials with an accumulated volume of around 2.1 billion tonnes. These reserves are constantly increasing – for example, since 1990 the annual rate of increase has averaged around 60 million tonnes. In per capita terms the net growth is equivalent to around 8 tonnes per person, whereas only around 2 tonnes per capita are removed from the stocks. "In Switzerland, gravel is by far the most commonly used raw material," notes Robin Quartier. But crushed concrete can sometimes be a suitable alternative. While recycling mineral demolition waste makes sound ecological sense, its drawback is that it is often not economically viable. "Unfortunately the low price of gravel means that recycled building materials are barely competitive," says Robin Quartier.

In Neuchâtel, the developers of the FSO complex adopted a creative approach to reusing building rubble right from the start. Instead of simply demolishing the existing SBB structures, they carefully removed all the bricks, beams and girders and offered them free of charge to anyone interested in taking them. In this way, around 80 per cent of the rubble was reused.

Choosing efficient solutions. For the natural ventilation of the new FSO complex, the designers drew inspiration from methods used in India and Pakistan for generating air flow through entire cities (e.g. Hyderabad) by installing ventilation shafts in carefully selected locations and constructing optimally designed courtyards. Cool air flows through the FSO complex via pivot windows and special wind vanes mounted on the roof and equipped with slats positioned to catch the wind. Air is extracted from the building via corridors and vertical shafts: thanks to the resulting chimney effect, the more than four-storey high interior courtyards ensure that the air is evacuated upwards. The entire building thus functions as a ventilation shaft. Büro Bauart also exploited the principle of heat transfer: here, the computer centre which produces waste heat is cooled by a current of air that then flows almost without losses via the corridors to heat the cooler rooms in the building. "The corridors and halls function as a kind of heating system. The advantage of this method is that, unlike standard ventilation channels in walls, these corridors are always clean," explains Willi Frei. The architects also came up with some good solutions with respect to energy supply. Solar collectors with a total

Roads, infrastructure facilities and buildings effectively represent a reserve stock of building materials with an accumulated volume of around 2.1 billion tonnes. This stock is constantly growing – for example, since 1990 the annual increase has averaged about 60 million tonnes.

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area of 1200 square metres have been installed on the roof, and they heat 2400 cubic metres of water stored in a heat-retaining reservoir. This system meets more than half the building's heating energy requirements.

The Federal Office for Buildings and Logistics (FBL) was responsible for the development of this pathbreaking building. The FBL manages all 2700 civilian properties of the federal government with a total value of around 5 billion Swiss francs and conscientiously observes the principles of sustainable development in its building and logistics activities. Its Sustainable Building workgroup draws up documentation for developers, planners and architects to help them take account of environmental protection, social requirements and economic efficiency throughout the entire useful life of the buildings they construct.

Subtle use of contrasts. Beyond functionality, sustainable construction also has to offer people residential and business premises in which they feel comfortable, and the FSO complex certainly meets this requirement. Slightly curved corridors and parquet floors contrast with the cool efficiency of the technical installations by providing a touch of the organic, and the transparent corridors and interior courtyards simultaneously create a sense of openness and shelteredness. And visitors to the cafeteria can appreciate magnificent views of the Lake of Neuchâtel. Architects speak of a "softly flowing room sequence" that is created by the interactions of light wells, stairways, lifts and bridges. Employees put it more pragmatically: they speak of a new building they enjoy coming to every day because its bright and cheerful atmosphere makes it a pleasure to work there.

Lucienne Rey

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Swiss Federal Railways (SBB) shows the way

rey. *With a railway network covering more than 3000 kilometres, Swiss Federal Railways (SBB) uses an enormous quantity of stones: between the rails lie more than 10 million tonnes of them! And since they are constantly subjected to wear and tear, they also have to be replaced from time to time. "Stones used as rail ballast have to be angular so that they interlock and thus guarantee the necessary degree of elasticity and stability of the track," explains Hanspeter Graf from the SBB Strategic Infrastructure Procurement section. For this reason, the SBB buys around 400 000 tonnes of rock each year to replace or supplement ballast between the rails.*

When a track has to be overhauled, the existing rock material is excavated and sifted on site. Stones that are still large and angular enough are returned to the track. For the finer pieces that are no longer usable as ballast, the SBB has a variety of customers who sift or wash the material so that they can then use it for the production of surfacing or concrete. Recycled rock material is also increasingly being used for layering railway platforms or in noise prevention barriers. The SBB is thus able to recycle around 80 per cent of its ballast material, while the remainder has to be disposed of in landfills, mainly because it is soiled with hazardous substances and therefore not suitable for recycling.

Disused rails, too, which are made of high-grade steel, are a valuable raw material source. "Once in the lifetime of a rail it can be refurbished by sanding its surface and restoring the original profile," says Hanspeter Graf. If a rail can no longer be restored, it is removed and melted down for use in the construction industry. The steel is thus fully recycled. In 2007, the SBB recycled 49 000 tonnes of metal from no longer usable rails and vehicles.

Refurbishment of railway lines: ballast and disused rails are recycled.

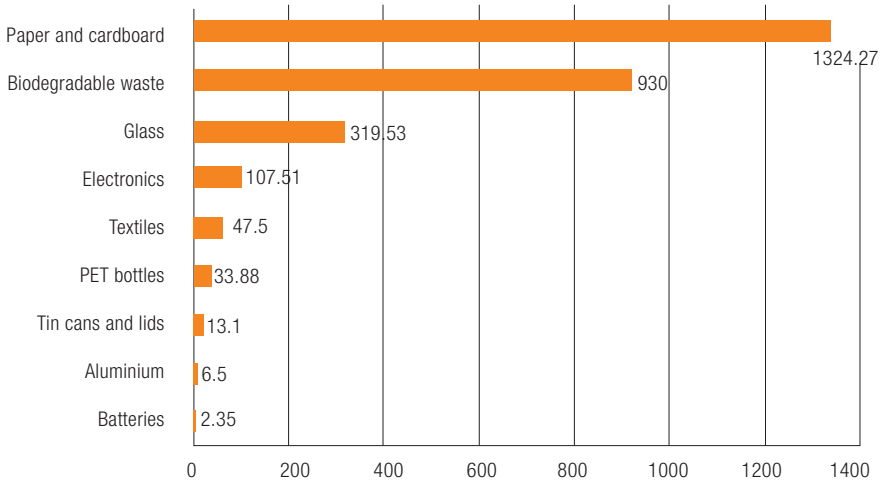
Photo: SBB

Recycling makes sense – but not at any cost

In Switzerland, more than half of all municipal waste is recycled. Despite this record volume of recycling, there is still further potential for increasing the proportion of separated and sorted waste in many locations. However, the goal is not to achieve 100 per cent recycling at any price, since for some waste materials, incineration and utilisation of the energy thus produced makes better ecological and economical sense than complex recycling processes.

In Switzerland, each person produces an average of 720 kilograms of municipal waste per annum, but by no means is all of this worthless material. Approximately 49 per cent takes the form of material that is disposed of in waste-to-energy plants, while the remainder consists of paper, glass, metals and organic materials that are suitable for recycling. The proportion of recycled waste has constantly increased during the past few decades because sorting and separation of waste yields economic benefits. For example, in a country like Switzerland that has limited natural resources, the paper, glass and steel industries rely heavily on recycled raw materials. Here the population makes a valuable contribution: in the 1980s, recycling only accounted for around a quarter of the overall volume of waste prior to the introduction of the Federal Environmental Protection Act, but this figure has meanwhile more than doubled. "The main reasons why people now separate household waste more than they did before are ecological awareness and financial incentives associated with the polluter pays principle," explains Peter Gerber from the FOEN's Consumer Goods and Life Cycle Assessment Section. "Empty bottles, waste paper, aluminium packaging, metal, old clothing, batteries and defective electrical appliances can now be disposed of free of charge almost everywhere." It is not only private households that benefit from recycling, but also the economy and the environment, since the extraction of primary raw materials is normally more costly than reusing resources, and it also causes more pollution and consumes more energy.

QUANTITIES OF SEPARATELY COLLECTED HOUSEHOLD WASTE IN 2007 (in 1000 tonnes)



Source: FOEN

Recycling of scrap metal: At Schmolz + Bickenbach steel works in Emmenbrücke (Lucerne), metal is recycled into high-grade steel products for use in the European automobile, machinery and appliances industries.

Photo: FOEN/AURA, E. Ammon

Financing on the basis of the polluter pays principle. The financing schemes for the separate collection and recycling of waste differs according to the material concerned. While paper and biodegradable waste are collected and delivered for recycling by the municipalities, private-sector solutions have been found for other recyclable materials. Here, private-sector organisations take care of recycling processes on behalf of the respective industry. This applies to PET bottles and aluminium and tin cans, for example, for which the federal government stipulates a recycling quota while the private sector is responsible for financing their collection. Since it was not always possible to find a satisfactory solution, the federal government had to intervene in the case of certain materials and make recycling mandatory and define a scheme for recovery of the related costs (see table on page 17).

As a rule, a charge for recovery and disposal is collected at the time the products and packaging are sold. Prepaid disposal fees based on federal regulations and recycling contributions charged by the respective industries have proved to be successful instruments. Together with the proceeds from the sale of recyclable materials it is thus possible to finance the recycling of the materials collected. "The polluter pays solution also takes due account of the fact that the prices of recycled goods are subject to constant fluctuation," says Peter Gerber. As a consequence of the global financial and economic crisis, demand for steel, paper and glass has slumped, and proceeds have thus fallen accordingly. The steel industry, for example, cut global production by 40 to 50 per cent in the last quarter of 2008. "Nonetheless, all existing collections of sorted waste continue to function smoothly in Switzerland, thanks to the finely tuned financing and recycling systems," Peter Gerber reassures us.

The separate collection of certain products is also necessary when materials that are harmful to both the environment and public health have to be separated from municipal waste, e.g. batteries and compact fluorescent lamps.

Still too much recyclable material lands in the refuse bag. Analyses carried out by the FOEN show that, despite exemplary waste separation and sorting facilities, too many recyclable materials are still ending up in household refuse and are thus not recycled, especially in municipalities that do not charge for waste collection by weight or bag. In these municipalities, an average of 100 kilograms more refuse per person and year is placed at the roadside for collection than in municipalities that tax waste according to the polluter pays principle. The average refuse bag still contains

paper and cardboard (20 per cent) and biological waste from gardens and kitchens (27 per cent). Depending on the material in question and the location, however, not everything is suitable for recycling. For example, soiled paper packaging and disposable tissues have to be incinerated. And in some areas there are neither collections of biodegradable waste nor composting facilities, and this too places limits on recycling potential.

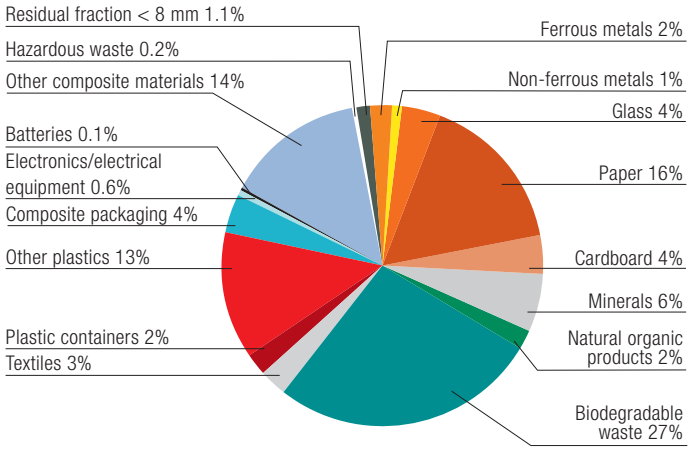
Expansion of recycling of plastics? The question of whether it is worthwhile expanding the collection and recycling infrastructure for plastics (which account for 15 per cent of household waste) is often raised. The broad range of plastic goods available on the market hampers recycling, since fractions such as polyethylene, polypropylene and polystyrol, for example, either have to be strictly separated prior to collection or subsequently sorted. The extra effort that is required seldom pays off, especially since plastics used for packaging are often soiled or combined with paper and aluminium, which makes recycling even more problematic. And in order to make public collection worthwhile, sufficient quantities of the various plastics have to be collected, and this is only possible by launching regional initiatives.

The smoothly functioning collection system for PET bottles is an exception here, but it has its price. While the cost of collecting and incinerating municipal waste in waste-to-energy plants is around 280 Swiss francs per tonne, the figure for collecting and recycling PET bottles is 600 Swiss francs. The large savings in terms of resources mean that this higher price is nonetheless acceptable. However, figures from Germany show that the production of plastic granules from yoghurt beakers for which disposal charges are collected at their point of sale costs up to 4500 Swiss francs per tonne. The fact that trade prices for recyclable plastics fell by around 50 per cent about a year ago has made this process even less economically viable. With a consumption of 118 kilograms of plastics per capita in 2007, these materials only account for a very minor proportion of oil consumption in Switzerland, while fuels and combustibles account for around 95 per cent. The options for the use of granules from household separate collection are also questionable, since the process often takes the form of downcycling rather than recycling, i.e. products such as roadside posts or garden benches are made from these low-grade plastics instead of from natural materials offering a better ecological balance, such as wood. There is also the added problem of possible contamination of recycled plastics with pollutants such as flame retardants.

Balancing the pros and cons. Despite these reservations, some municipalities in Switzerland still separate plastics from household waste. While the city of Bern currently incinerates the collected materials due to the lack of a regional sorting facility and merely utilises the resulting energy, Zug is involved in an experiment to reconvert plastics into oil. However, the ecological benefits in comparison with incineration in waste-to-energy plants are likely to be rather modest, since the energy requirements associated with the separate collection and transport, together with the conversion process, are high. This raises the question whether the development of regional infrastructure for this form

While the cost of collecting and incinerating municipal waste in waste-to-energy plants is around 280 Swiss francs per tonne, the figure for collecting and recycling PET bottles is 600 Swiss francs.

COMPOSITION OF WASTE MATERIAL, 2001/2002



Source: FOEN

The potential for recycling of household waste has not yet been exhausted, as an analysis carried out in 2002 of the content of refuse bags shows. There is still room for increasing the separate collection of biodegradable waste, paper and cardboard.

Collection and recycling organisations and financing schemes

Material	Name of organisation	Purpose	Means of financing collection and recycling
Batteries	INOBAT (battery disposal) www.inobat.ch	Organises the collection and recycling of batteries and accumulators on behalf of the government and collects prepaid disposal fee	Prepaid disposal fee between CHF 0.05 and CHF 2.30 for the most commonly used batteries
Glass bottles	VetroSwiss www.vetroswiss.ch	Collects prepaid disposal fee on behalf of the federal government and distributes revenue to the entitled recipients	Prepaid disposal fee of CHF 0.02 for small bottles (0.09 to 0.33 litres), CHF 0.04 for medium-sized bottles (0.33 to 0.6 litres) and CHF 0.06 for bottles larger than 0.6 litres
Aluminium beverage cans, pet food containers, tubes	IGORA (aluminium recycling co-operative) www.igora.ch	Organises the collection and processing of aluminium cans, containers and tubes on behalf of the industry (manufacturers and distributors)	Prepaid recycling contribution of CHF 0.01 per can, tube, container
Household electronics equipment	SENS Foundation www.sens.ch	Organises the collection and recycling of electronics equipment (household, do-it-yourself, gardening, hobby, toys, lamps and lighting) on behalf of the industry	Prepaid recycling contribution of CHF 0.50 (devices under 5 kg) up to CHF 18.00 (devices up to 140 kg) Refrigerators/coolers, CHF 9.00 (appliances under 5 kg) up to CHF 60.00 (over 250 kg). Toys, CHF 0.50
Office and consumer electronics equipment	SWICO www.swico.ch	Organises the collection and recycling of office and consumer electronics equipment on behalf of the industry	Prepaid recycling contribution of CHF 0.07 (small devices such as iPods) up to CHF 20.00 (large screens) Other rates apply to companies
Tin cans	Ferro Recycling www.ferro.ch	Organises the collection of cans on behalf of the industry	Prepaid recycling contribution of CHF 0.01 (small cans up to 1.5 litres) and CHF 0.02 (cans up to 5 litres)
Lamps and lighting equipment	Lighting and Lamp Recycling (SLRS) www.slrs.ch	Collects prepaid recycling contribution and organises the collection and recycling of light bulbs and lighting equipment (fluorescent tubes, energy-efficient lamps) on behalf of the industry	Prepaid recycling contribution of CHF 1.00 to CHF 15.00 for lighting equipment, and CHF 0.50 per light bulb
PET bottles	PET Recycling Switzerland (PRS), www.prs.ch	Organises the collection of PET bottles on behalf of the beverages industry	Prepaid recycling contribution of CHF 0.018 per PET bottle
Textiles	Co-ordination Centre for Textile Collection in Switzerland www.textilkoordination.ch	Co-ordinates the periodical collections of Contex, Solitex, Texaid and Satex	Resale of textiles

Source: FOEN

Prepaid disposal fee = stipulated by the federal government
Prepaid recycling contribution = collected on a voluntary basis on behalf of the industry concerned so that it can meet federal requirements on the return and recycling of beverage packaging and the return and disposal of electrical and electronic equipment.

of recycling is economically and ecologically viable, in view of the currently existing 30 waste-to-energy plants. Almost all these plants are now equipped with an extremely effective flue gas purification system and they efficiently convert the energy contained in the waste material into heat and electricity.

"As the example of plastics shows, recycling does not offer benefits in every case," emphasises Peter Gerber. It is therefore important to carefully weigh up the respective ecological and economic pros and cons. "Recycling is an important means of preserving resources, but it must yield benefits in terms of overall ecological balance and be economically viable." The FOEN is closely monitoring the ongoing pilot trials in Zug and Bern aimed at recycling plastics from household waste, but for the time being it does not intend to push for an equivalent nationwide collection system.

However, if the price of oil should climb again to the record level it attained in summer 2008 and remain around this level, regional collections of good-quality mixed plastics for recycling could well become financially viable. The situation with respect to the recycling of plastics from industry and agriculture is very different. Here, significant quantities of single-component, barely soiled plastics (e.g. from punch presses, in the form of sheeting and foils, etc.) are available, making recycling worthwhile. Most of this material is therefore already being recycled.

"Consumers often have means at their disposal to eliminate or greatly reduce the quantities of plastics in the waste they produce," says Peter Gerber. "Refills are now available for a variety of cleaning agents and body care products, and we recommend using reusable shopping bags made of textiles or plastics, or shopping baskets or trolleys, instead of thin disposal plastic bags."

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Heat and green power from waste-to-energy plants

Highly advanced technologies in new waste-to-energy plants minimise emissions of pollutants and permit efficient use of processed waste – the Tridel plant, opened in Lausanne in 2006, is a good example of this. Not so long ago, waste incineration plants were regarded as major sources of pollution. Today, however, they actually benefit the environment through the clean production of district heat and electricity and the recovery of metals.

From the platform of the Sallaz station of the new Lausanne Metro the striking complex of the Tridel plant can be seen on the left in the Flon Valley. Until fairly recently, putting a waste-to-energy plant in the heart of an urban area would have met with strong opposition from the local population. But the times when people could point an accusing finger at the smoking chimneys of waste incineration plants are definitely over. New regulations governing air pollution control and advances in exhaust gas purification have enabled a great deal of progress to be made in these facilities in the past two decades.

"The prohibition of the disposal of combustible waste that took effect in 2000 was another important milestone in the greening of Switzerland's waste management," explains Michael Hügi (FOEN Urban and Construction Waste Section). "This move ensures that energy-rich waste is thermally processed and thus avoids the formation of polluted seepage water in landfills and helps to protect the climate by preventing the release of significant quantities of methane from landfills into the atmosphere."

Delivery by rail. Waste-to-energy plants now exist in almost every area of the country where large volumes of waste are produced. This reduces transport costs and emissions of pollutants associated with road traffic. In Ticino, which has not had its own facility to date and therefore has its household waste incinerated in the German-speaking part of Switzerland, a new plant (Giubiasco) is to commence operation in 2010. This will be the last waste-to-energy plant to be built with financial support from the federal government.
The Tridel plant in Lausanne is the newest of the 29 facilities currently in operation in Switzerland. Here, around 160 000 tonnes of waste from 150 municipalities in the canton of Vaud are incinerated each year in two furnace lines. In order to minimise environmental pollution from road transport, 60 per cent of the waste is delivered by rail – via a tunnel that is almost 4 kilometres in length and runs beneath the city.

Oak trees as bio-indicators. Since the Tridel plant is located in a rapidly developing residential quarter, the operators decided to leave nothing to chance with respect to flue gas purification and reduction of emissions. The 80-metre chimney is 20 metres higher than normal, as a study by the Federal Institute of Technology in Lausanne revealed that this height is more suitable for the local wind conditions. Tridel uses state-of-the-art technology to purify the flue gas. "Our original target was to undercut the limits specified by the Ordinance on Air Pollution Control (OAPC) by at least half," says Stefan Nellen, a member of the Board of Directors of Tridel. "But in practice we are significantly exceeding this target – the level of emissions is about 85 per cent below current standards." A device for analysing exhaust gas constantly monitors the emissions. "As soon

At the waste-to-energy plant in Lausanne, almost 100 000 tonnes of waste per year are delivered underground by rail (approximately 60 per cent of the waste incinerated by the plant). The use of a tunnel protects the local population against air and noise pollution caused by road transport.
Photos: Tridel SA

as even more efficient technologies for flue gas purification are available we will use them and reduce the environmental impacts of our plant still further," Stefan Nellen assures us.

As bio-indicators for long-term monitoring of deposits of pollutants in the vicinity, Tridel collects and analyses the leaves of around 30 oak trees. Oak leaves are ideal for this purpose since they actively accumulate pollutants and only fall late in the winter. This project is carried out in collaboration with Les Cheneviers waste-to-energy plant in Geneva, which has been conducting similar analyses since 1989. "Due to efficient exhaust gas filters and additional processing, emissions from waste-to-energy plants are negligible today relative to other sources of pollution like transport, heating and industry," notes Michael Hügi. For example, the total level of dioxin emissions from all such plants in Switzerland fell from over 250 grams in 1980 to about 5 grams in 2005 – a decrease of 98 per cent.

Maximum recovery of recyclable materials. Although incineration reduces the volume of waste by more than 90 per cent, about 20 per cent of the original weight still remains. Per tonne of waste, approximately 200 kg of inorganic bottom ash, 20 kg of flue ash and 5 kg of other residue from exhaust gas purification are left over. At the Tridel plant, in an initial separation process more than 1000 tonnes of metal are recovered from around 30 000 tonnes of slag and passed on for recycling. During combustion, certain volatile heavy metals such as zinc and lead end up in the flue ash, which is then treated with the acidic rinsing water from the flue gas purification process. This leaches out the heavy metals and concentrates them in the residue left over from waste water purification, enabling the metals to be recovered. "For flue gas purification we use collected rainwater," Stefan Nellen explains. "This not only preserves a valuable resource, it also saves money." The slag and some of the cleansed flue ash are sent to the St. Triphon bio-reactor landfill near Ollon (canton of Vaud), where smaller fractions of metal are separated out. Since the remaining flue gas residue still contains considerable quantities of zinc, it is processed and recycled in Le Havre (France) by the Zurich-based company CITRON.

Tridel is closely monitoring findings on a new process for the dry removal of slag that is being trialled at SATOM in Monthey (canton of Valais) and has been used at the Hinwil waste-to-energy plant (canton of Zurich) since 2008. It is hoped this process will make it possible to greatly increase the quality and quantity of ferrous and non-ferrous metals recovered from slag.

Electricity as a by-product. The Tridel plant uses the energy released by the combustion process to simultaneously produce electricity and heat through cogeneration. Steam flows out of the furnaces at 400 °C with a pressure of 50 bar and drives the blades of a tapped condensing turbine, the generator of which produces electricity both for the plant's internal use and for feeding into the grid. With this turbine, Tridel produced a quantity of electricity in 2007 that corresponds to the average annual electricity requirement of more than 10 000 single-family dwellings. The steam that is produced in the boiler is fed through heat exchangers in which the water is heated to 175 °C and subsequently pumped via an insulated underground pipeline to the Pierre-de-Plan district heating plant, from where it is fed to the connected buildings. The thermal output of the Tridel plant is sufficient to meet the heating and hot water requirements of around 18 000 people.

Given the proportion of biomass in waste of approximately 50 per cent, roughly half the energy produced from waste incineration qualifies as renewable energy. Due to the higher value of electricity, about 39 per cent of the incinerated waste in the Tridel plant is used for electricity production and 40 per cent for the production of heat. Thermal processing reduces the use of fossil fuels – and thus emissions of the most important greenhouse gas, carbon dioxide (CO_2) – and cuts the operating costs of waste-to-energy plants. Lausanne intends to gain further energy-related benefits from the Tridel plant by expanding its district heat network.

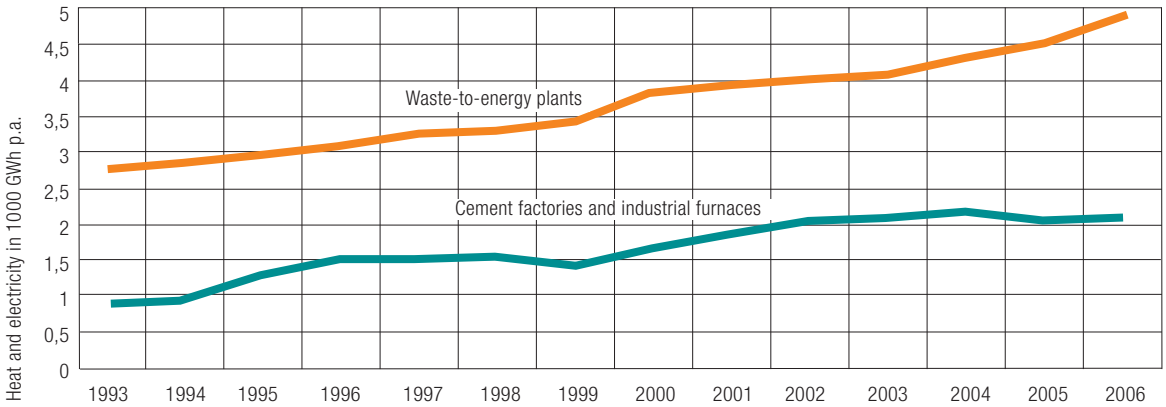
With a total efficiency rate of 79 per cent, Tridel is currently ranked number 5 among Switzerland's waste-to-energy plants in terms of energy efficiency. The Basel waste-to-energy plant, which operates an extensive district heat network and also supplies the local pharmaceut-

"Due to efficient flue gas filters and additional processing, emissions from waste incineration plants are negligible today relative to other sources of pollution like transport, heating and industry."

Michael Hügi, FOEN

ENERGY PRODUCTION FROM WASTE INCINERATION

More and more heat and electricity is being produced by thermal processing of waste. Since 1996, waste-to-energy plants have increased their energy production by around 60 per cent.



Source: FOEN

icals industry, is currently at the top of the table. "In 2006, the combined output of Switzerland's waste incineration plants met around 2 per cent of the country's total energy requirement," Michael Hügi points out.

Outlook. The question of overcapacities of waste-to-energy plants is frequently raised in connection with the approximate 300 000 tonnes of waste material imported into Switzerland annually (about 9 per cent of total domestic incineration capacity). However, Pierre Ammann, president of the Association of Operators of Swiss Waste Treatment Plants, sees no cause for concern. These imports are mainly due to shortages in incineration capacity in Germany. Importing and thermally reprocessing waste in Switzerland makes better ecological sense than depositing it in landfills in Germany, and it improves the utilisation rate of Switzerland's waste incineration plants. Since Germany intends to increase the number of its own waste-to-energy plants in the near future, the volume of imports can be expected to gradually decline. "The trend is towards more concentration of waste-to-energy plants," says Pierre Ammann, "which means that some furnace lines will probably be decommissioned, and smaller facilities in Switzerland might be closed down altogether." This will not affect the modern and efficient facility in Lausanne, however, especially since Les Cheneviers in Geneva will be decommissioning the oldest of its three furnaces in 2010. Tridel has underscored its forward-looking approach by announcing its intention to sign the future climate charter for waste-to-energy plants, which aims to further enhance the energy efficiency of these plants and optimise the recovery of raw materials such as ferrous and non-ferrous metals.

Potential co-operation with cement factories. Alongside waste-to-energy plants, Switzerland's cement factories also play a major role in reutilising energy-rich waste. Over the past few years, they have used an average of about 250 000 tonnes of alternative fuels (close to 40 per cent of their heating requirements). This reduces coal consumption by around 200 000 tonnes p.a. In an effort to further reduce the CO_2 output of its factories and save costs, the cement industry is now showing a greater interest in waste materials that have a high energy content (e.g. solvents, waste oil, used tyres, plastics, animal meal, dried sewage sludge). As a rule, cement factories do not compete with waste-to-energy plants because of their different requirements. "Materials such as paints and dyes, solvents and used tyres are more suitable as combustibles in cement factories because they have to be burned at very high temperatures that cannot be attained in waste-to-energy plants," explains Stefan Nellen. Plastics are the only waste material for which competition might exist. In Stefan Nellen's view, talks should be held with cement producers in order to find a solution acceptable to both sides.

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Producing vegetables from leftovers

In Switzerland more than 3 million tonnes of biogenic waste are produced every year. Garden waste, kitchen leftovers, sewage sludge, waste wood, abattoir by-products, etc., can be used for producing electricity, heat and fertiliser. The goal of the FOEN is to optimise the recycling of all such waste products.

Bruised vegetables, split oranges and wilted flowers are tipped out of a transport container onto the floor of a compost gas facility in Jona (canton of St. Gallen). The driver is delivering unsold foodstuffs from retail outlets. Numerous gardeners call by to drop off cuttings. The composting facility also accepts leftovers from the catering trade, vegetable manufacturing waste, harvest residues and other biogenic materials, which are then shredded, sieved and conveyed to sealed receptacles. Inside the fermenter the matter is sanitised at around 55°C and fermented without air intake. A certain portion of the resulting biogas is used for producing electricity and heat in a cogeneration plant, while the remainder is refined and fed into the gas network.

The waste spends two to three weeks in the fermenter and is then separated into solid fibres and liquid with the aid of a press. As fertilisers, both the solid and the liquid products, which

have a high nutrient content, can be used for growing plants and vegetables, thus completing the foodstuff cycle.

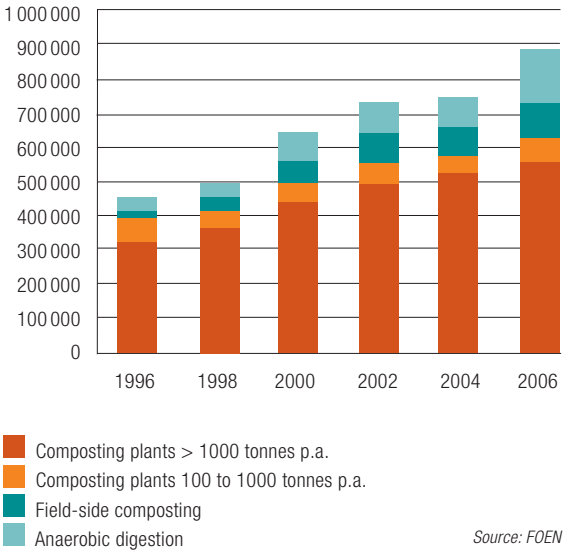
This example shows that biodegradable waste is also a raw material suitable for producing energy, fertilisers and other products. In addition to garden waste and leftover foodstuffs from the catering and retail sectors, other forms of biogenic waste such as sewage sludge, abattoir by-products and waste wood, both treated or untreated, all of which are also produced in large quantities, can be used for a variety of purposes.

Optimisation of methods and processes. The focus of public attention today is on utilisation for energy purposes, since the fermentation of biogenic waste to produce biogas is a widely recognised means of increasing the use of renewable energy. During the past decade alone, the production of energy in the forms of electricity, heat and gas from agricultural and commercial biogas facilities has increased sixfold in Switzerland. And on our roads, gas-driven cars and goods vehicles display labels advertising the ecological benefits of filling the tank with fuel obtained from recycled biodegradable waste.

In the view of the FOEN, however, it is also important to ensure that the nutrients contained in biogenic waste are fed back into the soil to the greatest possible extent. "Here it is essential to make sure that the recycled material cannot give rise to additional soil pollution," says Kaarina Schenk (FOEN Waste and Raw Materials Division). "Depending on the source material, biogenic waste therefore has to be processed in such a way that any potential pollutants are eliminated." It is for this reason that the use of sewage sludge as a fertiliser was banned a few years ago. Making sure that individual loads containing pollutants do not prevent the recycling of large quantities of unpolluted biodegradable waste is essential. Thus material swept off the road should never end up in digestion and composting plants. Despite all precautions, waste collected for anaerobic digestion and composting can still contain traces of heavy metals. Operators of these facilities have to more thoroughly check heavy metal concentrations and modify their acceptance practices for source material as necessary. In addition, studies carried out on behalf of the FOEN show that biodegradable waste also contains polycyclical aromatic hydrocarbons. These result from combus-

AURA

FIGURES FOR COMPOSTING METHODS AND FERMENTATION IN SWITZERLAND FROM 1996 TO 2006
(in tonnes)



Source: FOEN

Recycling of biogenic waste (2006)

Recycled volume	Product	Optimisation requirement
Biodegradable waste, 880 000 tonnes		
Composting facilities (84%); anaerobic digestion facilities (16%); waste incineration plants	Compost; fertiliser from liquid and solid digestate; gas, electricity, heat	Improvement of product quality through specifications for composting and digestion plants; ensuring environmental compatibility of facilities; better marketing of compost and digestate as quality products
Sewage sludge, 200 000 tonnes dry matter		
Municipal waste incineration plants, cement plants, mono-combustion facilities	Electricity, heat, clinker, sewage sludge ash	Recovery of phosphorus
Waste foodstuffs, 300 000 tonnes		
Pig feed (60%) Anaerobic digestion (40%)	Meat Electricity and heat from gas; fertiliser from digestate and extracted liquid	100% digestion, since recycling as animal feed is banned due to risk of disease Optimisation of digestion and sanitisation
Abattoir by-products, 220 000 tonnes		
Good-quality waste meat Incineration of animal and bone meal Incineration of animal fat Offal, blood, etc.	Pet food Heat, electricity Heat, electricity Electricity, gas, fermented matter, extracted liquid	 Recovery of phosphorus Optimisation of digestion, sanitisation
Residual wood, 1 220 000 tonnes		
Combustion Processing	Heat, electricity Derived timber products	Increased use of residual wood from forests
Waste wood, 470 000 tonnes		
Combustion Processing	Heat, electricity Derived timber products	Increased use of waste wood for domestic energy production

Source: FOEN

A shift in favour of biogas production makes sense if good-quality fertiliser is produced at the same time.

tion processes, but it is unclear how they end up in recycled fertilisers.

Today, treatment and processes that are applied to biogenic waste are still primarily based on economic considerations and outdated methods. It is therefore important to ensure that in the future the most suitable process is selected for each type of source material. "There is clearly a need for optimisation here," Kaarina Schenk points out, "especially from an ecological point of view."

More anaerobic digestion, less composting. Despite a strong trend towards anaerobic digestion, it is still the case that the majority of waste material from gardens and landscaping companies is composted. According to Swiss waste management statistics, the proportion was 84 per cent in 2006. A shift in favour of biogas production makes sense if good-quality fertiliser is produced at the same time. To obtain a high-quality product, operators need to optimise the digestion process. In order to produce high-quality compost, digestate must undergo a maturation process (post-composting).

Without this stage, it can be used for agricultural purposes, but is not suitable for use in gardens, as tests on plants have revealed. Thus the company Kompogas in Jona differentiates in how end products are put to use. Inside the hall a large brown mound of fibrous material with a high nutrient content awaits collection by farmers who use it to fertilise their crops. This digestate has only undergone a brief maturing and is an inexpensive fertiliser. This also applies to the nutritious liquid manure that is conveyed to farms in the region in manure cisterns or tanker lorries. Digestate intended for use in gardens is transported to a composting facility for post-treatment. This product is more expensive and is mainly used for preparing soil mixtures.

New technologies. Thanks to technological innovations such as the Schubio mechanical-biological separation process we can expect biogenic waste to be utilised even more effectively in the future. In Switzerland, this method is being used for the first time in the waste recycling plant in Beringen (canton of Schaffhausen). According to its developer, Reinhard Schu, it offers the following advantages: The material is washed before it is processed, and this eliminates any sand and stones which could interfere with the digestion process. Only the liquid portion is fermented to produce biogas. The purified liquid is subsequently used as fertiliser, while the dried matter can be used as a clean peat substitute that is suitable for producing soils for plants.

Reinhard Schu also emphasises the advantages of his method for countries that do not carry out separate collection of waste. The same process can also be applied to obtain compost from mixed waste that meets the requirements for certain purposes. In Switzerland, composting from municipal waste material is generally no longer permitted because with conventional methods the material often contains too many undesirable substances. This means that nutrients cannot be recovered from unused foodstuffs and leftovers that end up in refuse bins. An analysis carried out by the FOEN has shown that, in households, biogenic waste accounts for around a quarter of the bag weight.

More comprehensive use of biomass

Biomass (e.g. wood and agricultural products) can be used in a variety of ways. In order to pursue uniform goals in this area, four federal authorities have defined a joint strategy. One of their objectives is to create added value through multiple use of biomass. The aim is to produce high-quality products such as foodstuffs and construction materials, and consistently exploit synergies. For example, by-products and waste from the foodstuffs industry can be used as animal feed. Animal manure from farmyards can be used for producing electricity in biogas plants, while the solid and liquid digestate can be used in agriculture as fertiliser. The heat obtained from electricity production sustains the digestion process and can also be used by trade and industry as process heat and room heating.

Recovery of nutrients. The Schubio separation facility in Beringen makes it possible to recycle the nitrogen from waste in several steps. Here it is converted into gas and subsequently transformed in the exhaust air scrubbing process into ammonia sulphate. It will also be possible to recover a portion of the phosphate from waste water in the future, with the aid of a new process that permits the reuse of this nutrient in sewage sludge ash as a fertiliser.

At present, nutrient-rich sludge from sewage treatment plants is only recyclable as an energy source, since problematic residues gave rise to a ban on its use as a fertiliser. The sludge produces biogas in the fermenters of sewage treatment plants, and this can be used for the production of electricity, heat and motor fuels. For example, buses in Bern use biogas from the Neubrück sewage treatment plant, and dried sewage sludge is used as a combustible in waste incineration plants and cement plants.

A process has meanwhile been perfected for separating phosphorus from the ash resulting from incinerated sewage sludge. However, this means that residual matter from sewage treatment plants has to be incinerated in special furnaces instead of ending up together with other waste in incineration plants and cement kilns, where the phosphorus is destroyed. In the future the goal is to start recovering this increasingly scarce nutrient from animal and bone meal again. These products were once used as animal feed, but are now primarily burned in cement works in order to minimise the risks associated with BSE. “This solution has never been satisfactory from the point of view of preservation of resources,” explains Kaarina Schenk. “We therefore want to completely substitute imported phosphorus mineral fertiliser with recovered nutrients from biogenic waste.”

This means that only biogenic waste that for safety reasons can only be used for producing heat should end up in slag from waste incineration plants, and thus in landfills. Treated wood waste, for example, should only be burned in municipal waste incineration plants or cogeneration plants (depending on its quality) if for ecological reasons it can no longer be reprocessed into derived timber products.

Beatrix Mühlethaler

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PUBLIC PROCUREMENT

“Viewed over the long term, sustainable products are not more expensive.”

Swiss Post spends almost 3 billion Swiss francs a year on the procurement of goods and services. In the interest of sustainable development, its procurement practices are determined not only by economic factors, but also by ecological and social criteria. “environment” spoke to Axel Butterweck, chief procurement officer.

Axel Butterweck has been chief procurement officer at Swiss Post in Bern since 2004 and is a member of the group executive board. He studied business economics at the University of Passau (Germany) and specialised in procurement. Since the mid-1980s he has worked for a variety of companies in Germany, France, England and Switzerland, including as chief procurement officer of Swatch Group in Biel. For its procurement of goods and services, Swiss Post attaches a great deal of importance to ecological criteria, as is evidenced by the fact that it uses emission-free vehicles for mail delivery and internal transport.

Photos: FOEN/AURA, E. Ammon

environment: Swiss Post is one of the country's biggest enterprises. Does it use its market power to promote sustainable products?

Axel Butterweck: Despite an annual order volume of around 3 billion Swiss francs, Swiss Post's market power is fairly limited. As a purchaser of buses, for example, we are the country's biggest player, but measured in terms of global demand we do not even buy the equivalent of a half-day's production. The same applies to other areas such as information technology. Although Swiss Post figures among the five biggest clients of leading suppliers, in 2008 it contributed less than half a per cent to the annual sales of the largest computer manufacturer, which were more than 60 billion US dollars. So our dominance is relative.

With respect to environmental and social standards, big companies clearly have to act in line with the policies of their head office. We endeavour to bring in our own ideas, but this is not always easy.

Describe some of these ideas for us.

I firmly believe that we should pursue a strictly ecological procurement policy. This applies to lorries and buses, for example. Today's market allows us to buy vehicles that consume 15 per cent less fuel. In recent years, Swiss Post has also retrofitted more than half its fleet of post buses with particle filters. Since 2006 we have only purchased vehicles that meet the EEV exhaust standard, which is more stringent than the 2009 EURO 5 standard. Our fleet of company cars includes 35 vehicles with hybrid drives. In addition we operate one of the country's largest fleets of gas-fuelled vehicles, and are rapidly expanding our fleet of electric scooters for post deliveries.

What special efforts is Swiss Post pursuing to protect the environment?

In the past ten years, under the auspices of our environmental management system we have implemented hundreds of measures at a cost of over 130 million Swiss francs aimed at reducing our consumption of water, energy and paper, and producing less waste. Since 2000 the overall level of pollution attributable to Swiss Post has fallen by 14.6 per cent, and our energy consumption has decreased by 6 per cent. Despite a 19 per cent increase in the passengers and goods we transport, we use 6 per cent less motor fuel today. The main reasons for this are our promotion of rail transport, optimal planning, avoidance of journeys with unladen vehicles and the use of advanced drive systems. Thanks to the "Minergie" standard, our new buildings – for example, the mail distribution centres – consume 60 per cent less energy for heating and cooling purposes.

Since the beginning of 2008, we have been meeting 100 per cent of our electricity requirement

from renewable energy sources. In addition, we distribute all internal mail climate-neutrally and now offer our clients the option of paying a small surcharge to have their letters, parcels and goods delivered CO_2-neutrally. Our efforts are sometimes hampered by market conditions, however: for example, the electric scooters we intended to introduce in autumn 2008 for postal deliveries were initially not available on the market at all.

What are Swiss Post's special requirements?

Delivery personnel have to travel 20 to 30 metres, then switch off the engine again in front of the next building. This constant starting and stopping puts an immense strain on vehicles in daily use. After we had thoroughly tested numerous scooters for their suitability as delivery vehicles, we found the ideal supplier at the right time who recognised the market potential and was prepared to participate in a trial programme with us.

You have previously been chief procurement officer for various large companies. Is it easier to pursue a sustainable procurement policy at Swiss Post or in the private sector?

It is easier at Swiss Post, especially because the Federal Council strongly promotes the principle of sustainability. Consequently, numerous criteria aimed at supporting this policy also apply to public procurement. For example, it is only permitted to buy category A (i.e. the highest energy efficiency category) washing machines and dishwashers for use in government buildings. Such criteria make it relatively easy for our procurement section to insist on products that meet ecological requirements.

How much can Swiss Post spend on efforts aimed at protecting natural resources?

The costs of procurement in accordance with ecological criteria vary greatly from product to product. For example, since 2008 we have only been using paper certified by the Forest Stewardship Council (FSC). This means that the entire source material comes from ecologically and socially compatible forestry management. To begin with this policy was the subject of considerable internal dispute, but in talks with the main suppliers we soon discovered that FSC paper is not more expensive if it is ordered sufficiently in advance. As far as energy-consuming products such as washing machines are concerned, energy efficiency category A appliances do in fact cost 100 or 150 Swiss francs more, but since they consume less energy the higher purchase price is more than recovered over the entire service life. I am convinced that, viewed over the long term, a company does not have to pay more for the procurement of sustainable products. Here, staying power and good ideas are the key.

But surely this is precisely where the problem lies, since companies also have to meet short-term financial objectives.

The concept of sustainability is supported by all members of the executive board, and I never encounter opposition. As soon as you adopt a longer-term view, additional costs pay off. Our most efficient buses cost between 15 000 and 20 000 Swiss francs more, but they consume 10 litres less fuel for every 100 kilometres. Assuming a bus covers around 1 million kilometres throughout its service life and the price of fuel is 1.50 Swiss francs per litre, the savings in fuel costs amount to around 150 000 Swiss francs per vehicle.

According to the most recent annual report of Swiss Post, employees' travel to and from work accounts for 11.5 per cent of the group's overall level of pollution. The concentration of distribution centres is therefore hardly likely to have a positive effect on this balance, is it?

We regard this concentration as the best economical and ecological option for ensuring that we can remain competitive over the long term. Although employees' travel to and from work only accounts for around 3 per cent of our total transport volume, we nonetheless take this problem seriously. All employees receive a half-fare card for public transport or a general rail pass at a reduced rate. Our staff car parks are no longer free of charge. We also recently initiated and support a new bus service to the distribution centre in Härkingen (canton of Solothurn), and are promoting car pooling for night shifts.

But is this concentration really the best solution from an environmental point of view?

Yes. The reduction from the original 18 distribution centres to 3 main centres and 6 sub-centres has resulted in significant ecological improvements. For example, water consumption and noise pollution have been reduced, as has our total utilised area. Where services by road and rail are equal, we give preference to the latter. Since some of our employees will have further to travel to and from work, the overall ecological balance is perhaps not yet positive, but it will certainly become so over the long term.

Swiss Post prepares an ecological balance each year. Are there still weaknesses or optimisation potential to be addressed?

Certainly. Energy consumption for IT systems, for example, is being reduced by between 5 and 10 per cent each year thanks to the use of more efficient devices. We therefore always choose the latest models. Our PCs are replaced every three to four years in order to keep pace with the rapidly developing technology.

What happens to the IT equipment you replace?

Like other companies, we pass our PCs on to the GEWA Foundation for Vocational Integration, which either sells them second-hand or disposes of them ecologically.

In view of its commitment to sustainability, wouldn't it be better for Swiss Post to ensure that functioning equipment is used for as long as possible?

This is a problem area. In the IT world, technological development takes place at such a fast pace that it does not pay for large players like Swiss Post to keep using old (but functioning) equipment. The costs of daily use would be too high and their use would also not make sense ecologically.

Does lower energy consumption compensate for the pollution caused by the production of new generations of appliances?

Electricity consumption is not the sole factor here – we also have to consider the speed of the machines. If our 27 000 employees had to wait 10 seconds for the PC to respond every time they enter data, this would add up to an equivalent waiting time of 75 hours, which would of course be very inefficient.

So in this case you decide on the basis of economic criteria?

Here we have a conflict of objectives. As a company in competition with others we cannot always give the highest priority to ecological criteria when making our decisions. Otherwise we would have to turn back the wheel of time. Ecologically speaking, it would of course be ideal if everyone could just go back to living in caves and trees!

What about social responsibility, for example with respect to working conditions in the Asian factories of manufacturers of computers used by Swiss Post?

We can draw attention to these globalisation-related conditions, but we are hardly in a position to significantly influence them. However, we do require our suppliers to abide by our social and ethics codes, which call for compliance with local legislation and strictly prohibit both corruption and child labour. Not all manufacturers find it easy to guarantee compliance with these requirements.

So what happens if a supplier fails to meet them?

Those who do not sign these codes or infringe against them have a problem. For example, in the past we have had to stop doing business with a number of suppliers in the clothing industry. However, we have not had any such problems with IT suppliers, mainly because we only deal with leading manufacturers and they take great care to avoid negative publicity.

Do you verify compliance with social standards directly in situ?

We work closely together with suppliers and specialised auditors, who guarantee compliance with our codes. However, we also realise that it is not always easy for them to verify compliance with these standards at all levels of the supply chain.

Does this mean you rely entirely on information provided by suppliers?

This is certainly the case with major suppliers, but in the clothing sector we visit suppliers and carry out our own audits or entrust an agency with this task.

What would be the impact of a headline like "Postmen's uniforms sewn by children" on your company?

This would of course be immensely damaging. Headlines of this nature are fatal for a company's image and for the confidence placed in it by its customers.

Interview: Kaspar Meuli

www.environment-switzerland.ch/mag2009-3-07

AURA

Transport is the main culprit

As the 2006 ecological balance for Swiss Post shows, transport accounts for two-thirds of all the group's environmental impacts. 33% is attributable to passenger transport, 11% to employees' travel to and from work, and 22% to goods transport. Electricity consumption accounts for almost 28%, and energy for heating almost 5%. Water and paper consumption each account for less than 1%, and are thus of little relevance.

Pointing the way towards more environment-friendly products

Life cycle assessments are a tool for recording and evaluating all the main environmental impacts of goods, services and companies. They enable specialists to identify weak points and potential for improvements.

Consumers who purchase a kilogram of green asparagus from Peru at the beginning of April are unwittingly also putting 12 kilograms of carbon dioxide (CO_2) in their shopping basket. These emissions of the most significant greenhouse gas primarily consist of the exhaust from the aircraft engines during the long flight from South America to Europe, apportioned to the share of the asparagus in the cargo weight.

But if consumers choose white asparagus from the shelves of Coop supermarkets at the same time of year, the associated CO_2 emissions only amount to 1 kilogram, even though the asparagus also come from Peru.

The explanation lies in the different storability of these two products. White asparagus is more robust and can withstand longer transport times, which means they can be transported by sea. Since modern cargo ships carry huge loads and consume little fuel in relation to the freight volume, the impacts in ecological terms are minor even when goods are transported over a distance of several thousand kilometres. But those who want to be truly climate-smart should wait a few weeks before buying asparagus, since supplies start arriving from Alsace (France) in the second half of April and the domestic supply commences in May offering the shortest transport routes and the best results in terms of climate impact, with only around 0.5 kilograms of CO_2. As a general rule, seasonal foodstuffs from organic, field-grown crops have the lowest environmental impact.

Need for ecological optimisation. The comparison involving asparagus is just one of many life cycle studies carried out by the Institute for Environmental Engineering at the Federal Institute of Technology, Zurich, on behalf of Coop Switzerland concerning 28 types of fruits and vegetables from 29 countries of origin. Here the effect on climate is part of a thorough assessment of all environmental impacts that can be attributed to foodstuffs from the time they are planted until they reach the shelves. The assessment includes environment-relevant aspects such as land use, irrigation, fertilisation, use of pesticides, energy requirements, transport, storage and packaging. The studies found, for example, that artificial irrigation of asparagus fields in Peru requires 600 litres of water to produce 1 kilogram of asparagus, and the corresponding figure for southern Spain is 800 litres, whereas in Switzerland natural rainfall is sufficient.

Coop wants to ecologically optimise its range of products with the aid of such studies. Thus it will discontinue its special offers on green asparagus from Peru, and from now on will only import white asparagus by sea.

Orientation aid for more conscious consumers. "If the findings of complex ecological assessments

are communicated in a simple and appropriate manner, they can also function as an orientation aid for environment-conscious consumers," says Norbert Egli (FOEN Consumer Goods and Life Cycle Assessment Section). For example, a scientific study carried out on behalf of Swiss water supply companies has shown that the burden on the environment attributable to bottled mineral water is 100 to 1000 times greater than that for tap water. Here, lengthy transport routes have a negative impact on the life cycle assessment in the same way as they do for fruits and vegetables, especially if the products are transported by air or road. If plants are cultivated in heated greenhouses, however, the focus of environmental impacts shifts from transport to cultivation. For example, according to calculations made on behalf of Coop, despite the need for intercontinental flights, roses that are transported to Switzerland by air from warm countries like Kenya or Ecuador cause lower levels of CO_2 emissions than imports of flowers grown in heated greenhouses in Holland. If less perishable products are stored in warehouses for several months after harvest, the energy required for cooling is the decisive factor. A kilogram of Swiss apples that are freshly harvested and consumed in September only results in 100 grams of CO_2. This figure rises continually to 350 grams up to the end of cool storage in July, but is still well below the level of 600 grams of CO_2 for apples imported from New Zealand. Thus the shorter storage time due to the harvest that takes place there six months later cannot offset the ecological impact of long-distance transport by sea.

But a better balance in terms of climate protection does not always lead to a positive overall assessment. A comparison carried out by the federal government between a fossil fuel (petrol) and biogenic fuels shows that, despite the lower CO_2 emissions, the impacts of the majority of motor fuels made from agricultural crops are greater because their production results in soil, water and air pollution. In view of this, as the first country in the world Switzerland has stipulated in its legislation governing oil taxation that in order for biofuels to qualify for tax relief they have to demonstrate a "positive aggregate environmental impact". Tax relief can only be granted if a product meets the minimum social and ecological requirements, and the latter have to be demonstrated in the form of well-founded life cycle assessments. "This means that this instrument is now binding and firmly backed by legislation," notes Norbert Egli.

Principle of ecological scarcity. Behind these simple-sounding facts and figures lies an immense

swiss/Ruth Schürmann

"If the findings of complex ecological assessments are communicated in a simple and appropriate manner, they can also function as an orientation aid for environment-conscious consumers."

Norbert Egli, FOEN

amount of work and research. Every life cycle assessment comprises three steps. First of all the system limits of the products to be compared have to be defined (goal and scope definition). The second step is to specify all relevant flows of material and energy (inventory analysis), and in the third step their environmental impacts in each stage of their life cycle have to be assessed and weighted in the form of "eco-points" (impact assessment). Switzerland has carried out pioneer work in this area with the support of the FOEN and has established a database for this information called "ecoinvent". This worldwide leading life-cycle inventory database is now in use in more than 40 countries and contains detailed information on key areas such as energy production, agricultural products and processes, building materials, production of raw materials, transport and waste treatment.

The life-cycle impact assessment method most widely used in Switzerland takes into account a variety of effects on human health, ecosystems and the availability of resources based on the principle of ecological scarcity. Norbert Egli: "The ecological scarcity method postulates that the environment can absorb a certain degree of pollution and regenerate itself, but problems arise when critical levels are exceeded." In Switzerland, the legally established environmental quality targets and limits for pollutant emissions serve as the basis for measurement. Examples of excessive pollution include summer smog, impacts of acid rain on ecosystems, raised levels of hormonally active substances in bodies of water, the thinning of the ozone layer, the greenhouse effect, the threat to the diversity of species and the consumption of resources such as oil, water and soil. "Reducing all these data to points on a scale permits the simple depiction of a complex reality on the basis of specified environmental targets," explains Norbert Egli.

However, these evaluations are based on different criteria, depending on the method applied. "Thus the question has to be examined as to how environmental damage occurring today and in a local context should be weighted in comparison to other effects happening elsewhere, or that will only become manifest in the future." The "Eco-indicator" method that was developed in Holland and is widely used in Europe is based on a relative weighting of the respective ecological impacts by a committee of environment experts. In their assessments they regard land use and the consumption of scarce resources (oil and gas) as problematic. Various methods make it fairly easy to determine whether certain differences identified between compared products can be confirmed or are simply attributable to special characteristics relating to the evaluation process. "With the aid of life cycle assessments," Norbert Egli points out, "it is possible to analyse and compare goods, services and production processes, or entire companies, on the basis of uniform criteria. In this way, from the production of raw materials through to treatment and refining processes and final disposal, it is possible to identify ecological weak points and potential for improvement, evaluate the best solutions for the environment and thus implement optimisation measures."

Beat Jordi

www.environment-switzerland.ch/mag2009-3-08

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The life-cycle impact assessment method most widely used in Switzerland takes into account a variety of effects on human health, ecosystems and the availability of resources based on the principle of ecological scarcity.

Life cycle assessment of tomatoes

Source: FOEN; photo: Natalie Boo/AURA

The environmental impact attributable to the cultivation of tomatoes varies according to location and season. As the evaluation with the ecological scarcity method shows, the most negative factors concern water consumption in southern Spain (Almería), international transport and the heating of greenhouses. The figures show that production in Switzerland is ecologically competitive if the requirement for heating greenhouses can be kept low. To accomplish this, various measures can be implemented, e.g. better insulation, use of waste heat or storage of solar heat in the soil.

Bodensee-Wasserversorgung

Energy and life cycle assessment of drinking water

For 1 litre of water consumed in a household	Oil equivalent	Eco-points (EP 2006)
Drinking water, Switzerland, non-carbonated, tap, uncooled	0.003 dl	1
Drinking water, Switzerland, carbonated, from home soda maker, uncooled	0.2 dl	40
Drinking water, Switzerland, carbonated, from home soda maker, cooled	0.6 dl	105
Mineral water, Switzerland, non-carbonated, from bottled water dispenser, uncooled	0.5 dl	115
Mineral water, Switzerland, non-carbonated, from bottled water dispenser, cooled	0.9 dl	180
Mineral water, Switzerland, non-carbonated, disposable PET bottle, cooled	1.5 dl	260
Mineral water, Switzerland, carbonated, disposable PET bottle, cooled	2.0 dl	360
Mineral water, EU, carbonated, recyclable glass bottle, cooled	2.9 dl	650

Source: SVGW / FOEN

Mineral water causes considerably greater pollution of the environment than water from the tap. Transport, packaging, addition of carbon dioxide and cooling have a decisive impact on the energy and life cycle assessment.

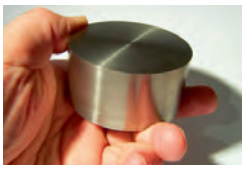
Environmental impacts of aviation

bjo. *What are the impacts on the environment of a flight from Zurich to Los Angeles and back? The example of aviation illustrates the complexity of life cycle assessments. An A340-600 Airbus, for instance, contains around 177 tonnes of materials such as aluminium, titanium, steel and various plastics. Obtaining and processing these materials from metalliferous ores, oil and other primary sources requires energy and results in large amounts of waste that can threaten or destroy the original ecosystems. At the same time, air pollutants such as sulphur, nitrogen oxides and diesel soot are produced, bodies of water are contaminated and the atmosphere is polluted with greenhouse gases such as carbon dioxide. The many impacts harm both the environment and our health. They affect the diversity of species, the global climate, the ozone layer and genetic material. However, calculated over the entire service life of an aircraft, the environmental impacts per flight associated with the aircraft's manufacture and disposal are less significant than the kerosene consumed during the flight.*

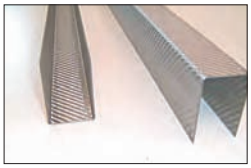
An A340-600 Airbus with a maximum take-off weight of 380 tonnes can hold almost 153 tonnes of fuel. If the aircraft carries a maximum load, it can cover a distance of around 10 500 kilometres. Expressed as an average for all flights, Swiss International Air Lines estimates a per passenger consumption of almost 40 litres of fuel (or 30 kilograms of kerosene) per 1000 kilometres. For a flight to and from the west coast of the USA, this corresponds to about 700 litres, or the emission of 1.6 tonnes of carbon dioxide per passenger. This high level of fuel consumption has various negative impacts on the environment, from the extraction of the oil through to its transport, refinement, distribution, storage and consumption. The infrastructure required to conduct flights – including runways, docks, airport buildings and utility installations – is also a significant factor. Their construction requires land, gravel, cement, steel, glass, plastics, electricity, gas, water and numerous other resources that also negatively affect the environmental life cycle assessment, although to a far less extent than the kerosene consumed by air travel.

Manufacture and disposal of an aircraft


Bauxite/aluminium >>>


Titanium >>>


Steel >>>


Composite materials >>>


Electronics >>>


Disposal

Infrastructure of an airport


Gravel extraction >>>


Cement production >>>


Construction >>>


Land use >>>


Electricity and heating >>>


Disposal

Consumption of kerosene for flight operations


Extraction of oil >>>


Transport in oil tankers >>


Refinement to kerosene >


Rail transport to tank depot >>


Storage of kerosene >>


Refuelling of aircraft

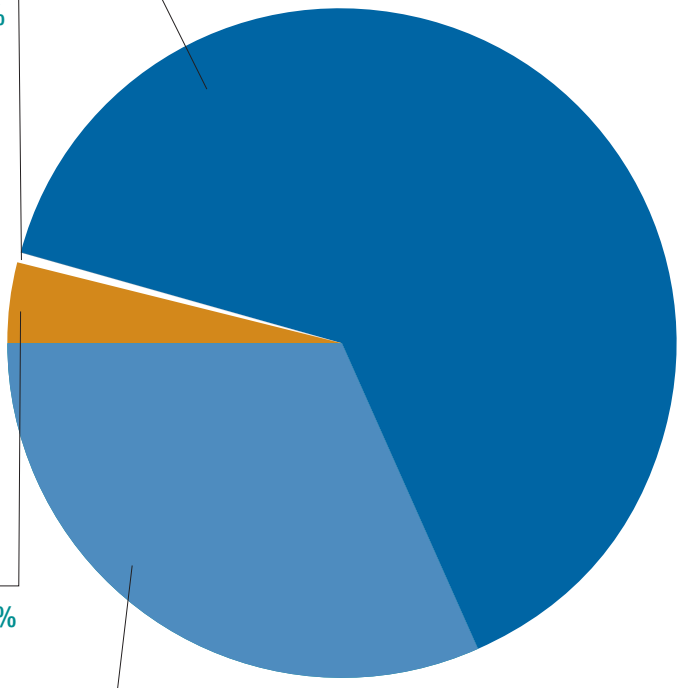
Ecological footprint of a flight

Manufacture and disposal of the aircraft 0.4%

Airport infrastructure 3.9%

Environmental impact attributable to civil aviation

(measured in EP 2006)



Photos (from top left): Rio Tinto-Alcan; de.wikipedia.org; airbus-flickr; AURA; www.avion-europe.de; www.flightglobal.com/Airbus; www.kiesag.ch; www.holcim.ch; www.flightforum.ch; www.skyguide.ch; www.flughafen-zuerich.ch; www.bkw-fmb.ch; Unique; www.flightforum.ch; www.nautifonds.de; www.egghof.com; www.technikatlas.de; SBB; www.hotelcoronado.ch; swiss (2)

DISPOSAL COSTS PER CAPITA

30 cents a day

Switzerland's waste management sector has been constantly improving its environmental performance since the mid-1980s. Despite this progress, consumers do not have to pay more for the recycling and environment-friendly disposal of household waste than they did several years ago. These services cost around 30 cents per person per day.

"We're used to price fluctuations," says Martin Baltisser, president of the Swiss Association for the Recycling of Steel, Metal and Paper, "but we've never before experienced a slump like the one that occurred in autumn 2008." The previous summer, record prices were still being paid for recyclable goods, but with the onset of the worst financial and economic crisis in decades, demand fell sharply. It virtually disappeared for low-quality scrap metal as numerous steel factories temporarily halted production. In spring 2009 the situation with respect to waste paper was hardly any better. "For some types of paper, the recycling facilities are no longer paying anything for the material but instead are charging a fee just for accepting deliveries," says recycled paper trader Daniel Griesser, a member of the Association's board. "We're in the midst of the worst crisis in over two decades." It is "simply impossible" to forecast how things will develop, but Martin Baltisser nonetheless remains fairly optimistic concerning the prospects of the private waste management sector. "It's likely that some operators will find themselves in difficulty, but in my view the outlook for the recycling industry as a whole is still positive over the medium and long term."

Sales contracts cushion price fluctuations. For those who produce waste, the dramatic situation has had little effect so far. Waste paper is still being collected from households and businesses even though it has become almost worthless. "Everything is proceeding more or less as normal," explains Alex Bukowiecki, head of the Municipal Infrastructure section of the Association of Swiss Towns and Cities. "This is mainly due to long-term contracts with paper factories that have been concluded with about two-thirds of all municipalities and cities, and which are a decisive factor in cushioning the price fluctuations that occur during the economic cycle."

Switzerland's recycling programme for waste paper and cardboard has proved highly successful. In 2007, 79 per cent of the approximately 1.68 million tonnes of waste paper that were produced were recycled. This high recycling rate was achieved thanks to a large number of organ-

The annual costs per capita for the disposal of household waste amount to 106 Swiss francs, with transport and thermal processing accounting for 61 Swiss francs and the collection and processing of recyclable materials for 45 Swiss francs.

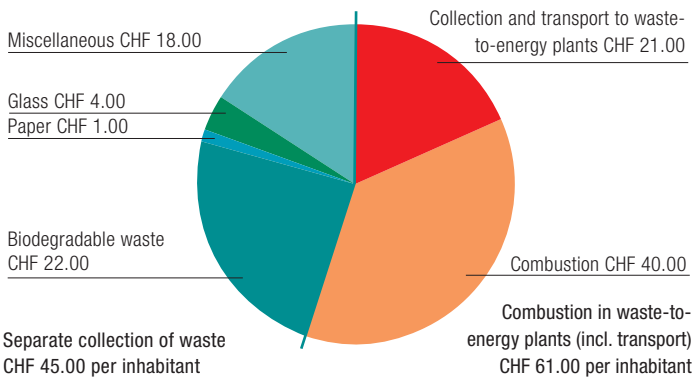
Photos: FOEN/AURA, E. Ammon

isations involved in waste paper collection that operate on the basis of a broad-based commitment to recycling. In rural areas, waste paper is often collected by associations or schools, while in urban areas this is usually done by municipal waste disposal services or by private transport companies acting on behalf of local authorities.

Recycling instead of disposal. A quarter of a century ago, when the debate on the environment reached its peak with the dispute over the proposed new Environmental Protection Act, it became clear that the existing system of waste management would have to be fundamentally changed. At that time, untreated and heavily polluted hazardous waste was often deposited in landfills located in the vicinity of groundwater, waste incineration plants belched out filthy smoke that polluted the surroundings with soot, heavy metals and organic toxins, and recycling was in its infancy. In 1986, the Federal Commission on Waste Management issued guidelines thereby establishing the bases of the much needed reorientation. Under the new concept, waste management should above all be environmentally sound instead of as cheap as possible. In order to protect natural resources, disused products and packaging should be recycled or thermally processed and the residue treated so that it can be safely disposed of in landfills. "The Technical Ordinance on Waste dating from 1990 and the subsequent revision of the Environmental Protection Act formed the legal basis for fundamentally changing the waste management industry," says Hans-Peter Fahrni, head of the FOEN Waste and Raw Materials Division.

Although implementation was a time-consuming process that in some areas is still ongoing today, the results achieved in the past two decades are impressive. Nowadays, neither hazardous waste nor combustible residue is deposited in landfills. More than half the volume of household waste is recycled, and the remainder is used for energy production in waste-to-energy plants. While numerous small plants were decommissioned, the renovated and new facilities in use today are equipped with efficient exhaust gas filters that minimise emissions of pollutants.

COSTS OF DISPOSAL OF HOUSEHOLD WASTE
per person and year



Good and open relations. The key to success for the new waste management policy was the introduction of the polluter pays principle. Imposing a per-bag charge for disposal of household waste spurred record recycling rates for glass and paper. But the industrial sector, too, complied with the new legal requirements and made production processes more environment-friendly. For various types of waste, suitable disposal solutions have been defined in collaboration with private-sector partners. The Swiss Association for the Recycling of Steel, Metal and Paper, the Association of Swiss Towns and Cities and the FOEN all strongly agree on the importance of successful interaction between the public sector and the private economy. Good and open relations lead to constructive solutions in everyone's interest, and above all for the well-being of the overall community. "Recycling and ecological treatment of waste can only be secured over the long term if the state specifies the requirements that have to be met," adds Hans-Peter Fahrni.

Still room for improvement. Waste management is a public service that cannot be provided free of charge, but the disposal of all household waste costs only about 30 cents per person per day, the equivalent cost of two text messages. The considerable increase in separate collection and recycling of waste, the 2000 ban on landfilling of combustible waste, and billions of Swiss francs invested in new facilities and in the renovation of existing ones have not significantly driven up the cost of waste management, mainly because waste-to-energy plants now market products such as electricity and heat from waste, as well as recovered metals. Per capita expenditure on waste management is now less than it was in the late 1980s. As Brigitte Fischer (Canton of Zurich Office for Waste, Water, Energy and Air) points out, "There is still room for improvement at the local level. For example, it makes sense to organise collections on a regional basis and standardise collection methods, since larger quantities mean that better conditions can be negotiated."

Although progress has been made, we cannot rest on our laurels. "To increase the efficiency of waste management still further, in future we need to focus on product design," says Hans-Peter Fahrni. "Products need to be conceived so that the processed materials can be easily recycled after they reach the end of their service life." The unpopular alternative to significantly reducing our consumption of resources worldwide is accepting a significant drop in our standard of living.

Urs Fitze

www.environment-switzerland.ch/mag2009-3-09

The key to success for the new waste management policy was the introduction of the polluter pays principle.

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AURA

Christian Rüttimann

Coop recycles two-thirds of its own waste

Conscientious waste management protects resources and reduces disposal costs. "environment" spoke with Christian Rüttimann, who is responsible for operational environmental protection at Coop Switzerland.

environment: What are Coop's waste management objectives?

Christian Rüttimann: The main goals are to reduce the volume of waste and increase the proportion of recycling. We are also looking for better solutions for specific types of waste. For example, much of the organic waste is now used to produce biogas that fuels our delivery vehicles or serves to produce green power. We now convert cooking oil from our restaurants into biodiesel that is added to the fuel used by our fleet of heavy goods vehicles. For packaging materials we always look for sector-specific solutions and are committed to further increasing our recycling quotas.

Have your efforts been successful?

Coop achieved a recycling quota of 67 per cent in 2008. By reducing the quantity of waste and more effectively separating recyclables we are bringing down our waste disposal costs.

Where are there limits, and where is there still need for action?

Much of the waste material is returned from our outlets to our distribution centres. This is where the most urgent need for action lies. To ensure that our sales outlets sort recyclables more consistently, we have been training all employees since the beginning of 2009 in handling waste and recyclables. There will always be waste material, of course, but we can still greatly reduce the volume through consistent separation of recyclables. For example, we should ensure that small pieces of cardboard and colourful plastic foils are no longer incinerated.

INTERNATIONAL CO-OPERATION

Protecting resources throughout the world

More and more electronic devices are now being disposed of in developing and emerging countries. If they are not properly recycled and the pollutants are not disposed of using state-of-the-art technology, they represent a threat to public health and the environment. To reduce these risks, Switzerland is putting its know-how to work abroad in the areas of procurement, waste management and protection of resources.

In Soweto, a suburb of Johannesburg (South Africa), waste collectors queue up to sell their recycled materials (left). Switzerland developed a pilot facility in South Africa for the ecological processing of electronic waste.
Photos: Empa

Developing and emerging countries have been defending themselves for some time against illegal imports of electronic waste from industrialised countries. In the meantime, however, poorer economies are increasingly having to dispose of electronic equipment from their domestic market. In developing countries, this kind of waste material is welcomed since it contains copper and aluminium, as well as precious metals such as gold, palladium and silver, and people can earn good money by recovering and selling these raw materials. Unfortunately, electronic waste also contains problematic materials such as quicksilver, beryllium and bromide fire retardants in plastics.

The conditions under which these materials are recovered, particularly in many Asian and African countries but also in Latin America, make a mockery of all efforts to protect workers and the environment. Backyard operators burn off cable insulation, for example, in order to extract the copper, or heat up circuit boards over open fires to recover gold, and thus expose themselves to harmful vapours containing dioxins or mercury. "Organic pollutants, heavy metals and other toxic substances are a threat to people's health and have a negative impact on the environment since they contaminate the air, the soil and bodies of water," explains Marco Buletti (FOEN Consumer Goods and Life Cycle Assessment Section).

Need to promote more awareness. Switzerland possesses considerable know-how relating to environmentally sound waste treatment that is also attracting a great deal of interest in developing and emerging countries. To protect such states against unwanted imports of hazardous waste, many years ago Switzerland launched the initiative that led to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which came into force in 1992. In the framework of this Convention and other projects, various federal authorities are actively committed to know-how transfer and are involved in the development of environmentally sound disposal solutions in Asia, Latin America and Africa. Co-operation schemes involving authorities, non-governmental organisations and

the private sector are proving to be especially successful. For a pilot project on the ecological treatment of electronic waste in South Africa, the Swiss Federal Laboratories for Testing and Research (Empa) and the State Secretariat for Economic Affairs (SECO) were able to secure the support of world market leader Hewlett-Packard. The pilot facility that was set up in Cape Town in 2008 initially processed 58 tonnes of discarded computers and printers, and created 19 jobs. Each device was examined in terms of recyclability, was manually dismantled and then disposed of in an environmentally sound manner after the valuable metal parts had been removed, and the facility even succeeded in making a profit of several thousand US dollars. It also trained informal waste collectors, who play an important role throughout Africa with their backyard recycling operations. "This project called attention to a significant environmental problem in South Africa and should serve as a model throughout the continent," hopes project manager Mathias Schluep (Empa Technology and Society Section). Regulated disposal is becoming a matter of some urgency – in 2007, for example, 19 000 tonnes of discarded PCs had to be disposed of in South Africa alone. In view of this situation the South African government is now considering introducing a prepaid disposal fee for electrical appliances similar to the scheme used in Switzerland. There is also a new organisation – eWaste Association of South Africa, eWASA – that advises companies and private individuals and assists them with the ecological recycling of electronic appliances.

"Since the Nairobi Ministerial Declaration on the Environmentally Sound Management of Electronic and Electrical Waste adopted at a conference of the Basel Convention in 2006, a great deal has happened in this area," says Mathias Schluep. Projects similar to that in Cape Town have since been initiated with Switzerland's assistance in Morocco, Tunisia and Kenya. The Empa and SECO are also involved in similar initiatives in Costa Rica, Colombia, Peru and Chile, as well as in China and India, where quantities of electronic waste have risen sharply in the past few years due to the increasing use of information technologies.

Second life for mobile phones. Mobile phones are a perfect example of how rapidly a device can conquer the world's markets. Around a billion new phones are sold each year. In affluent industrialised countries like Switzerland, users change their mobile phone on average after 12 to 18 months of use, either because new functions have become available or simply because they want the latest design. Even though some mobile phones remain in use as replacement or second-hand devices, several hundred million are nonetheless discarded each year worldwide.

To ensure that they do not become an additional hazard to public health and the environment, Switzerland launched the Mobile Phone Partnership Initiative (MPPI) under the Basel Convention. "Our aim was to create a widely recognised method for disposing of discarded mobile phones in a responsible and ecological manner," says MPPI initiator Marco Buletti. He succeeded in gaining the support of the twelve largest manufacturers of mobile phones in the world, as well as of many leading network operators, for this endeavour. Together with authorities, recyclers and non-governmental organisations, they drew up five solution-oriented guidelines dealing with effective collection systems, state-of-the-art refurbishment, environmentally sound recycling, transboundary movements of used and end-of-life mobile phones and aspects of ecological design. These guidelines were adopted in Bali in 2008 by the 172 signatory states of the Basel Convention. "This means that the problems are now clearly recognised at the international level, and can also be directly addressed," explains Marco Buletti.

Following the success of the MPPI, the aim now is for a similar partnership between governments, the private economy and non-governmental organisations to promote the sustainable processing and environmentally sound disposal and recovery of discarded computers. The principal objective of the Partnership for Action on Computing Equipment (PACE) is to protect valuable resources through effective recycling.

Sustainable production and consumption patterns. The unresolved public health and environmental problems associated with electronic waste in

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Eveline Venanzoni, FOEN

many countries clearly indicate that attention has to be paid to ecological aspects of goods and services right from the start of their life cycle. "During the conception stage it is essential to already focus on ensuring that production, use, recycling and disposal cause as little harm to the environment as possible," explains Eveline Venanzoni (FOEN Consumer Goods and Life Cycle Assessment Section). Thanks to technological innovation, it is possible today to manufacture products that require a fraction of the resources that are normally used, without sacrificing comfort or convenience. Examples here include "Minergie-P" buildings, electric cars and wind turbines for electricity production.

At a conference in Marrakech following the World Summit on Sustainable Development that was held in Johannesburg in 2002, the international community initiated the development of a framework programme for defining environmentally and socially compatible consumption and production patterns. Seven task forces were formed to deal with the various aspects of this mammoth job. The FOEN is heading the Marrakech Task Force on Sustainable Public Procurement.

Exemplary role of the public sector. "With their buying power, administrations and government enterprises can make a decisive contribution towards the promotion of sustainable goods and services," says Eveline Venanzoni, who is head of the Marrakech Task Force on Sustainable Public Procurement. "And as large-scale buyers they can also play an exemplary role for companies and households." With a market volume that can be as high as one-tenth of GDP in many industrial countries, government procurement officials can help products that protect resources and are socially compatible to make a breakthrough onto the market. In Switzerland alone, the public sector spends around 32 billion Swiss francs a year on buildings and engineering structures and on goods and services such as vehicles, computers, office equipment, furniture, uniforms, paper, electricity and business travel. In view of the quantities involved, sustainable public procurement also makes a significant contribution towards the implementation of the objectives of international conventions.

The Marrakech Task Force aims to support interested governments of industrialised and developing countries with the creation of a sustainable procurement system. One of its main goals is to sensitise and educate state procurement personnel in the respective countries. Following a pilot project in Argentina, other trials are being carried out in Mexico, Costa Rica, Uruguay, Tunisia, Ghana, Mauritius and New Zealand up until 2010.

Measures to introduce or further develop sustainable public procurement are being systematically implemented in accordance with a method developed by the Task Force. An analysis is first carried out of the current situation, the legal bases and the market situation, and this is followed by training programmes aimed at developing the necessary skills locally. The intention is to incorporate all players involved in the procurement process, including the manufacturing industry. "It is essential to think in terms of the life cycles of products," says Eveline Venanzoni. "Many goods with an optimised life cycle assessment may cost a little more to buy, but their operating costs are lower because they require less energy, and they are often cheaper to dispose of. So, by purchasing such products, the public sector not only reduces environmental pollution, but also often cuts costs."

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