



LIFE III



LIFE and waste recycling

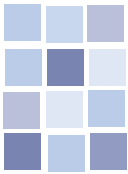
Innovative waste management options in Europe



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For more than 30 years, efforts to reduce and avoid the negative impacts of waste on the environment and human health have been central to EU environment policy. Significant progress has been made based on the principle of the waste hierarchy that prioritises waste prevention and sees landfill generally as the least favourable waste management option for the environment.

Heavily polluting landfills and incinerators are being cleaned up. Re-use, recycling and energy recovery are being applied to regulated wastes. The diversion of biodegradable waste from landfills is an important contribution to limiting greenhouse gas emissions. Yet, while recycling and re-use are increasing, overall amounts of waste are still growing, increasing demand for primary resources and stress on eco-systems.

This unsustainable trend reveals that, despite all progress achieved, the challenges for waste policy are still mounting and a lot still needs to be done. The new EU “Thematic Strategy on the prevention and recycling of waste” sets out the objectives and means by which the EU can further improve the management of waste and make better use of its material and energy resources. A closely related revision of the “Waste Framework Directive” will be voted on in the European Parliament and in the European Council in the coming months.

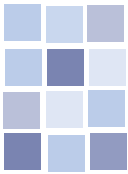
In this context, now is an opportune moment to consider what promising and encouraging best practices already exist. The more than 290 waste-related projects co-financed since 1992 under the European Commission’s LIFE (Financial Instrument for the Environment) programme reveal some of the ways in which Europe’s waste management challenge can be successfully tackled.

This LIFE-Focus brochure on “LIFE and waste recycling. Innovative waste management options in Europe” is therefore published at just the right time. It presents 20 projects, which represent a small but valuable selection of the numerous successful waste-related LIFE initiatives that support the EU’s evolving waste policy. Covering the wide range and scope of activities carried out over the years, these projects not only refer to solutions to waste as a problem, but also to opportunities to see waste as a valuable resource for industry, generating jobs and businesses.

The projects serve to highlight some of the key principles around which European environment policy is built. They underline the value of information sharing and exchange and have the potential to contribute to the European Union’s long term vision: to become a recycling society that seeks to avoid waste and uses waste as a resource.

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The aim: Moving towards improved waste management

The objectives of EU waste policy are to reduce the negative impact of waste on the environment and public health and to ensure the most efficient use of resources, particularly natural resources. Towards these goals, it aims to improve and strengthen measures to prevent the disposal of waste and promote its re-use, recycling or recovery.

The challenges

Every production process generates some form of waste and all material placed on the market is destined to become waste at one time or another. This has already resulted in ever growing waste mountains. Each year 1.3 billion tonnes of non-agricultural waste is generated in the European Union - some 58 million tonnes of which is hazardous. This amounts to a yearly average of 570kg of waste production for every man, woman and child in the EU-15 (300-350kg in the EU-10).

Waste represents an enormous loss of resources in the form of both materials and energy. In addition, waste management itself creates environmental damage. Of the total waste generated in the EU, 31% is currently landfilled, 42% is recycled, 6% is incinerated with energy recovery and 21% is unaccounted for. Landfilling and incineration contribute to pollution of the air, water and soil as well as noise and other nuisances. Furthermore, the economic costs of municipal waste and hazardous waste management alone amount to around €75 billion a year.

Waste is not just a serious problem; it is also a growing problem. Between 1990 and 1995 - in the EU-25 - waste generation rose 10% compared to a GDP increase of only 6.5%. Municipal waste is the single fastest growing waste stream; it increased by 19% between 1995 and 2003. The Joint Research Centre predicts that 42.5% more waste could be generated in 2020 compared to 1995.



Waste volumes are increasing at rates equalling and sometimes outpacing economic growth

The objectives

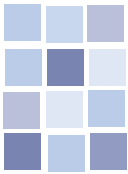
The significant and growing environmental, social and economic challenges presented by waste explain why the EU's 6th Environment Action Programme identifies waste as one of its top four priorities. This EU-level work is based on three principles: waste prevention; recycling and re-use; and improving final disposal and monitoring.

There have been waste policy successes, including increases in recycling and reductions in dioxin emissions from municipal waste incinerators. However, the greater increases in waste generation mean that the EU still has the challenge of decoupling the use of resources and the generation of waste from the rate of economic growth.

An important tool to guide European efforts is the life-cycle approach to

resource management - environmental policy needs to ensure that any negative environmental impact is minimised throughout the entire life-cycle of resources. Life-cycle thinking is also being introduced into waste policy. Furthermore, more ambitious waste prevention policies and re-use of products and components can also contribute to avoiding the negative environmental impact from the extraction of primary raw materials and their transformation in production processes.

For the EU, improving waste management is about becoming an economically and environmentally efficient recycling society that seeks to avoid waste, or, where this is impossible, to use it as a resource.. Supported with high environmental standards, this will ensure the protection of human health and the environment against the harmful effects of waste and enable sustainable economic growth.



EU waste strategy and legislation

In the face of the growing challenges posed by waste generation, treatment and disposal, the EU has placed waste management at the heart of its environment strategy. It has called for specific efforts on the prevention and recycling of waste and the sustainable use of resources. EU legislation has been adopted since the mid-1970s to provide a framework for action by the Member States towards the overall objective of improved waste management.



LIFE04 ENV/FR/000289

The key objective of the Thematic Strategy on waste prevention and recycling is to make Europe a real recycling society.

Strategy

The EU strategy for **waste management**, adopted in 1989 and reviewed in 1996¹, refers to prevention, re-use and recovery, optimisation of final disposal, and regulation of transport as strategic guidelines for the management of waste in Europe. The document specifies that waste management should first of all aim at preventing waste generation. If that is not possible, material waste recycling and the incineration of waste with energy recovery should be pursued.

The 'worst' options are identified as the use of landfill and incineration without energy recovery. This order of preference is known as the '**waste hierarchy**'.

The **environment action programmes** (EAP) represent the EU's tool to define the priorities and objectives of European environment policy and to describe measures to be taken to help implement its sustainable development strategy. The **6th EAP**² - adopted in 2002 - established 'the sustainable use of natural resources

and management of wastes' as one of its four priorities. The objective is to ensure that the consumption of renewable and non-renewable resources does not exceed the carrying capacity of the environment and to achieve a decoupling of resource use from economic growth through significantly improved resource efficiency and waste reduction.

The 6th EAP specifically targets a 20% reduction in the quantity of waste going to final disposal by 2010 and a 50% reduction by 2050. To this

aim, it defines several actions, such as the improvement of existing waste management schemes and investment in quantitative and qualitative prevention. Furthermore, it called for the development of seven thematic strategies, including those on 'the sustainable use of natural resources' and 'the prevention and recycling of waste', which were published by the European Commission on 21 December 2005.

The Thematic Strategy on the **sustainable use of natural resources**³ aims to reduce the negative environmental impacts arising from the use of natural resources in a growing economy. To achieve this it focuses on improving knowledge, understanding and awareness of European resource use, developing monitoring tools, and fostering strategic approaches and processes in specific economic sectors. It stresses that policies need to move beyond emissions and waste control if they are to reduce the environmental impact of resource use; they must cover the whole life-cycle of resources from collection to disposal.

A 'European recycling society' is the long-term vision of the Thematic Strategy on the **prevention and recycling of waste**⁴. It seeks to promote a 'recycling society' in Europe and provides the framework for a comprehensive revision of EU waste policy in view of the priorities set on prevention and recycling in the EAP. The strategy calls for the existing legal framework to be clarified, simplified, streamlined and also modernised with the introduction of a life-cycle analysis in policymaking. It stresses that progress requires a renewed emphasis on full implementation of existing legislation and better knowledge and information on the current situation and best practice. More ambitious waste prevention policies and common reference standards for recycling are also needed to prevent the threat of 'eco-dumping' in Europe.

Framework legislation

One of the first legal measures taken to protect the environment at EU level was the **waste framework Directive** (WFD)⁵ of 1975 (revised in 1991 and codified in 2006). The WFD lays down the principles for – and therefore has a direct or indirect impact on – all other EU legislation related to waste. It sets guidelines for waste management in Member States, including the obligation to take all necessary steps to prevent waste generation, to encourage re-use and to ensure safe disposal. Provisions relating to the establishment of an integrated and adequate network of disposal installations are intended to make the Community self-sufficient in waste disposal.

The Thematic Strategy on prevention and recycling of waste foresees a further revision of the WFD as described above. To improve implementation it seeks to oblige all EU Member States to develop national waste prevention programmes. To contribute to better regulation it calls for the hazardous waste and waste oil Directives (see below) to be merged with the WFD.

The **hazardous waste Directive**⁶ of 1991 laid down stringent requirements for the management of a list of commonly defined hazardous wastes. It requires Member States to ensure that hazardous waste is recorded, identified and not mixed with other hazardous or non-hazardous waste. It states that any establishment carrying out disposal operations must obtain a permit and be subject to inspection. The competent authorities must publish plans for the management of hazardous waste, to be evaluated by the Commission.

The Regulation on the **shipment of waste**⁷ sets out a system of control for the movement of waste; it specifies the documentation to be provided and the security measures to

be taken during transportation. Procedures must take into account the principles of self-sufficiency, proximity of waste for disposal and prior informed consent.

Processing and disposal facilities

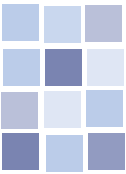
The European Union has laid down strict conditions that need to be met by European waste facilities. Common technical operational standards aim at reducing the impact of the treatment and disposal of waste – particularly incineration and landfilling – on the environment and human health.

Based on the definition of different waste and landfill categories, the Directive on **landfill of waste**⁸ lays down a standard waste acceptance procedure to avoid risks. This includes the obligation that waste be landfilled according to type and treated before disposal. It defines wastes not to be accepted in any landfill and sets up a system of operating permits for landfill sites.

The Directive on **waste incineration**⁹ covers waste incineration and 'co-incineration' plants – the main purpose of the latter being energy generation or the production of material products. It introduced technical

Although the recycling of municipal waste has been increasing, this has been almost completely offset by an increase in municipal waste generation.





LIFE05 ENV FIN 000539

Waste hierarchy

Current EU waste policy is based on a concept known as the 'waste hierarchy', which classifies the different options for managing waste from 'best' to 'worst' from an environmental perspective: prevention; re-use; recycling; recovery; and disposal. Although the waste hierarchy should not be seen as a rigid rule, the aim of moving towards a recycling and recovery society means moving up the hierarchy, away from environmentally damaging landfill and incineration procedures.



Waste prevention awareness raising poster

requirements and operational conditions for these plants, including the obligation for plants to have prior authorisation. Emission limits are set for certain pollutants released into the air or water.

Special waste streams

To complement the measures set out above, the EU has adopted detailed legislation covering specific individual waste streams. These typically cover both preventative measures and common rules for separate collection and treatment.

The Directive on **waste electrical and electronic equipment (WEEE)**¹⁰ was introduced to tackle this fast growing waste stream by setting targets for its separate collection, recovery and recycling. It shifts responsibility to producers for recycling electrical and electronic equipment, which consumers can return to them free of charge. This is complemented by the Directive on the **restriction of the use of certain hazardous substances (RoHS)**¹¹, which requires the substitution of various heavy metals and brominated flame retardants in new equipment entering the market. Together, these aim to provide incentives to improve the design of electrical and electronic equipment to facilitate recycling.

The Directive on **packaging and packaging waste** (adopted in 1994¹² and amended in 2004¹³) supplemented the Community measures¹⁴ first introduced in the early 1980s, covering the packaging of liquid beverage containers intended for human consumption. The directive sets out measures and requirements for the prevention, re-use and recovery of packaging waste in Member States. It aims to harmonise national schemes to ensure the viability of collection and recycling activities within the internal market.

The 1975 **waste oil** Directive¹⁵, as last amended by the 2000 waste incineration Directive, promotes the safe collection and disposal of mineral-based lubricants or industrial oils which have become unfit for their original intended use. According to the directive, Member States must ensure that waste oils are collected and disposed of appropriately. Priority should be given to refining and thus regenerating waste oils. Alternative procedures may include combustion, destruction, storage or tipping. The directive outlaws certain disposal methods and requires the registration and supervision of entities engaged in waste oil collection or disposal.



LIFE03 ENV/S/000596

Bunker to receive used vehicle oil filters and conveyer belt

The Directive on **end-of-life vehicles**¹⁶ promotes more environmentally friendly dismantling and recycling of motor vehicles. It establishes targets for the re-use, recycling and recovery of vehicles and calls on manufacturers to incorporate recycling objectives within vehicle design. It is foreseen that vehicles may be put on the market only if they are re-usable and/or recyclable to a minimum of 85% by mass or are re-usable and/or recoverable to a minimum of 95% by mass. This has been complemented by several pieces of implementing legislation on spare parts, certificates of destruction and rules on monitoring implementation.

From September 2008, a new **Battery Directive**¹⁷ will ban mercury in all batteries and cadmium in most portable ones. In addition, it will establish rules for the collection, recycling, treatment and disposal of batteries and accumulators to reduce the amount of hazardous substances dumped in the environment.

The Directive on the **disposal of polychlorinated biphenyls and polychlorinated terphenyls**¹⁸ (PCB/PCT) aims at the controlled decontamination and disposal of all PCBs and equipment containing PCBs as soon as possible. It requires Member States to prepare inventories, collection plans and decontamination and disposal plans for electrical equipment manufactured before the restrictions on PCB use.

With the Directive on **sewage sludge used in agriculture**¹⁹, the EU seeks to prevent harmful effects on soil, vegetation, animals and humans from



The LIFE Paperfoam project developed an alternative packaging material made from potato starch, replacing traditional plastic CD holders.

heavy metals, poorly biodegradable organic compounds and potentially pathogenic organisms that can be found in sewage sludge. It prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. It further regulates the use of sludge in agriculture to prevent contact with crops and grazing animals.

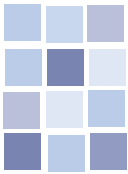
The Directive on the **management of waste from extractive industries**²⁰ aims at minimising negative effects on the environment and human health from the treatment and disposal of mining and quarrying waste. The Directive covers the planning, licensing, operation, closure and after-care of waste facilities and provides for a major-accident policy for high-risk

facilities. Inventories of closed facilities posing serious risks to the environment and health have also to be drawn up.

- 1 COM(96) 399
- 2 European Parliament and Council Decision No 1600/2002/EC
- 3 COM(2005) 670
- 4 COM(2005) 666
- 5 European Parliament and Council Directive 2003/30/EC
- 6 Council Directive 2003/96/EC
- 7 European Parliament and Council Directive 2004/8/EC
- 8 COM(2005) 265 final
- 9 COM(2006) 545 final
- 10 European Parliament and Council Directive 2002/91/EC
- 11 Council Directive 92/42/EEC
- 12 European Parliament and Council Directive 2000/55/EC
- 13 European Parliament and Council Directive 96/57/EC
- 14 Council Directive 92/75/EEC
- 15 Council and Commission decisions 2001/469/EC, 2003/168/EC, EC/2422/2001
- 16 European Parliament and Council Directive 2005/32/EC
- 17 European Parliament and Council Directive 2006/32/EC
- 18 European Parliament and Council Directive 2003/87/EC
- 19 Council Directive 96/61/EC
- 20 European Parliament and Council Directive 2006/21/EC

Life-cycle thinking

The introduction of the concept of 'life-cycle thinking' to waste policy aims at ensuring that the optimal environmental option within the waste hierarchy is selected in each specific situation. The approach examines environmental impacts at each stage in the life-cycle of a resource or a product with the aim of minimising the overall impacts.



LIFE: Support for an evolving EU waste policy

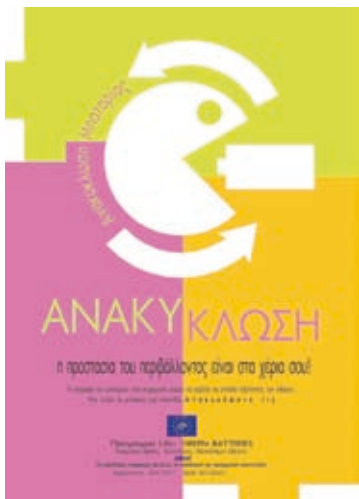
Good waste management begins with preventing or minimising waste generation in the first place. However, where waste material is produced, management and treatment solutions are necessary. Featuring a wide range of innovative and successful waste-related LIFE projects, this LIFE-Focus publication illustrates methods and technologies to treat waste in an optimal way to reduce risks to human health and the environment.

Despite the numerous regulations adopted over the last decades, and the intensive efforts of some Member States to reduce waste volumes, the potential for waste prevention, recycling, re-use and recovery in the EU is not yet fully exploited. Unsustainable trends in waste generation need to be stopped and waste management further improved.

EU waste policy has the potential to reduce the negative environmental impact of resource use and increase resource efficiency in the European economy. This will not only contribute to maintaining the resource base, essential for sustained economic growth, but developments in waste management and recycling will also generate jobs and business opportunities.

Numerous projects co-financed by the European Commission's Financial

Collecting batteries



LIFE02 ENV/GR/000373

Instrument for the Environment (LIFE) demonstrate the technical feasibility and financial viability of methods and technologies that can successfully enhance environmental performance in the waste sector. These include not only a number of projects showing how the planned introduction of life-cycle thinking into waste policy can effectively be implemented, but also many 'win-win' projects¹ underlining that measures to protect the environment can also be financially beneficial.

Current waste policy tools need to be complemented by approaches that promote smarter resource use. This can be achieved by changing production and consumption patterns and through innovation, as confirmed by the European Environment Agency².

However, even innovative technologies that can deliver sizable environmental benefits can have difficulties breaking into the market due to high entry barriers when competing against established conventional technology.

LIFE represents an important tool in helping to overcome such entry barriers. By financing demonstration projects aimed at developing and testing innovative solutions to

¹ For example LIFE99 ENV/NL/000232, LIFE02 ENV/E/000236, LIFE00 ENV/S/000853, LIFE99 ENV/IRL/000605 or LIFE02 ENV/E/000187.

² EEA Signals 2004. A European Environment Agency update on selected issues, p. 6



LIFE00 ENV/GR/000789

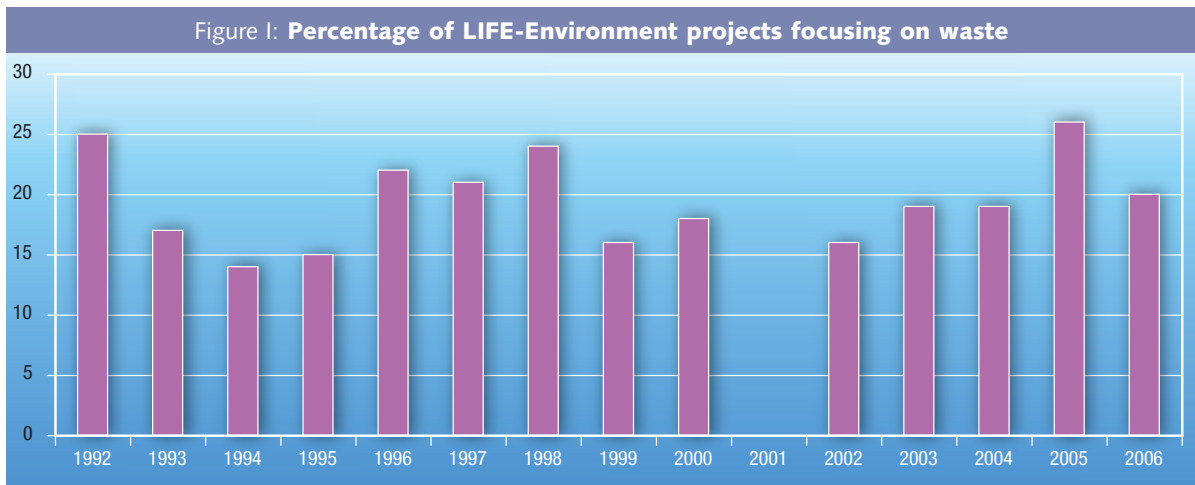
LIFE in action: Managing earthquake demolition waste in Greece.

environmental problems, the programme links research and commercialisation. LIFE bridges the gap between research and development and large-scale application, and assists the widespread dissemination of verified pioneering technologies and good practices.

Recycling paper and cardboard



LIFE04 ENV/FIN/000299



Since 1992, the percentage of waste-related LIFE-Environment projects has remained consistently high and close to the overall average of 19%. (Please note that a cumulative budget covered 2000 and 2001 due to a delay in the launch of the call for proposals under LIFE III.)

290 waste-related LIFE-Environment projects

Since 1992, LIFE-Environment has financed more than 290 projects focusing on waste. These have been complemented by a number of waste-related LIFE-Third Countries and some LIFE-Nature projects. In total, 19% of all LIFE-Environment projects have specifically addressed issues in the waste sector. Project themes include waste collection, manage-

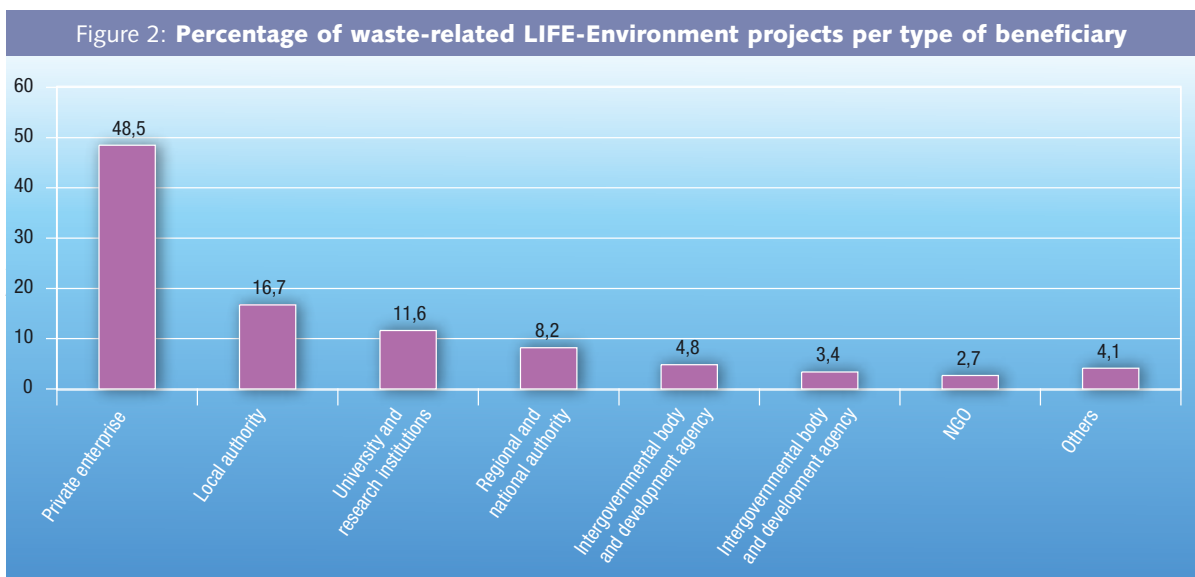
ment, recycling, re-use and recovery. Some projects looked at waste in general, while others focused on specific waste streams such as hazardous waste (19%), municipal waste (18%), packaging and plastic waste (10%), agricultural waste (9%), and waste from electric and electronic equipment (7%) or end-of-life vehicles (6%).

Nearly half of the programme’s waste-project beneficiaries were

private enterprises, underlining the strong economic interest in reducing the amount of waste produced.

The table below shows the range of private and public entities that have engaged -through LIFE - in efforts to improve waste management. The projects covered in the present brochure reflect this balance: twelve of the twenty projects featured are managed by private enterprises.

Enterprises constituted more than 50% of the LIFE-Environment beneficiaries of waste-related projects.



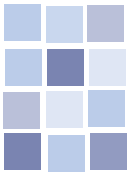


Figure 3: LIFE-Environment projects by approach

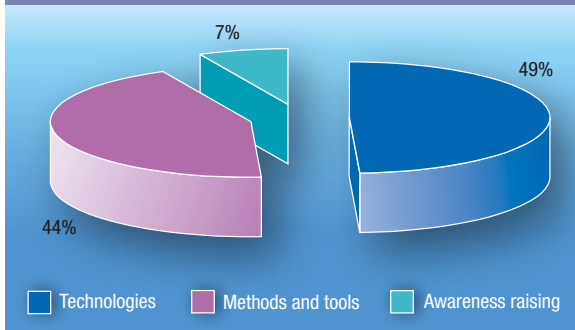
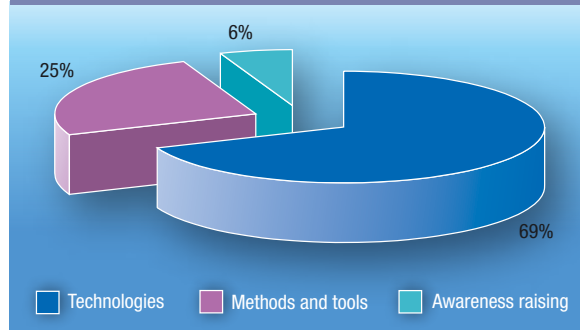


Figure 4: Waste-related LIFE-Environment projects by approach



Old Member States implemented the most waste-related projects, with the most active countries being Spain (51 projects), France (44 projects) and Italy (35 projects). However, two new Member States, Hungary and Slovakia, had the highest proportion (33%) each of projects focusing on waste.

Over two-thirds of all waste-related LIFE-Environment projects were technology-focused, compared to less than half of all LIFE-Environment projects. This shows the particular focus on developing new and more efficient technologies and improvements in working methods in the waste sector. Support from LIFE is

therefore directly contributing to the realisation of the long-term goal of the European Union as defined in the Thematic Strategy on the prevention and recycling of waste: to become an economically and environmentally efficient recycling society.

Disseminating results

Knowledge and information are important to strengthening and improving waste management policy. This brochure aims to support this need by highlighting successful waste-related projects.

The projects featured are from 15 countries and were selected for their level of innovation, the sustainability of their outcomes, their relevance to environmental policy and legislation, or their demonstration value and transferability.

The initiatives chosen for this brochure represent only a small sample of the many LIFE waste projects. Other exciting projects dealing with this issue are listed on page 50 of this publication, and many more can be found on the LIFE website's project database at <http://ec.europa.eu/environment/life/project/Projects/index.cfm> or its thematic pages on waste at <http://ec.europa.eu/environment/life/themes/waste/index.htm>.

Collection point for electrical and electronic equipment



LIFE00 ENV/RL/000764

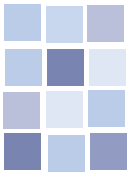
Packaging and plastic waste

Packaging is now estimated to form up to half the volume of municipal waste in western Europe. Over the next ten years, the total amount of packaging waste in the EU-15 is projected to increase by 20-25 % compared to the year 2000.

Packaging comprises an increasing proportion of non-degradable plastic and produces toxic emissions during incineration. It consumes significant raw materials during its manufacture and typically has a very short useful lifetime, soon becoming waste that must be treated or thrown away. Although on the European scale, there has been a continuous increase in the recycling rate of packaging waste, the situation varies significantly between Member States.

The EU packaging Directive encourages the establishment of re-use systems and sets clear targets for recovery and recycling. The LIFE programme supported projects developing innovations such as a self-supporting selective-collection system for plastic packaging waste in the construction sector, a divided packaging waste management system for tourist use or foldable, reusable, and recyclable boxes for fruit and vegetable packaging.





Paperfoam: The 'baked potato' reinvented as sustainable packaging

This LIFE-project successfully demonstrated how injection moulding of potato starch and paper can produce a new form of biodegradable packaging that is economical and of high quality.

Complaints abound concerning the waste produced by packaging. Although necessary for the protection of products for distribution, storage, sale and use, packaging often produces unbiodegradable waste that ends up in landfills and frequently employs non-renewable resources in its sometimes very energy-intensive production.

Whilst high-quality alternatives to traditional petroleum-based packaging, such as bio-plastics, have been developed in the past, these were all very expensive. Just over ten years ago, however, Vertis B.V., a Dutch automation services provider, invented a process and product, which they called 'Paperfoam' that addresses many of these concerns. Paperfoam is a sustainable packaging solution which is sufficiently cost-effective and of high enough quality to be commercially attractive.

The injection moulding technology that Vertis invented in 1996 produces a substance made of renewable natural fibres and potato starch - Paperfoam. In essence, the process involves the injection of a mixture of potato starch and water into a mould before this mixture is then 'baked' in the heated mould. Once ejected from the mould, the substance is ready to be used as packaging. This technology was a major breakthrough in terms of the economies of production and the cost of biopolymer based foam-packaging, especially when compared to other techniques, such as wafer irons. The injection moulding technology originated in the plastics industry, but until Vertis' development, no one had ever tried to use it to make starch-based, biodegradable packaging.



Apple chose Paperfoam for its ability to provide unusually shaped packaging.

Vertis used Paperfoam to package products such as desktop phones, DVDs and iPods. It could also be used, however, for much more complicated and unusually shaped objects. Later on, the firm found that the packaging needed to be stronger to pass transport and drop tests. This was achieved by adding paper to the mix.

'Baking' sustainable packaging

When you walk through the Paperfoam offices, it smells more like the baking of biscuits than baked potatoes. "It is a sort of baking process," says Jan Wietze Huisman, the company's director of research and technology. "In fact, it is quite like baking cookies in another way as well. When you bake biscuits, the first day they are very brittle, but if you leave a tray of them on the kitchen table, you notice that the next day, they are slightly soggy, more flexible. This is because they have absorbed some moisture from the air. Well, Paperfoam uses a similar sort of process

to 'moisturise' the packaging so that it becomes more flexible and less brittle too."

Alternative packaging solutions such as EPS (polystyrene) and cardboard are far less environmentally friendly due to their origin (EPS) or their energy-intensive manufacturing process (cardboard). Paperfoam's process is, compared to corrugated board, much less energy intensive. This is because the wet paper pulp that is used as base material for corrugated board contains about 5% dry matter, whereas the suspended solution of starch and water, which forms the basis for Paperfoam, contains 50% dry matter. This means that it uses about ten times less energy to reach the requested dry matter percentage if Paperfoam is used as base material instead of corrugated board. Furthermore, Paperfoam can be easily disposed of in any waste process (paper recycling, combustion or composting), as it is completely biodegradable and contains no toxic components.

Vertis set up a separate company, Paperfoam B.V., to oversee the implementation of the 'Paperfoam' project. However, first of all, Paperfoam needed to prove the viability of the technology. "We could not afford to produce enough packaging ourselves to supply worldwide," recounts Huisman. "So we needed to prove that the machines and the technology worked."

Demonstrating viability

Thus, with LIFE funding supporting a project that lasted from 1999 to 2001, Paperfoam built a demonstration plant to show the market that all conceiv-

able kinds of packaging could be constructed in a continuous production process, combining design tools (CAD), the injection moulding technique and the company's knowledge-base of fibre-starch recipes.

Specifically, this demonstration plant was meant to enable the Paperfoam company to attract its first commercial orders. This would be achieved by developing a packaging product that was qualitatively very good, biodegradable, able to hold a weight of 1kg, used less energy and contributed to a reduction in surpluses from the industrial processing of agricultural substances into goods that are not meant for human or animal consumption (agrification).

At the end of the project, the results were better than expected. Following the demonstration project, the beneficiary generated orders from five multinational companies primarily in the non-food sector: Bosch, Siemens, Packard, Detewe and Ascom. Furthermore, it sold four licences, to firms in Malaysia, Denmark, China and the US. The financial figures were also better than expected, as more sales revenue was received. Depending on the scale of production and purpose of the Paperfoam packaging, an investment in machinery can be paid back in seven years. As of the end of the project, the profit after seven years was expected to be between €1.4 and €4.5 million. While the basic production cost is higher than other types of packaging, when looking at the entirety of the business production chain, Paperfoam comes out cheaper. As it weighs so much less, transit costs are lowered substantially, thus in the end, the cost to the end-consumer are comparable to other competing products. Additionally, the reduced transportation needs result in lower CO₂ emissions.

In an energy audit performed in 2004, Paperfoam found that in the following year, 2005, almost 7000 GJ of energy

would be saved, when compared with traditional packaging energy requirements, leading to a reduction of 300 tonnes of CO₂ equivalents.

An attractive technology

As it happened, many firms have been attracted to the technology for reasons other than its eco-friendliness. "When people see Paperfoam, they think it is beautiful and recyclable, but often it is some of its other special characteristics that attract clients," notes Ciaran Jetten, Paperfoam's sales manager.

"For instance, because it is very difficult for Paperfoam to be copied – the pre-mix that we add to the starch and water is a secret recipe: it is very difficult to make 'pirate' packaging." This can help with the prevention of piracy of the product the packaging encases. "When companies track down what might be a pirated copy of their product, they can quickly tell if the packaging is not Paperfoam. AMD, when they were looking for new packaging for their hard-drives, went for Paperfoam for these anti-piracy qualities." Similarly, Apple chose Paperfoam for its ability to provide unusually shaped packaging for its sharp lines, a task for which traditional cardboard is less well suited.

However, because the technology cycle for consumer electronics products requires changes in packaging every three years or so, Paperfoam has decided to divide its business into two lines: the first services specialty packaging needs of licensees; and the second line services the packaging needs of standard, more mainstream products that have longer technology cycles, and thus provide more constant business.

This second line has so far produced mainly packaging that replaces the traditional plastic CD and DVD packaging, as well as that of gift cards. Paperfoam themselves now produce some 80 million CD and DVD cases a year. This is

still fairly small – there are 2 billion CD packages produced worldwide every year - but it is all part of the 'green wave' washing over the entertainment industry at the moment as it replaces its petroleum-based packaging.

Under pressure from environmental and labour rights campaigners, the world's largest retailer, Wal-Mart, recently introduced a sustainability 'scorecard' amongst its suppliers – they were to deliver items that were both good for the environment and good for the bottom line. Taking heed of this new approach, Universal Music Group chose Paperfoam as its packaging supplier to improve its sustainability score with the retail giant.

For businesses in a declining sector such as record companies, most packaging alternatives have proved too expensive, even in large volumes. Paperfoam is thus a perfect fit, as it can be produced in bulk and at low cost. Other major record labels, including Sony BMG and EMI have now also decided to go with PaperFoam.

This 'green wave' is expected to spread throughout the entertainment industry and beyond. Thanks to its 'start-up' demonstration funding from LIFE, Paperfoam will be at the forefront of developments, 'baking' its way to sustainable packaging worldwide.

Project Number:

LIFE99 ENV/NL/000232

Title: Paperfoam: demonstration of the applicability of an innovative technology to produce packagings, made of natural fibres and starch, which are both environmental friendly and of a high quality

Beneficiary: Vertis B.V.

Total Budget: € 1,608,000

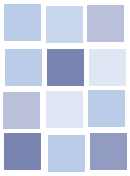
LIFE Contribution: € 358,000

Period: Feb-1999 to Aug-2001

Website: www.paperfoam.com

Contact: Jan Wietze Huisman

Email: huisman@paperfoam.com



AFM: Cleaner, safer water filtration, thanks to recycled glass bottles

This innovative UK project demonstrated the potential of using recycled glass as a medium for water filtration. This not only provides an interesting secondary use for the bottles, but manages to out-perform standard sand filtration methods in terms of water quality.



Recycled glass is the basis of the water filtration medium used here, in this Scottish swimming pool

The project started from the observation that 80% of water supplies in the UK were being treated by rapid gravity and pressure sand filters, the performance of which deteriorate as the bacteria biomass in the sand develops. Bacteria colonise the sand in sewage treatment works, drinking water and swimming pool filters, producing a sticky alginate coat that prevents the filters from working properly after just a few days.

The Scottish-based marine biological company, Dryden Aqua, believed they could develop a new and innovative water filtration product called AFM (Active Filter Media) from recycled glass. It expected that AFM could prove to be more effective than sand filtration systems for the treatment of municipal drinking

water supplies to the benefit of public health. It would also provide an important new use for processed recycled glass.

Recycled glass outperforms sand

The project developed a process to create the AFM water filtration media from recycled glass bottles. The glass is firstly reduced in particle size to equate with sand. It is then further processed to give the media surface a high negative charge or zeta potential and amplify the inherent properties of glass to provide catalytic activity. The negative charge means that AFM can absorb much smaller particles than sand, including sub-micron particles as well a proportion of dissolved organics.

AFM proved to be highly effective at removing bacteria, parasites and organic matter in water filters tested at several different locations, including swimming pools and large aquariums. It improved the quality of sewage effluent by eliminating 90% of pollution and the quality of drinking water by removing 30% more waste. Results included the removal of specific pathogens, the reduction of dangerous chemical compounds – such as trichloramine and trihalomethanes – and a reduction in chlorine consumption of up to 80%.

AFM is presently used on a small scale (approximately 1,000 tonnes) in pressure filters to treat a wide range of water types. However, this project served to demonstrate the tremendous growth potential of AFM for tertiary treatment of sewerage effluent, industrial wastewater, fish farms, swimming pools and landfill leachate. The Drinking Water Inspectorate has also approved AFM filters for use in domestic water supply.

Before and after AFM treatment of sewage effluent



Although the product is more expensive than the sand equivalent, the medium has a lifespan at least 3-4 times longer than sand filter media. Life-cycle cost analysis indicates a return on capital investment measured in months, especially for wastewater treatment, not to mention the health and safety benefits of the improved filtration efficiency. The results and the savings achieved were large enough to convince three local councils and many large private leisure centres in Scotland to adopt AFM in their swimming pools.

Using recycled glass bottles

Besides the obvious environmental and health advantages of the new water filtering system, the project has also created a feasible secondary use for the often wasted resource of used glass and offered the potential to decrease the use of virgin sand, a non-renewable natural resource, in water filtration.

Glass that is crushed and ready to be re-melted is called cullet. Based on the impressive results of the initial investigations, the project sought to create a network of suppliers for the raw cullet that would meet Dryden Aqua's specifications. However, despite the excess of recyclable glass, this proved more difficult than anticipated, with the project unable to source adequate quantities of processed glass.

Much waste glass is reprocessed by the recycling industry for use in industrial sectors such as the production of aggregate for road building. This requires much less processing than is needed for AFM and at present there is little economic incentive for glass to be processed in the specific way required given the limited market for such a product.

Project logo showing the Active Filter Media

Furthermore, since companies that presently process glass for recycling in the UK are not accustomed to treating glass as a secondary product, but as a waste product, few of the big recycling companies have the ability to supply the glass processed in the way required for the AFM product.

Instead of a network, the beneficiary therefore developed a working relationship with one company to supply the required glass. It established the first full-scale processing facility for AFM, primarily exploiting waste green and brown bottles, with a capacity to process 20,000 metric tonnes per year. It is hoped that an incremental increase in demand for AFM will be met with a similar increase in supply.

Extending the use of AFM

The fact that the AFM filter out-performed traditional sand filters in initial testing suggests there is much scope for the extended use of the filter to provide improvements in water quality. Opening up future markets to AFM could, for example, contribute to removing the environmental impact of industrial, sewage and landfill wastewater discharges. It could also reduce the need for chemical treatment through improved primary filtration.

The approval of AFM by the Drinking Water Inspectorate has already presented opportunities for its use within the water industry. Significantly, the political climate is currently highly favourable for the future expansion



Dr John Hargreaves, chief executive Scottish Water PLC, and minister for the environment Ross Finnie, MSP, visit the AFM system

of the market. As drinking water and wastewater disposal standards become stricter in the coming years, AFM filtration will become increasingly attractive to water treatment facilities of all kinds.

The development of the AFM market will provide considerable benefits to public health and the aquatic environment. Furthermore, since a large water plant may require up to 35 tonnes of AFM, it will also contribute to boosting the market for recycled glass. The AFM LIFE project has thus made an important contribution towards the double objective of enhancing wastewater treatment and waste glass recycling.

Project Number:
LIFE02 ENV/UK/000146

Title: Development and applications of advanced filtration medium

Beneficiary: Dryden Aqua Limited

Total Budget: € 1,166,000

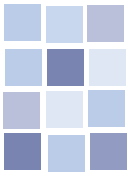
LIFE Contribution: € 176,000

Period: Jul-2002 to Jul-2005

Website: www.AFM.eu

Contact: Howard Dryden

Email: aqua@drydenaqua.com



WPC-Recycle: 'Greener' outdoor products from recycled thermoplastic waste

BEST PROJECTS AWARD
2004-2005

This German LIFE project demonstrated a new technology to use recycled thermoplastic waste to create 'Wood Plastic Composites' (WPC), a new, cost-effective and more environmentally friendly material for manufacturing products for outdoor use.

Traditionally, products for outdoor use such as garden furniture have had to be coated with duro-plastic resins and treated with environmentally damaging fungicides. The energy input during production is relatively high due to the long treatment times at high temperatures. Furthermore, the combination of chipboard and duro-plastic means that used products cannot be recycled.

Thermoplastic waste, such as packaging waste, is also a major environmental hazard. However, the German project beneficiary Werzalit - a company specialising in veneer sheets, woodchip panels, furniture and weather-resistant products - foresaw a way to recycle thermoplastic waste to create an environmentally friendly WPC material for outdoor products that could itself be recycled after use.

Cheaper and more environmentally friendly

The combination of the technical characteristics of woodchips and thermoplastics was shown to be feasible during laboratory research. The project experimented with and optimised the production of WPC with young polypropylene, substituting the thermoplastic component up to 100% with recycled polypropylene.

Based on excellent test results, the project produced decorative, covered, semi-finished side panels using WPC core material and thermoplastic foils suitable for outdoor use. The foils and the extruded molten WPC core material were combined in a double belt press,

calibrated and cooled. This resulted in a non-destructible adhesion without the need for additional glues.

The new material proved to be weather-resistant, without the need for potentially environmentally harmful wood preservatives. The more effective production process also reduced the overall quantity of material needed and minimised the use of new thermoplastic material in wood-plastic-composites.

WPC does not require the use of fungicides, halogens, chlorines, or formaldehyde, whilst the substitution of pure plastics with ecological wood-based materials (domestic timber) helps reduce CO₂ emissions. It creates new opportunities for recycling thermoplastic waste material, thus extending its life cycle. Future waste is also prevented, since the material itself is easily recycled and spare material and chippings can be easily remoulded.

The project therefore successfully demonstrated that the recycled material could replace, and even outperform coated wood chipboards. The new technology also offers economic benefits, since recycled polypropylene is cheaper than young polypropylene.

Since the project ended, compression moulding has been replaced by injection moulding and also extrusion. Although extrusion products - such as profiles for flooring - are still produced with juvenile plastics because of the high optical requirements, the share of recycled plastic in the



WPC can make use of more than just a handful of recycled pellets from thermoplastic waste

injection moulding is about 60%. By September 2007, six full-scale production lines and 16 new jobs had been created in Werzalit's WPC department. Increasing quantities and varieties of WPC products are being produced and the plastic wood compound sold as granulate to other injection moulding companies. The material is now being used by well-known sound system supplier Bose to equip Audi with high-fidelity speakers.

Project Number:
LIFE00 ENV/D/000348

Title: Pilot-plant for the material utilisation of plastic waste in the production of products based on new, polymer-bound wood materials

Beneficiary: Werzalit AG + Co KG

Total Budget: € 1,579,000

LIFE Contribution: € 153,000

Period: Dec-2001 to May-2004

Website: www.werzalit.de

Contact: Matthias Schulte

Email: m_schulte_of@werzalit.de

Organic and biodegradable waste

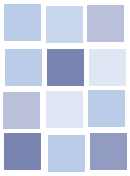
Biodegradable waste is capable of undergoing biological decomposition. It is made up of food waste, garden waste, paper and cardboard, some textiles and wood waste. Much of it comes from ordinary households. On average, the annual production of biodegradable municipal waste is around 300kg per capita in EEA member countries.

The main negative impact of biowaste occurs when it is landfilled. This produces methane, a greenhouse gas which is a potent greenhouse gas (21 times more potent than carbon dioxide) and which accounted for 3% of total greenhouse gas emissions in the EU-15 in 1995. A major aim of the European Landfill Directive is, therefore, to reduce the amount of landfilled biodegradable waste and to apply life-cycle thinking to biowaste management policies.

The three principal alternative treatments to landfill are central composting, incineration with energy recovery and recycling. The LIFE programme has supported the development of such alternatives, including projects on the recycling of organic waste through co-fermen-

tation in municipal sewage sludge digesters, local systems for recycling wastewater and organic household waste, and the development of biodegradable covers for sustainable agriculture.





RecAsh: Recycling ash to enhance the sustainability of biofuel production from wood

The forests of Sweden and Finland are the first to benefit from the RecAsh project, which has developed new systems for spreading wood ash, helping to return important nutrients to forest soils and, thereby, greatly improving the sustainability of bioenergy production from logging residues.

One contribution to the EU objective of developing new and renewable energy sources is to increase the use of biomass, such as wood. However, when logging residues such as small trees, branches and tree tops are also harvested for use as bioenergy the loss of nutrients and acid-buffering substances from forest ecosystems increases by a factor of 1.5 to 4.

These practices can lead to the acidification of soil and the disappearance of fish from neighbouring streams and lakes. The EU's 6th Environment Action Programme (EAP) recognised this potential conflict between forest sustainability and the increased use of biomass when it stated its objective "to ensure the consumption of renewable and non-renewable resources and the associated impacts do not exceed the carrying capacity of the environment."

The Swedish Forest Agency saw that intense wood harvesting was being carried out on an area equal to 30,000 hectares per year in Sweden and that this was set to increase. Furthermore, despite recommending ash recycling in forests, this was only happening to a fraction of the estimated annual production of 300,000 tonnes.

From existing research, the agency was aware of the benefits of spreading ash in forests and knew that there was interest in this technique. However, a lack of knowledge, regulation and training materials represented significant barriers to the practice. It therefore applied for LIFE funding



Spreading recycled ash in the forest returns valuable nutrients to the soil

to help develop, document, demonstrate and analyse regular ash-recycling systems covering the entire chain from bioenergy extraction to ash recycling.

Optimising ash recycling processes

The project gathered and analysed existing knowledge on ash recycling before selecting, developing and testing two full-scale demonstration working methods in Sweden and Finland. These systems integrate all stages of the process - including ash storage, production of hardened products, transport, contact with forest owners and authorities,

spreading, and documentation.

Lars Andersson from the Forest Agency highlights that, "a significant achievement of the project was in taking techniques from different places and situations and demonstrating how these could be integrated into a single system, including treatment and controlled spreading of the ash."

The project allowed the partners on the ground to experiment with processes and techniques to achieve the best results. Each system was monitored to localise bottlenecks and identify and test ways of improvement along the various steps in the chain.



Recycling wood ash enables logging residues to be used as bio-fuel in a sustainable way.

In the Finnish case, the project worked specifically to find the optimum balance of peat ash and wood ash for forest fertiliser and on combining sludge and ash recycling. It developed an efficient logistics system for ash recycling, and linked the ash handling of smaller heating plants with existing pioneer systems. It included the identification of difficult stages in the ash recycling chain and potential solutions for overcoming these difficulties.

Ash classification study and optimisation of processes

The project carried out an ash classification study to produce recommendations for maximum and minimum contents of various elements - including both nutrients and hazardous elements - and a minimum level of stabilisation for recyclable wood and wood/peat ashes.

The study concluded that wood ash should only originate from the combustion of non-contaminated wood and contain all the macronutrients present in logging residues (except nitrogen, which is eliminated during combustion). It should first be processed to reduce reactivity and solubility. These conditions are designed to prevent: the accumulation of harmful substances in the soil; damage to natural vegetation, such as mosses, during spreading; and harmful adjustments in the pH of nearby streams through any acidification of the soil.

Three main methods for processing wood ash were identified: self-hardening and crushing; compaction; and granulation. In all three processes, the

ash is first soaked in water to initiate chemical hardening, but the amount of water required and the procedures that follow vary between the processes. Self-hardening and screening was found to be the most widely practised technique, mainly because it is cheap - between €10 and €20 per tonne of ash - and requires little auxiliary equipment.

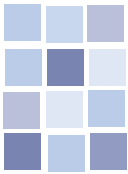
When the ash has been properly processed, it can be spread either by ground spreader - which is considerably more common due to the lower cost - or helicopter. A ground spreader normally comprises some kind of forwarder and tractor with spreading equipment consisting of rotating plates. The spreading capacity is between 8 and 13 tonnes per hour and the cost of spreading is approximately €16 per tonne.

Suitable sites for spreading include thinned stands where the ash spreader can use existing access roads and clear-felled areas with established ground vegetation. Ash is typically transported to forests in demountable body trucks. The maximum transport distance should generally be 100 km and the cost of this is between €0.5 and €1 per tonne per 10 km. The ash (pile or container) and spreading site should not be more than 400 m apart and a spreading location should be at least 20–25 hectares in total area. Naturally, small sites far from the road are more expensive to treat than large ones at the roadside.

A suitable dose of ash must be determined. The maximum dose allowed in Sweden is 3 tonnes of wood ash (dry weight) per hectare, while lower doses are recommended for less fertile soils. In medium to highly productive mineral soils in southern Sweden, a dose of 2 tonnes of ash per hectare has been found to increase tree growth by 14% on average. In Finland higher doses are used to increase tree growth on drained peatland.

Recycled ash can also be spread in the forest by helicopter





Organic and biodegradable waste

Environmental benefits

In the Swedish demonstration areas, the LIFE project RecAsh successfully reduced the amount of ash dumped in landfills from 22,000 to 13,000 tonnes. This equated to a reduction from 60% to 35% of total wood ash production. In the same area, ash recycling - either as forest fertiliser or to cover old landfill sites - increased from zero tonnes in 2002 to 7,500 tonnes in 2006. A total of about 5,000 hectares were treated with ash.

Within the Swedish case study area, the harvest of logging residues during regeneration felling increased during the whole project period from 16% (2002) to 38% (2006). This harvest of logging residues was performed on approximately 27,000 hectares, corresponding to an energy value of 270,000 m³ of oil and 990,000 tonnes of CO₂ from fossil origin.

The project suggests that wood fuel combustion can be sustainable in the long-run. Recycling wood ash to the forest should enable more logging residues to be used for bioenergy in a sustainable way, thus contributing to the development of renewable energy with reduced waste and CO₂ emissions.

The expected environmental benefits from further ash recycling include an optimised nutrient balance and buffering capacity of forest soil and improved water quality in small streams within the forest landscape.

Sustainability and continuation of ash recycling

Lars Andersson points out that “the major challenge for the implementation of ash spreading in forests is the existence of cheaper alternative uses for ash such as landfill cover.” The pressure from these competing alternatives forced the project to seek cost minimisation at all times. “This should be beneficial in the future when competition from landfill diminishes and greater economies of scale emerge.”



The project tested all stages in the ash recycling chain to ensure a sustainable process

A key element of the project was the development of handbooks, demonstrations and seminars for local, regional, national and European stakeholders to raise awareness of the motives for ash recycling and technical, logistic and administrative solutions.

The handbooks describe techniques, laws, costs and environmental benefits of ash recycling in Swedish, Finnish and English. Seminars covered how to sample, stabilise, store, transport and quality declare the ash, the choice of receiver areas, and finally how to document each treatment.

As they do not depend on high technology, it is expected that the methods developed will be widely transferable to other countries in an affordable manner. One entrepreneur is already spreading ash on a commercial basis in Sweden following the RecAsh experiences.

The extended spreading of recycled ash will partly depend on the developing role of biomass in energy production. To compensate for the increased exploitation of wood as a source of bioenergy, there will be scope for fur-

ther legislation to promote the recycling of ash.

Lars Andersson concludes that, “perhaps the greatest success of the project was that it received positive comments from all groups, including forest owners, local authorities and environmentalists.” These are the groups who will be in a position to maintain the systems beyond the project and with whom the responsibility now lies to advance the processes developed.

Project Number:
LIFE03 ENV/S/000598

Title: Regular Recycling of Wood Ash to Prevent Waste Production

Beneficiary: Skogsvaadsstyrelsen Vaermland–Oerebro - now the Swedish Forestry Agency

Total Budget: € 1,714,000

LIFE Contribution: € 853,000 (expected)

Period: Aug-2003 to Dec-2006

Website: www.recash.info

Contact: Lars Andersson

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lars.t.andersson@skogsstyrelsen.se

Bio Waste: Increasing the composting of household bio-waste in Latvia

A new system for collecting and composting biodegradable household waste in Latvia has reduced the amount of bio-waste going to landfill by 30%. This contributes to reducing gas emissions and groundwater pollution.

More than 30% of Latvian municipal waste was identified as biodegradable. Around 40% of this was composted, but the rest was generally disposed of in landfills. This practice was contributing to methane emissions and the pollution of local groundwater with heavy metals, toxic organics, microbes and other pathogens.

Efficient collection of bio-waste

The LIFE project mapped the waste produced and concluded that it was most efficient and effective to locate collection points close to major residential buildings with special 'bio containers' for separated biodegradable waste, secondary used materials and waste for disposal. It established 35 collection points with 83 bio containers across two municipalities. During the implementation of the project around 600 tonnes of sorted bio-waste was collected - about 60m³ per month. The beneficiary, the Waste Management Association of Latvia, estimates that this equates to around 30% of the total household bio-waste produced.

The project promoters held meetings with local people to ensure their active participation in waste management. Leaflets and posters raised awareness of waste sorting and collecting, while printed paper bags were distributed to households for the collection of biodegradable waste and to inform inhabitants about composting. From initial levels of 10-15%, this educational work reduced the impurities found in the collected biomass to around 5%.

Based on the results of the project, it is estimated that if the separately collected bio-waste had been dumped and



The compost gained from the project's closed bioreactor plant showed to be of better quality than the compost from open-air windrows.

digested in a landfill site, it would have produced around 117,600 m³ of landfill gas. Further CO₂ emission reductions were achieved thanks to the shorter transportation distance to the composting site compared to the landfill.

Improved composting

The project designed a pilot closed bioreactor plant with a capacity of 25 m³ of bio-waste per week and tested this against composting in open-air windrows and open-air piles. The compost from the bioreactor was the best quality and could be used in gardens and fields to provide valuable nutrients and organic matter to soil. This ensured the return of the bio-waste to the life cycle as high quality fertiliser.

Open-air composting is relatively cheap - the treatment cost of €10 per tonne is less than the €15 disposal fee in new sanitary landfills. However, the produced compost contained imbalanced nutrients and bacteria such as *St.aureus*. It was therefore deemed inadequate for use as a fertiliser, although it could be used as landfill covering material.

Both municipalities involved in the project expect to continue collecting separated biodegradable waste for composting, while other Latvian municipalities have also shown an interest in this approach. The project results were used as the theoretical and practical basis for the elaboration of a complete national plan of bio-waste management by the Latvian Environment Ministry, thus ensuring their continued impact on future practice.

Project Number:

LIFE03 ENV/LV/000448

Title: Treatment of Biodegradable Organic Municipal Waste Using Composting Technologies

Beneficiary: Waste Management Association of Latvia

Total Budget: € 934,000

LIFE Contribution: € 432,000

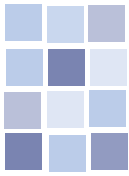
Period: Oct-2003 to Dec-2005

Website:

www.lasa.lv/life_en/index_L_en.html

Contact: Dr. Ruta Bendere

Email: bendere@edi.lv



Ecofilter: Reducing ammonia emissions and odours from composting

The Ecofilter LIFE project used a new Best Available clean Technology to achieve a 95% reduction in ammonia emissions and odours from compost production. The closed system developed at the mushroom plant of the Hungarian beneficiary also improved production efficiency and reduced energy use.

Agaricus bisporus – better known as the white button mushroom – has become an increasingly popular food product: European output has risen to about one million tonnes per year. The problem is that cultivating this amount of mushrooms requires the production of compost - from straw and horse and chicken manure - which releases approximately 13,000 tonnes of ammonia into the air per year.

The beneficiary, Bio-Fungi Ltd. is a family-based Hungarian company, which has amplified its production of mushrooms since the transition from communism from a few hundred to nearly thirty thousand kilograms per week. However, this success was generating complaints from local residents regarding the smell from its factory in Áporka.

Closing the composting process

The company aimed to implement the Best Available (clean) Technology to satisfy the strictest possible social and environmental conditions. LIFE funding contributed to the development of a composting process that is closed throughout with an associated clean system for purifying the air.

Covered wetting, mixing and storage areas were established. The aggressive nature of composting was taken into account with the use of ammonia and moisture resistant materials - such as hot-dip galvanised iron, stainless steel - and tight insulation.

Three indoor tunnels were constructed with pressure controls and an exhaust



24 compost tunnels were constructed by the end of 2007

duct system with integrated bio-washer and bio-filter. The air is first drawn through the bio-washer, which uses clean water to absorb up to 80% of the ammonia and reduce its concentration to around 100 ppm. It then passes through the bio-filter, which uses a material such as straw to absorb around 90% of the remaining ammonia. Thus, a totally clean process, without the use of chemicals, achieves a 95% reduction in local air and odour pollution.

The used water from the bio-washer is not expelled into the ground where it would pollute the soil, but collected and used to contribute to the production of the compost. The quality of the compost produced is improved: the average yield increases by 15-20%. Furthermore, the operation of a conveyor belt and overhead-filling system helps generate energy savings of 20-30% compared to traditional processes using front-end-loaders or turntable devices. The project achieved ISO 14001 and 9001 certification, thus demonstrating the quality of the management process implemented.

The project increased the production capacity of the company and

simultaneously saw complaints from residents diminish. This double positive ensures the sustainability of this growing sector and demonstrates its attractiveness for similar companies elsewhere.

After the project ended, the beneficiary continued to construct compost tunnels for mushroom production: 24 tunnels were completed at the site - equalling an investment of approximately €4 million - by the end of 2007. An additional ten workers were employed as a result of this expansion.

Project Number:
LIFE04 ENV/HU/000372

Title: Modern and environmental friendly composting methods of agricultural waste

Beneficiary: Bio-Fungi Termelő és Kereskedelmi Kft (Bio-Fungi Mushroom growing Compost producer Ltd)

Total Budget: € 1,681,127

LIFE Contribution: € 340,683

Period: Dec-2003 to Dec-2005

Website: <http://www.biofungi.hu/eng/index.php>

Contact: Arpad Mutsy

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Waste oils

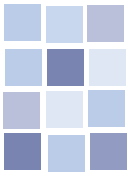


In 2003, the EU was consuming roughly 4.4 million tonnes of lubricant oils a year, with just over half of this destined to become waste oil - the rest being lost during use, or through leakages. The 2.5 million tonnes of waste oils generated each year are hazardous and can severely contaminate water, air and soil.

Collecting as much used oils as possible is crucial, both to avoiding contamination of the environment and to realising profit from the very high recovery potential of this waste stream. The average collection rate in the EU-15 is around 81%, which can be improved. The remaining 19% is unaccounted for, but is probably burned illegally or dumped in sewage or elsewhere.

For a long time, the waste oil Directive has regulated the disposal of waste oils and prescribed waste oil regeneration. In the context of simplifying the current legal framework, it is planned that a new provision in the waste framework Directive will repeal and replace the Directive. Successful LIFE projects have contributed to improving the management of waste oils with the establishment of effective collection systems and innovative regeneration methods.





ICOL: Driving up waste lube oil recycling rates in Greece

This LIFE project demonstrated an integrated collection system to allow for the regeneration of waste lube oils (WLO) in Greece. A true ‘win-win’ project, it not only provided a more sustainable alternative for the management of WLO, but also removed the need for WLO importation by Greek re-refineries.

Lube oil is a by-product in the distillation of petroleum to produce petrol. It is a transparent, colourless oil, which is of low value but produced in high quantities to meet the growing needs of industry and motor vehicles. It is used to lubricate moving parts and for cooling, cleaning and corrosion control. Used mineral lubricating oils represent the largest component of liquid, non-aqueous hazardous waste in the world.

In Greece, the standard methods of WLO collection and re-use were considered inadequate and did not completely guarantee environmental safety. Comparative figures showed that with only 37% of WLO collected in 2000, Greece was bottom of the table of the EU-15. In 1999, 63% of the waste oils in Greece were illegally burnt, 28% incinerated and only 8% regenerated.

Burning or uncontrolled dumping represented inadequate disposal methods posing significant environmental threats, including the pollution of soil, surface water and groundwater. Furthermore, poor collection rates meant that the potential for the re-use of collected oil was lost and refineries had to rely on imports of more expensive crude oil.

Pioneering WLO collection in Greece

Where no systematic collection existed, ICOL aimed to develop and monitor an integrated system to increase WLO collection rates, with minimised costs and significant envi-



Michalis Pachnos and Panos Metsovitis in front of the Cyclon refinery in Asporrygos

ronmental benefits. To test the system’s transferability and sustainability, it was implemented in two large but different urban and industrial centres in Greece: Thessaloniki in Northern Greece and Patras in the south-west.

Launched in October 2002, the 36-month project was implemented by the beneficiary, CYCLON Hellas S.A., a private industrial and commercial company acting mainly in the field of WLO re-refining and the production of lubricants and base oil, and its partner, EPEM S.A., a private environmental consulting company.

“What I am most proud of is that this LIFE project was a driving force to escalate the collection of the very dangerous WLO in Greece,” says Dimitrios Kontaxis, managing director of CYCLON. “You might have a good idea, but you never know if it will really work and pay off. The LIFE programme helped to overcome this dilemma.”

An optimum WLO collection system

The project team created a first register of 1188 WLO sources, which provided a basis for developing effective WLO management procedures. By the end of the project, this register had been extended to all the sources in the two regions: 1975 WLO sources in Thessaloniki and 765 in Patras. The main sources were found to be petrol stations, vehicle-repair workshops, factories, harbours and airports. All collection points were registered on digital maps with the help of a Geographical Information System (GIS), using their unique spatial coordinates.

The established fleet of collection trucks (eight for Thessaloniki and four for Patras) were equipped with GPS and GPRS enabling the continuous monitoring of their geographic position, speed and direction. The data was transferred via mobile telephony and easily accessible on the internet, so that CYCLON was in the position to record and process it. Together with the digital maps, this enabled the optimised organisation of collection routes.



A fleet of trucks collects WLO from more than 33,000 sources all over Greece

Level sensors installed at the bottom of the tanks at the collection points and on the trucks' tanks gave accurate and up-to-the-minute information about the availability of WLO at each collection point and the amount already collected by the trucks. These elements allowed for the systematic and real-time monitoring and optimisation of the integrated WLO collection process. This facilitated increased efficiency through the minimisation of collection journeys and the maximisation of quantities collected through optimising the capacity to deal quickly and effectively with delays and potential problems such as leakage or illegal WLO trading.

Two transfer stations, one in Thessaloniki and one in Patras, were constructed for the temporary storage of the collected WLO, prior to transfer to the beneficiary's refinery in Aspyrgos. Here, chemical quick tests were conducted on the incoming WLO, including a drop test (to detect crude oil), a LUX test (to detect fatty acid and esters) and a distillation test (to detect the water content).

During the project, all the collected WLO was found to be suitable for regeneration in the CYCLON refinery using the environmentally friendly cat-

alytic hydrogenation method. This is the most efficient method for refining mineral oils, to produce high quality regenerated oil without toxic waste.

Noteworthy results

"The collection and treatment of WLO is a difficult and dangerous job," states Panos Metsovitis, who was responsible for the ICOL project implementation and is still in charge of WLO collection. "ICOL's results are therefore very impressive, and were realised much quicker than expected." Indeed, with 9,818 tonnes of WLO collected and regenerated, remarkable recovery rates were achieved during the implementation of the project.

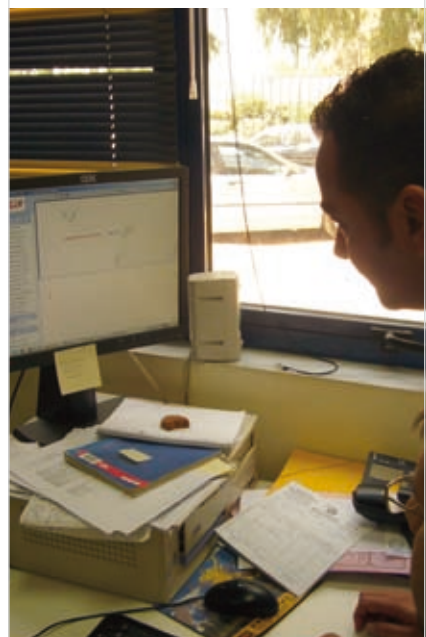
Michalis Pachnos, who was responsible for ICOL's administrative project support, explains that another challenge was that, "collection rates originally dropped in the coldest months due to the illegal and dangerous use of WLO as heating fuel and in the summer because of the holiday period." Thanks to growing environmental awareness and the dissemination work of the project team the collection rates were stabilised throughout the year. Panos Metsovitis is sure that "more and more people now know

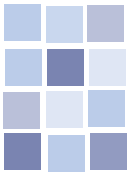
that, because of the major negative health and environment impacts, waste lube oils should not be burnt as heating fuel."

EPEM compared alternative WLO management practices such as the burning of WLO in cement kilns and regeneration. The implementation of a Life Cycle Assessment of WLO made it clear that regeneration is far better for the environment than the production of virgin oil and the uncontrolled disposal of WLO. Avoiding incineration and dumping reduces air emissions and water, groundwater and soil contamination.

A cost-benefit analysis revealed that the integrated collection of WLO implemented by ICOL is an efficient business activity and has positive socio-economic and environmental effects. The study came to the conclusion that the incineration of WLO results in external costs of €186.50 per tonne. In contrast, the WLO collection and subsequent regeneration via catalytic hydrogenation created an annual benefit of approximately €1,000,000 for Thessaloniki and €560,000 for Patras.

The Geographical Information System enables Niotis Manolis to check the WLO collection in real time





Taking samples of the incoming WLO

Synergy effects with Greek legislation

In 2004, a Presidential Decree (PD) 82/2004 on measures, terms and programme for the alternative management of WLO was passed, in line with EC legislation for the environmentally sustainable management of waste oils.

The PD was the driving force behind the establishment of a company called EL.TE.PE as the certified national body for WLO collection in Greece and subsidised by the producers of lube oil in Greece according to the 'polluter-pays-principle'.

Although CYLCON and ICOL began their activities 18 months before this supporting national Decree became operational, as Michalis Pachnos explains, "the timing of the LIFE project and the introduction of the law were a happy coincidence. When the national collection system came into force in 2004, CYCLON's expertise and its knowledge about the collection points gained thanks to ICOL were very valuable."

LIFE after LIFE

Within Greece, the project has already demonstrated its transferability. Around 95% of all WLO sources in Greece were registered by 2007, giving a total of 33,000. Since 2006, this includes collection points on the 50 biggest Greek islands. This is a particular success given the high collection costs, at around €5,000 per tonne, of WLO on the islands.

Furthermore, the beneficiary has already established and operates five more transfer stations in other locations in Greece - Athens, Volos,

The ICOL collection system provides CYCLON with sufficient WLO to meet the production requirements.

Kozani, Kavala and Crete. The WLO collection system is therefore expanding to the whole country and could even be extended to other neighbouring countries.

Technical difficulties experienced during ICOL were tackled in successive projects, as Nikolaos Rempakos, project manager and CYCLON plant manager explains. "A Phase 2 project aimed to make the level sensors in the tanks more robust, since measuring WLO on a moving collection tank was not possible during ICOL. A further Phase 3 project is planned to develop sensors which not only measure the capacity of the trucks' tanks but also temperatures, pressures, engine data, etc."

The project has led to continued improvements in recovery rates: in 2006, 40,000 tonnes of WLO were collected and recycled. The team hopes to achieve 100% collection rates and the goal for 2008 is 60,000 tonnes. This will be facilitated by new efforts to collect WLO from ships.

Thanks to the project, CYCLON and other Greek refineries have now stopped importing raw material as the quantities of WLO are sufficient to meet the production requirements. In the future, CYCLON even hopes to start exporting the high quality oils obtained from regenerated WLO.

Project Number:
LIFE02 ENV/GR/000360

Title: Innovative collection system and Life Cycle Assessment for waste lube oils

Beneficiary:
CYCLON HELLAS S.A.

Total Budget: € 3,109,000

LIFE Contribution: € 731,000

Period: Oct-2002 to Sep -2005

Website:
www.epem.gr/icol/index.html

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Used Oil's Highway: Romania's first ever management system for waste oil

The Used Oil's Highway project created a new collection system, storage infrastructure and management process for all waste oils in Western Romania, reducing the pollution of local rivers by 30%.

The project beneficiary, the Environmental Protection Inspectorate Resita (EPIR), estimated that each year in the region of Western Romania, car owners who changed their motor oil themselves were generating between 0.4 and 1 million litres of waste oil, and regional industries another million litres.

None of the oil from either source was being recycled and although much was unaccounted for, EPIR believed that two-thirds of it was being dumped into the environment. This was estimated to cause 60% of the oil pollution of waterways in the region.

Collection and management of used oils

The Used Oil's Highway LIFE project created a Used Oil Division (UOD) within the PETROM Company to develop Romania's first integrated used oil management plan. UOD set up a pilot network of collection points for used motor oil at PETROM petrol stations in the county. It also established a single, authorised location to accept and store the oil, which had an Automatic Supervising System to monitor and control its environmental security.

From there, waste oil was dispatched to the nearest treatment installation, and around 100 tonnes was delivered monthly to industrial applications that burn used oil efficiently and safely.

A database was used to record and monitor the oil collected. EPIR was able to monitor 90% of the industrial facilities and close 95% of the unauthorised, inadequate storehouses of used oil.



From a central tank in Resita City, the used oil is transported via road and railway for refining or safe burning.

Spreading the message about oil recycling

A major challenge for the project was to change people's attitude to the disposal of used oil. Under the slogan "Every drop of used oil is important for us!" the project combined general awareness raising with specific information on how to minimise oil leaks, how to collect and store used oil and where to take it for recycling.

Used Oil's Highways contributed to proposals to bring Romanian law into line with the European Directives on used oil management. Used oil generators are now required to register and report their oil recycling activities and store and deliver their waste oil appropriately.

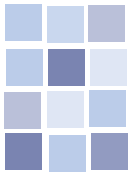
The project was awarded First Prize in the category of 'Environmental Protection and Technology in Central, Eastern and South-Eastern Europe', at the 2001 OEGUT Environmental Award.

The success of the pilot scheme saw it extended quickly to the national level. Since the project ended, two other environmental protection agencies asked for detailed information on the projects tools to replicate the scheme.

Furthermore, the used oil producers' database has been adopted by the Ministry of Water and Environment as a pattern for similar endeavours by local environment protection agencies.

The project helped reduce the pollution of surrounding waterways by 30%. In 2007, after the introduction of the LIFE collection system, the number of small-scale, used-oil pollution incidents decreased by 20-30%. To improve these results, the main challenge remaining is to further change the behaviour of individual oil consumers, from whom it was estimated that only 10% of used oil was collected during the project.

Project Number: LIFE00 ENV/RO/000989
Title: Creation of a selective collecting network for used oils in the Western (V) Region of Romania
Beneficiary: Environmental Protection Inspectorate Resita
Total Budget: € 732,500
LIFE Contribution: € 146,014
Period: Sep-2001 to Aug-2004
Website: www.uleiuzat.ro
Contact: Ilie Chincea
Email: environ@cs.ro



DOL-EL: Recovery of base oil fractions from used oil lubricants

BEST PROJECTS AWARD
2006-2007

The full-scale operation of a new 'Enhanced Selective-Refining' process to recover high-grade base oils and solvents from used oil lubricants was demonstrated by this German project.

Every year, the EU uses 4.7 million tonnes of oil lubricants and recycling rates have been very low. However, as the Mineralöl-Raffinerie Dollbergen GmbH (MRD) stresses, 'used' does not have to mean 'waste'.

It only takes 1.3 tonnes of used oil - compared to ten tonnes of crude oil - to produce one tonne of high-grade base oil for the lubricant market. Furthermore, even the leftover fraction of the recycling process can be recovered for use in industrial heating. From a life-cycle perspective, waste oil recycling is far superior to combustion.

A challenge in this sector has been the increased use of non-conventional oils such as synthetic oils with increasing amounts of elaborate poly-alphaolefins (PAO) and growing levels of toxic polycyclic aromatic hydrocarbons (PAH). These trends came partly from the development of new quality criteria for state-of-the-art motor oil lubricants - accounting for 50% of the recycled oil market.

MRD, the LIFE project beneficiary, had already developed an innovative solvent extraction process for used oils, but existing processes were not able to both eliminate the PAHs and recover the valuable synthetic base oil fractions - these expensive and fragile components were destroyed in conventional recycling processes. MRD therefore aimed to develop a new process based on a liquid-liquid extraction technology to achieve this double objective. This project demonstrated the full-scale operation of this new 'Enhanced Selective-Refining' process, using N-methyl pyrrolidone



Aerial view of the Mineralöl-Raffinerie Dollbergen site

(NMP). This highly selective non-toxic solvent is soluble in water and biologically harmless meaning it can be repeatedly and completely recovered and re-used in the process.

The process achieved the elimination of PAHs to less than 1 mg per kg (=1 ppm) with the simultaneous retention of high-quality semi-synthetic and fully synthetic base oil fractions such as PAOs and their associated positive properties. It completely satisfied and even exceeded current requirements regarding quality and improved on the results of traditional processes.

The average base oil yield within the process is about 91%. The base oils produced have superior properties, including a high viscosity index, low evaporation loss during use and high oxidation stability, providing excellent lubrication at different temperature levels and over time.

The process achieved its waste-free objective through the recovery and reintroduction of the used solvent and the collection of extracts from the process to be used internally as fuel for steam generation or sold as a heavy fuel oil component. This is in contrast to the old clay treatment process, which required the annual disposal of 4,900 tonnes of used clay.

Customer requirements with respect to colour and smell of the final products are fulfilled at the same time as substantially reducing greenhouse gas and sulphur dioxide emissions.

Both national and international patents have now been granted for the process, which promises high levels of flexibility in the face of evolving compositions of used oils and increasing quality requirements for base oils. This should ensure ongoing and widespread environmental benefits from the process.

Project Number: LIFE00 ENV/D/000318

Title: Planning and construction of the demonstration unit 'MRD-Selektive-Refining' for refining of waste oil

Beneficiary: Mineraloel-Raffinerie Dollbergen GmbH

Total Budget: € 9,620,000

LIFE Contribution: € 1,550,000

Period: Sep-2001 to May-2005

Website: www.avista-mineraloel.de

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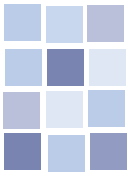
Waste from the construction and demolition sector

Construction and demolition waste is the largest single category of waste in Europe, accounting for approximately 31% of all waste generated in Western Europe. It is furthermore estimated that production levels in the EU-15 will have increased by another 30-35 % by 2020.

This waste stream can include dangerous substances, such as asbestos, which may be present in significant quantities when old buildings are demolished or renovated. However, many components in this waste category are easily recyclable and have the potential to replace up to 10% of all construction raw materials. Some EU countries, such as Germany, Denmark and the Netherlands, have achieved a recycling rate of up to 90% in this sector.

LIFE project themes included special topics such as managing earthquake construction and demolition waste and assessing the potential of plastic recycling in the construction industry. Other projects focused more generally on the improvement of recovery and recycling within the waste stream.





RECDEMO: Concrete and compost from recycled demolition waste

BEST PROJECTS AWARD
2004-2005

The German RECDEMO project developed a technique to recycle crushed concrete sand based on the wet treatment of demolition waste. The process produces fractions that can be used in making new concrete or compost, depending on their material properties. This enables 100% recycling of concrete sand in high-level uses.

Construction and demolition waste is the largest single category of waste in Europe, accounting for more than 30% of all waste generated. In Germany, about 60 million tonnes of demolition waste are generated annually. Although around 75% is recycled, this is mostly for low-grade uses such as filling material. This means that natural resources such as sand and gravel still have to be used to make new concrete.

To recycle concrete, the material has first to be crushed into particles of different sizes. However, the re-use of the sand fraction - which can be up to 40% of the total - in concrete production is uncommon. This is because the lower density and higher porosity of smaller sand particles means that the ability of the particles obtained from dry treatment to replace those obtained from natural

sources decreases in relation to the particle size. Furthermore, adherent binder matrix (cement) accumulates in the sand fraction reducing the quality of the concrete.

Managed by the Bundesanstalt für Materialforschung und -prüfung (a German public research institution) and in co-operation with industrial partners in Austria and Germany, the RECDEMO LIFE project set out to demonstrate the complete recycling of uncontaminated concrete sand for high-value applications.

The concrete was acquired by project partner Remex GmbH from the dismantling process of a heat-power plant in Dresden. Non-contaminated concrete was separated and tested to check its purity. To obtain broken material of high quality, they crushed the concrete, removed the iron rein-



Compost boxes with different material mixtures

forcements and used wind sorting. The resulting material was sieved to obtain the crushed concrete sand.

The demonstration plant and prototype jig for the treatment of crushed concrete sand were designed and constructed by the partner Allmineral GmbH. In the course of the project, approximately 150 tonnes of crushed concrete sand were treated in test runs within the pilot plant.

In the wet treatment process, water is added to the material and a stirring unit is used to remove adherent cement matrix from the grains (natural rocks) by attrition. The finest fraction (< 100 µm), containing settleable solids and abraded cement matrix, is removed by a hydro cyclone. The remaining fraction of 0.1-4 mm passes through the jig, where it is sorted by density into a heavy fraction (high density) and a light fraction. The three obtained materials - heavy fraction as the product of the process and light and finest fractions as residues - were collected separately, dewatered and investigated.

Concrete rubble before dry treatment



High-level uses for the heavy and finest fractions

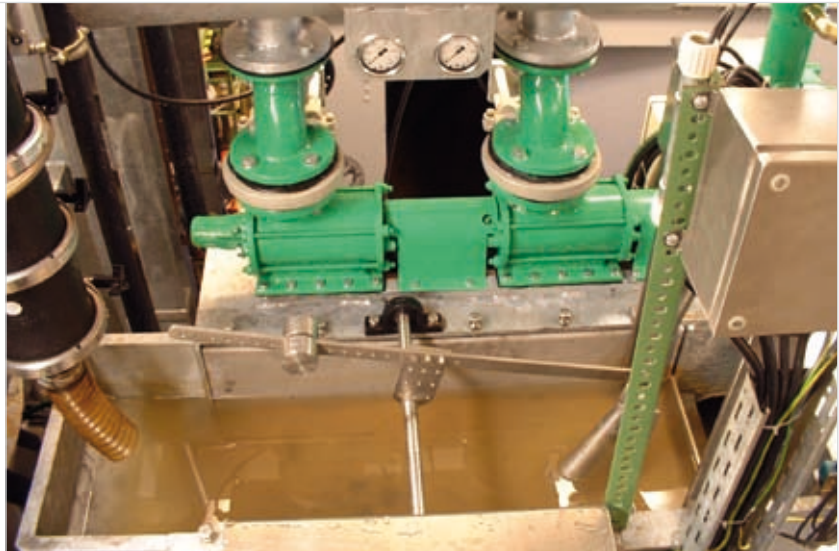
It was found that the heavy fraction contained approximately 25% less unwanted cement matrix. A batch of concrete was produced with up to 50% of the total aggregate made up of recycled crushed concrete sand. Compared to concrete made of 100% natural aggregates, this concrete showed a loss of strength of only 5%. The loss of strength when using this amount of untreated concrete sand was 20%.

The Austrian project partner Gebr. Deisl Beton GmbH tested the use of the residues - light and finest fractions - as components of compost. A series of tests at different locations and with varying conditions were carried out to optimise the composting process and to see the effects of adding these residues compared to other mineral carriers.

The composting processes were monitored and an ideal box system with ventilation was developed. Some differences in colour, structure and appearance of the resulting compost were observed when using the concrete sand. However, of greater importance was the effect of the sand on the fertility of compost.

When tested as a culture medium to encourage the growth of cress seeds, the light fraction decreased the fertility. However, the substrate with the finest fraction from concrete processing had results as good as natural rock powder. This not only means that the recycled finest fraction has a high-value use, but that

Concrete specimen made with recycled concrete sand



The jig in action: Wet treatment of the sand fractions

exploitation of natural rock powder as a raw material for compost can be reduced.

The bottom-line

The project carried out an eco-balancing process to assess the full environmental impact of the technology. It analysed the process and its material and energy flow rates using special software to compare the actual state (using natural sand) and the target state (using recycled concrete sand). Key elements covered in the eco-balance were energy consumption and greenhouse gas emissions, taking into account the effects of transportation.

It concluded that even after optimisation, the pilot plant would still entail higher energy consumption and emissions than processes exploiting natural sand. Manufacturing 1 m³ of concrete with natural aggregates would consume 41 kWh; 3 kWh more are needed in the target state scenario. Furthermore, the economic costs of the raw materials needed for the production of 1 m³ concrete with recycled crushed concrete sand are fractionally higher than the costs of producing the same amount of concrete using natural sand.

However, despite these slight negatives, the new process demonstrates a way to both recycle significant amounts of construction waste and to save important natural resources. Recycled 'sand fractions' can replace natural sand and gravel in the production of concrete and limestone in the production of compost. Trials have continued since the end of the project to further optimise the process and make it ready to be taken over by the industry. Although the cost factor remains a significant barrier, the beneficiary has been contacted several times by interested stakeholders from around the world and remains optimistic that, with further progress, the technology will be applied within the next 10 to 20 years.

Project Number:

LIFE00 ENV/D/000319

Title: Complete Utilisation of the Sand Fraction from Demolition Waste Recycling

Beneficiary:

Bundesanstalt für Materialforschung und -prüfung

Total Budget: € 878,000

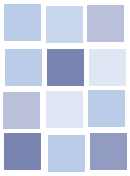
LIFE Contribution: € 387,000

Period: Dec-2001 to May-2004

Website: www.recdemo.bam.de/

Contact: Karin Weimann

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PAROC-WIM: Innovative waste recycling in the stone wool industry

A new process that feeds waste from stone wool production directly back into the production process removes the need for prior mixing with cement, thereby ensuring optimal use of raw materials, reducing harmful emissions and providing significant cost savings.

Stone wool is a product made from molten rock, which is either spun or blown to produce a mass of fine, intertwined fibres. It may contain a binder and also an oil to reduce dusting and to make it water repellent. Whilst the fibres are excellent heat conductors, they package air so well that when pressed into rolls or sheets, they become reliable insulators.

The total amount of waste generated in the 26 stone wool plants operating in the EU is estimated to be between 160,000 and 480,000 tonnes per year, representing a substantial 20-60% of total output.

Most waste is generated during the production process when the 10-20% of the molten rock that is not completely turned into fibre is thrown out. A stone wool line with an annual production of 20,000 tonnes generates 2-4,000 tonnes of process waste per year.

The Best Available Technique (BAT) - as described in the reference document for the glass industry - was to grind the waste and mix it with cement to make briquettes for use as a substitute for rock in the melting process. However, this requires high initial investment, uses an extra raw material - cement - and causes higher emissions of particulate matter and sulphur oxides when melted.

Technological solution

Paroc is an international company based in Vantaa, Finland produc-

ing building material such as mineral wool insulation. The negative effects of the briquetting methodology encouraged it to apply for LIFE funding to develop an alternative system.

The process they developed transports fiberized waste - 0-6 mm in size - to a hopper and a pressurised feeding tank. A rotating feeder in the bottom of this tank feeds small doses of material into three pneumatic pipes at the end of which lances are placed. The material moves through the lances where oxygen is added and it passes into the cupola furnace.

The PAROC-WIM process enables the injection of the waste from the fiberizing process directly into the melting zone. To test the realisation of this procedure, a first model was introduced into a plant at Oulu, Finland. This served as a prototype for the system implemented at a larger plant in Hässleholm, Sweden.

Implementing the process

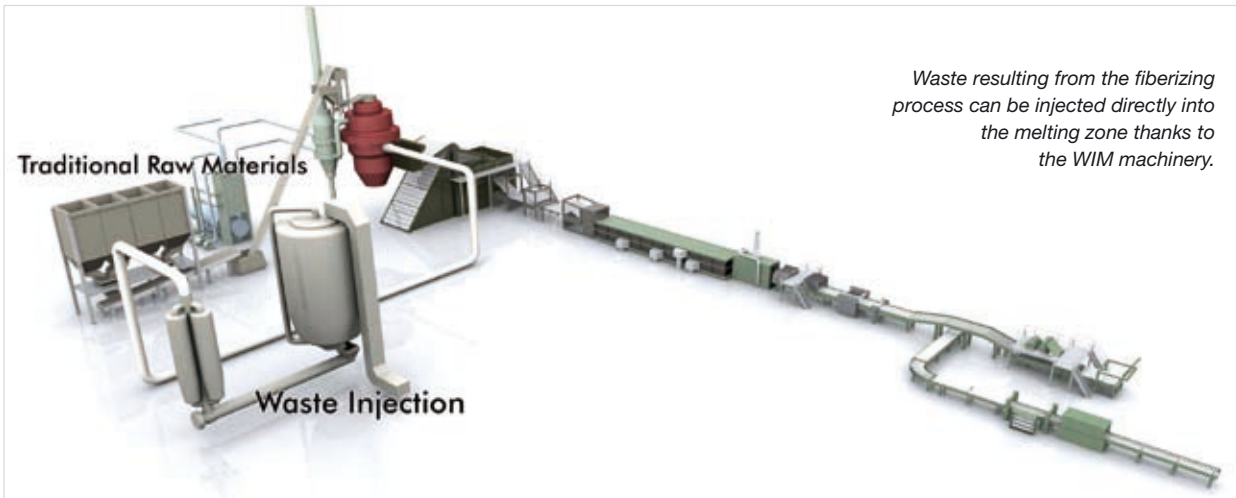
New materials and a new design were tested at Oulu to identify the best solutions to problems encountered. The materials and machinery design had to resist the extremely harsh environment within the process - temperatures in excess of 1700°C and harsh and abrasive materials. Working routines were also developed to achieve optimal utilisation of the machinery.

A year into the project, the plant was already recycling nearly 80% of the spinning waste as raw material,

corresponding to over 7% of the total amount of mineral raw materials. Fuel savings were also considerable. The energy required for melting was dramatically reduced when raw materials were replaced with 'pre-melted materials'. Such energy conservation had the benefit of reducing the use of coke by 8%.

The WIM technology is applicable where cupola furnaces for melting stone material are used.





Waste resulting from the fiberizing process can be injected directly into the melting zone thanks to the WIM machinery.

A totally new full-scale pilot plant was constructed at the beneficiary's stone wool factory in Hässleholm using the best elements of the prototype design and operational routines. This full-scale plant achieved even better results than the prototype.

In 2005, 93% of all production waste (2,421 tonnes) was recycled, a significant increase on 88% from the previous year. In the beginning, 50kg of waste per tonne of product was injected into the melting furnace; by the end, double that amount was recycled.

Furthermore, when replacing about 5% of pure raw material with production waste, the use of coke was reduced by more than 10%. This generated cost savings of 27% compared to the use of 100% virgin stone and 16% compared to using briquettes and stone.

Environmental benefits

The process opens up new possibilities for the use of fine fractioned raw materials and fuels - in particular fine fractioned coke. This reduces the amount of waste needing to be dumped in landfills from the production process of stone wool. It also reduces the amount of fuel (mainly coke) needed to heat the furnaces, providing three major benefits.

Firstly, energy consumption is reduced. The reduction of coke consumption generates a significant saving in the melting costs. Secondly, it saves important natural resources - principally virgin rock and coke.

Thirdly, the process lowers emissions from coke combustion. Compared to using virgin rock, it decreases the emissions of carbon dioxide by 4% and sulphur oxides by 10-15%. Compared to the other main method of recycling fibre process waste - briquettes - it has up to 50% lower emissions of sulphur oxides (depending on the sulphur content of the rock and cement used).

A bright future

Paroc says that WIM is a serious option for any new plants that it will build. As it proves to be a commercially viable process it can be implemented at other plants. Furthermore, implementation will become easier each time because of the previous experiences.

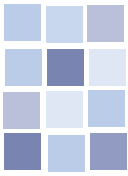
The process has already been cost effective to introduce into established plants such as Hässleholm, which was built in 1975. The beneficiary points out that "since the process is quite simple, it can be implemented at old plants without the need to build new ones. Maybe in ten years time, it will be a standard solution at all our plants."

The process offers an attractive method for helping to meet EU targets for the reduction of waste and greenhouse gas emissions in a cost-effective way. On top of the environmental advantages, the investment needed in implementing waste injection technology is about a fifth that needed for briquette-making equipment.

The project opens up possibilities to use fine fractioned raw materials and fuels.



Project Number: LIFE02 ENV/FIN/000328
Title: Waste Injection in the Stone Wool Melting Furnace
Beneficiary: Paroc Group, Finland
Total Budget: € 871,000
LIFE Contribution: € 194,000
Period: Dec-2001 to Nov -2004
Website: www.paroc.com/channels/com/about+us/customer+benefit/innovativeness/life.asp
Contact: Patrick Johansson
Email: Patrick.Johansson@paroc.com



Equation: Linking life-cycle assessment to sustainable building

BEST PROJECTS AWARD
2004-2005

Innovative environmental performance tools developed by the Netherlands-led LIFE project Equation are able to guide construction professionals in developing a life-cycle approach to waste. By preventing waste in the first place, the environmental impact of the construction sector is significantly reduced.

The construction sector is responsible for several million tonnes of CO₂-equivalents and an extensive use of resources. In the Netherlands alone, 16 million tonnes of building and demolition waste are also produced annually.

This LIFE project was launched to show that common environmental performance tools – based on Life Cycle Assessments (LCA) – would reduce the environmental impact of buildings in a quantifiable, reproducible and efficient way.

The large-scale project was implemented in the Netherlands, Belgium and the UK through 17 municipalities and over 100 demonstration projects. It involved a first phase in which the tools were developed and a second phase in which they were tested and improved.

Key tools: Eco-Quantum and EcoHomes

In the Netherlands and Belgium, the most important tool was Eco-Quantum (EQ). This advanced, LCA-based computer model calculates the environmental impact of the materials, water and energy used during a building's construction and expresses it in a single aggregated environmental indicator.

The UK used a similar tool - EcoHomes - that rates the environmental performance of homes on the basis of seven criteria. It provides a transparent eco-label for new buildings and the renovation of houses.

During the testing and implementation, 116 sustainable building projects



Preventing waste in the construction sector

with about 5,000 dwellings were evaluated at different stages of the building process. This enabled changes to be introduced as appropriate to minimise the environmental impact.

Testing revealed that Eco-Quantum was initially difficult for local communities and designers to use. Therefore, the beneficiary developed the simpler VO-tool, which only evaluates the most important building components. This instrument was very well received by practitioners.

Results

The project successfully demonstrated that the construction industry can use performance-based environmental standards using the LCA-methodology to achieve concrete environmental results. The evaluated Dutch projects showed an average improvement of their environmental performance by 15%.

By developing a more sustainable building policy the methodology can contribute to reducing CO₂ emissions, saving natural resources and preventing waste. Energy reduction turned out to be the most effective measure,

followed by the application of Forest Stewardship Council (FSC)-certified wood and minimal use of heavy metals.

The tools, which also allow decision makers to calculate the cost effectiveness of measures taken, have already demonstrated their appeal to practitioners. According to the beneficiary, a 'mini-Eco-Quantum', based on the experiences in LIFE-Equation, could be developed for a target group of over 500 users in the Netherlands. The EcoHomes tool was marketed in 2000, and some 6,000 units were already certified in the UK by the end of the project.

Nevertheless, an important final observation of the project was that, although LCA is a common language for environmental performance management, its international application requires careful adaptation according to the national and regional differences in construction practices and policies.

Project Number:
LIFE00 ENV/NL/000808

Title: Demonstration and dissemination project for stimulating architects and local governments to build sustainable with help of innovative design tools

Beneficiary: Stichting Bouwresearch (SBR)

Total Budget: € 645,000

LIFE Contribution: € 323,000

Period: Apr-2001 to Apr-2004

Website: www.life-equation.nl

Contact: Ruud Beek

Email: r.beek@sbr.nl

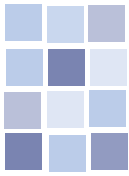
Waste electrical and electronic equipment

The amount of discarded waste electrical and electronic equipment (WEEE) is growing very quickly, with an expected increase of at least 3-5 % per annum. WEEE causes major environmental problems, due to the high content of dangerous pollutants such as heavy metals and various halogenated substances.

Significant recycling potential exists, which, if fully exploited, could make a major contribution to reducing the amounts of dangerous substances emitted. Furthermore, since the production of new electrical and electronic equipment requires substantial raw material input, it would also enable the recovery of considerable quantities of valuable materials.

LIFE projects successfully contributed to the implementation of WEEE legislation. They supported the construction of the necessary infrastructure for take-back systems and the optimisation of methods for sorting, dismantling and treating WEEE aimed at re-using end-of-life goods, recycling components and recovering valuable materials. They also encouraged the taking into account of waste management aspects when equipment is being designed.





HEATSUN: Pioneering the management of IT waste in Dublin

The HEATSUN project pioneered the collection of electrical and electronic waste in Greater Dublin – well ahead of the WEEE Directive – and piloted a community scheme for the separation and re-use of IT waste. The project enjoyed some considerable successes, including the development of a prototype for an eco-friendly computer, the iameco™ which now looks set to achieve the coveted EU Eco-label¹.

The European Union's Directive on WEEE (waste from electrical and electronic equipment) promotes the re-use, recycling and recovery of electrical and electronic waste and aims to minimise the environmental impacts of its treatment and disposal. The directive (2002/95/EC), which has been applied in Ireland since 2005, also sets targets on equipment collection and re-use, including design for disassembly.

Project 'HEATSUN' began as the (1999) initiative of Sunflower Recycling, a community-based enterprise working in Dublin's north inner city with Dublin City Council's waste management department in diverting household and commercial waste away from landfill and into re-use. Sunflower gained the support of another (south) Dublin social economy enterprise called HEAT, (hence the name, 'HEATSUN') Together, the partners approached Dublin City Council to bid for funding under the LIFE-Environment programme in 2000.

The original idea was for a project addressing the re-use potential of waste computers that would also provide training and jobs for Dublin's young and long-term unemployed. Says project manager José Ospina: "We knew the WEEE Directive was coming, and it seemed obvious

¹ A voluntary scheme designed to encourage European businesses to market products and services that are kinder to the environment. http://ec.europa.eu/environment/ecolabel/index_en.htm



Old reusable PCs collected and ready for sorting

that as well as focusing on re-use, we should also examine recycling and reduction of IT waste and try to carry out actions that addressed all of these aspects."

Launched in 2001, the project aimed to develop and implement an innovative model for IT waste management in the Dublin region through the creation of a permanent partnership of public, private and non-government sectors. This would be achieved by the generation of employment and training opportunities for local people and the creation of a sustainable local enterprise. The new company would construct state-of-the-art installations for the recycling, recovery, disposal and treatment of WEEE that can not be re-used.

Targeting the collection of computer waste from both domestic and cor-

porate users, three collection points were planned for the Dublin area, which would also act as distribution points for recovered and reconditioned equipment. Material not suitable for re-use would be handled by a central facility for recycling, recovery, treatment or disposal. The project aimed to collect 10,000 units of end-of-life IT equipment over its lifetime, and to repair and redistribute 2,000 units.

Finally, an end-of-life agreement was planned with a major manufacturer, and this company would also develop, in consultation with the project partnership, a prototype for an eco-friendly computer, securing an eco-label for this.

As well as Sunflower Recycling and HEAT, the project initially included three of the four local authorities in the

Dublin region: Dublin City Council (the project beneficiary); counties Fingal and Dún Laoghaire-Rathdown; Fingal Recycling, a private sector company involved in IT recycling; Apple Computer Ltd, based in Cork City; and FÁS, the national training and employment agency.

However, as the project got under way, problems began to emerge. HEAT, a small community enterprise based in south Dublin, was obliged to leave the partnership for internal reasons. Apple was advised by its lawyers in the United States that it could not enter into the proposed partnership agreement. FAS decided it could not perform both the roles of partner and co-funder without creating a conflict of interest. These problems led to changes, delays, and the need to amend the project.

The consortium set about addressing these problems. SwiTch (Saving Waste IT Can Help), a social economy enterprise set up by the project, replaced HEAT as a partner. Apple Computer was replaced by MicroPro, an SME, based in County Dún Laoghaire-Rathdown. FAS withdrew as a partner, but agreed to fund the social employment aspect of the project. The project duration was extended from three to five years.

Results

By the end of 2006 the project had successfully completed most of its planned actions and had exceeded some. In particular, it established six waste IT collection points in Greater Dublin, three more than the target. The aim of collecting and processing 10,000 items of waste IT equipment was also more than doubled with over 24,000 items collected, sorted and tested by the end of the project.

MicroPro continues to grow and is having continued success with its eco-friendly computer, which looks



Collection point for small waste from electrical and electronic equipment (WEEE)

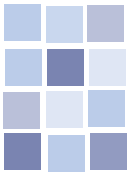
set to gain EU Eco-Label (see 'MicroPro – a HEATSUN success story').

SwiTch, the not-for-profit social economy enterprise established by the project, was able to continue to run, with government funding, for some months after the project closed, and to develop a business plan which took account of the introduction of the WEEE Directive into Irish law. SwiTch provided work for more than 20 people in total – only around 14 people were employed at

any one time. Unfortunately, as of August 2007, it is no longer operating. In some ways it was a victim of its own success because as fast as the programme trained the largely unskilled people, they left for jobs elsewhere. IT training proved profitable, but unfortunately is not permitted under the initiative's after-LIFE social employment grant "Unless there is a protected marketplace for this type of community services programme, it simply can't survive," says Ospina.

Computer waste at Dublin City Council's central facility for recycling





Waste electrical and electronic equipment

MicroPro – a HEATSUN success story

IT equipment makes up at least 39% of all electronic waste and contains a cocktail of hazardous materials, including PVC, brominated flame retardants, mercury, lead, cadmium, brominated fire retardants and polyvinyl chloride, to name a few.

Based in Rathfarnham, Dublin, MicroPro Computers, has developed its iameco™ range (pronounced i am eco) of green computers in partnership with project HEATSUN, the University of Limerick and the KERP – Centre of excellence Electronics & Environment of Vienna (Austria). Designed to meet the requirements of the European Eco-label for PCs, it is currently being tested for this standard. A prototype of the green PC was unveiled at the Green Week 2007 exhibition held in Brussels in May.

Available in natural wood (from renewable sources) and certified, exotic wood-veneer casings, the computers offer high levels of performance with a reduction of the use of many of the harmful substances. In addition, their power supply units use up to a third less energy than traditional computers. Crucially, the PCs are designed using recyclable, modular components that can easily be replaced in order to extend their lifespans from the industry norm of less than two years, to 7-10 years.

“People love our computers,” says managing director, Paul Maher. He claims the innovative use of the wood casings is already being replicated by major UK and Irish computer retailers. Undeterred, he maintains the EU eco-label will enable his company to steal a march on any rivals.

Looking to the future, he says: “European governments have expressed great interest in our iameco™ computers under their Green Procurement Policy. This is an area where we feel there will be huge growth.”

Finally, the number of IT units re-used was 600, significantly fewer than the target of 2,000. This was partly due to the inability of the project to tap into the corporate IT waste stream, which is still a lucrative area for those shipping old IT equipment overseas. Only 11.5% of equipment collected by

Micropro's green PC with natural wood monitor and keyboard



SWITCh came from corporate sources, although such computers represent around two thirds of IT waste.

According to John Singleton, representative for the lead partner, Dublin City Council, it is estimated that in Ireland alone 22,000 computers are disposed of annually by companies. These computers are likely to be of a higher-specification than those of domestic users, and normally still work when discarded.

Conclusion

The project's direct environmental benefits are difficult to quantify: HEATSUN successfully re-used 600 computers and has recycled over 24,000 items that would otherwise have gone to landfill. However, its impact in terms of awareness-raising is probably greater. The duration of the project coincided with the implementation of the WEEE Directive into Irish



Paul Maher, managing director of MicroPro Computers

law. The project and its local authority partners had the opportunity to pilot how this implementation would develop, both in terms of its strengths and its limitations.

Many things changed over the five years that could not have been foreseen at outset, and the project proved remarkably resilient in adapting to these challenges. “You have to examine this project within the context of what is possibly one of the most volatile and quick-changing industries in the world,” says Singleton, adding: “When we started the average price of a new PC was around €1,500 - €2,000 [compared with around €500 today]. At that price, there was a real opportunity for reconditioning computers and selling them on at a reasonable profit.”

Project Number:
LIFE00 ENV/IRL/000764

Title: HEATSUN - Community-Based Action for Prevention, Re-use and Recycling of Waste Electrical and Electronic Equipment

Beneficiary: Dublin City Council

Total Budget: € 1,851,000

LIFE Contribution:
€ 737,000 (maximum expected)

Period: Oct-2001 to Dec-2006

Website: www.projectheatsun.com

Contact: John Singleton

Email: john.singleton@dublincity.ie

SUMANEWAG: A major advance for e-waste management in Greece

Successfully demonstrating how to reduce WEEE in Greece, this LIFE project provided vital information for the formulation of a sustainable national WEEE management system.

In 2001, at the start of the SUMANEWAG project, almost 100% of waste produced from electronic and electrical equipment (WEEE) in Greece ended up in the regular waste stream and was in some cases illegally incinerated or disposed of in unauthorised landfills. This released toxic materials into the ground and the atmosphere causing significant environmental problems.

SUMANEWAG developed and implemented a first sustainable WEEE-management system in Greece. Carried out by the Ecological Recycling Society, the project also conducted research on the potential end uses of the repaired and recycled computers, including their possible installation in the computer labs of elementary schools.

The LIFE project established a separate collection system for computer equipment and peripherals from homes, companies and offices in the area of Attica. Re-usable computers and components were repaired - with the data removed from the hard drives - and sold to interested parties.

The discarded components and materials were disassembled and, after salvaging all reusable components,

Copper collected



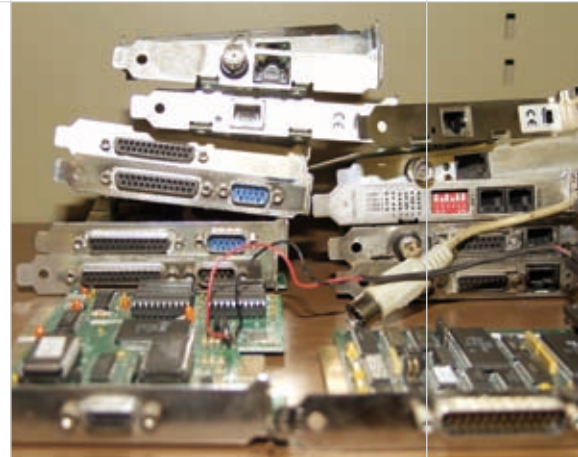
recycled. All of the toxic and hazardous materials were stored separately and sent for safe handling and recycling. The project collected and therefore diverted from landfill 7,049 EEE units or 73 tonnes of WEEE. The project alone thereby managed to achieve 2.3-2.8% of the proportional target for the treatment of computer equipment set for Greece by 2006.

In gathering and analysing the project information, the initiative also created the first ever database on WEEE in Greece. This included details of the type of WEEE collected, whether each component was sent for re-use, recycling or disposal, the type of repair or treatment required and the average life-span of the equipment.

An economic impact study on the sustainable management of WEEE and a code of good practices were produced. Also, the public's participation in the project was encouraged and awareness on the issue raised with the help of a public awareness campaign, including press articles and a telephone help line.

Supporting the development of Greek E-waste legislation

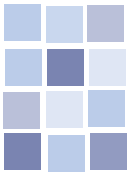
At the time of the implementation of the project, relevant EU and Greek legislation was being introduced in the area: Greek legislation for alternative management for waste packaging and other products and the European WEEE Directive (2000/95/EC). SUMANEWAG successfully contributed to the implementation of regulation agreements, financial tools and training to harmonise the national situation with the European Directive.



Hard disc drives collected

An e-waste discussion forum was set up during the project, bringing together interested parties to formulate policy and strategy and to train technical staff. Follow up by the LIFE monitoring team has found that the e-waste forum still functions informally. Furthermore, the beneficiary continues to ensure that relevant stakeholders are updated on the new legislation and their evolving responsibilities and rights.

Project Number: LIFE00 ENV/GR/000688
Title: Sustainable Management of E-waste in Greece
Beneficiary: Oikologiki Etairia Anakyklosis (Ecological Recycling Society)
Total Budget: € 919,000
LIFE Contribution: € 446,000
Period: Nov-2001 to Nov-2003
Website: <http://www.ecorec.gr/>
Contact: Philip Kirkitsos
Email: info@.ecorec.gr or pkirkitsos@hol.gr



PIRR: New benchmarks in the recycling of dangerous technological waste

PIRR's innovative system for collecting and separating technological waste demonstrated the considerable potential for increasing recycling rates for both mobile phone batteries and cathode ray tubes in Italy.

Mobile phone batteries contain substances such as nickel, cadmium, and cobalt, which can pollute soil and groundwater when disposed of in landfills. In Italy alone, 966 tonnes of batteries were disposed of in 1999 and the forecast for 2010 is 2,550 tonnes.

Cathode ray tubes (CRTs) contain toxic phosphors, barium compounds and heavily leaded glass, which present serious environmental and health hazards at end of life. The disposal of CRTs in landfills or incineration releases toxic chemicals into the air, soil or water.

The project beneficiary Tred Carpi, which provides a wide range of waste disposal and recycling services, recognised that an essential first step in improving the management of these WEEE streams was to introduce an appropriate collection system.

The project partners therefore worked to improve and extend separate collection points for technological waste. Furthermore, they introduced a specific new service for the separate collection of batteries from mobile phones and other electrical appliances and created an integrated centre for differentiated waste collection.

Mobile phone batteries

The project implemented an innovative technological process to identify the batteries coming from mobile phones and other electric

tools according to their type, quality and technical status and send them for the most appropriate treatment.

Exhausted batteries are sent to the recycling system, where they are ground down and their components separated and recovered as new raw material. Non-exhausted rechargeable batteries are reassembled to make new batteries for devices such as electric vehicles. Follow-up work to the project successfully tested battery-powered water bikes.

This battery recycling promises positive economic effects. The project developed a study of the market for the finished batteries that will guide future efforts towards optimising the economic performance of the whole system.

Cathode ray tubes

The project succeeded in using innovative machinery to separate the cathode tube from the other parts of the television, cutting the tubes along the line where its two different types of glass are joined. The machinery then cleans the glass rendering more than 90% of it recyclable.

The cathode tube recycling plant is able to treat about 5,000 tonnes of devices a year and produce about 1,200 tonnes per year of recovered glass and other recycled materials.

The technologies used in the project are easily accessible to the



The Tred Carpi site is located in the Province of Modena, Italy.

vast majority of the companies possibly interested in reproducing the demonstrated processes. Furthermore, the new benchmarks set in recycling WEEE provide a level which governments could set as a new legal requirement in the future.

Project Number:
LIFE04 ENV/IT/000538

Title: Integrated pole for recycling and valorisation of waste

Beneficiary: Tred Carpi S.r.L

Total Budget: € 1,350,000

LIFE Contribution: € 300,000

Period: Dec-2003 to Mar-2006

Website: www.pirr.it

Contact: Gabriele Canè

Email: info@tredcarpi.it

End-of-life vehicles

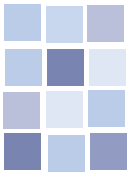
It is estimated that almost 14 million tonnes of end-of life vehicles (ELV) will have to be treated annually by 2015, compared to an estimated 10 million tonnes of EU-25 ELV waste in 2005. A quarter of ELV waste is currently considered as hazardous in some Member States, making up around 10% of the total hazardous waste generated each year in the EU.

The ELV Directive has already triggered technological developments in the area of ELV treatment, but new techniques have not yet fully diffused across Europe. Further support is therefore necessary for the continued development of treatment technologies with environmental benefits, particularly in overcoming market failures.

LIFE funding has supported many initiatives to cut waste from ELVs by promoting the re-use, recycling and recovery of their components. This has included the development of processes

to separate metal components, extract re-usable materials from waste tyres or re-use specific parts such as particle filters.





SuperRubber: Turning used tyres into football pitches

This Danish-led LIFE project successfully demonstrated how high-pressure CO₂ treatment of used rubber can create an attractive end product for new applications. It thus provides an economically viable alternative to the environmentally hazardous practices of landfilling and burning used tyres.

Over a billion tyres are produced worldwide each year, using roughly 10 million tonnes of rubber of which almost 70% is virgin rubber. To make these tyres, a blend of natural and synthetic rubber is mixed with carbon black and chemicals in a process of vulcanisation. Enormous amounts of energy are used to harvest and refine these products.

Unfortunately, once tyres have reached the end of their useful life, vulcanised rubber has few practical uses. Apart from the relatively few tyres that are retreaded, most are dumped in landfills, burned in controlled processes to provide industrial energy or re-used in harbours or in agriculture.

None of these solutions are particularly efficient or environmentally friendly. Energy gains from controlled burning nowhere near offset the costs in terms of depleted resources, whilst disposing of tyres can release potentially harmful compounds - such as polyaromatic hydrocarbons (PAHs), benzene and phenol - into the environment during decomposition of the material.

Additionally, large volumes of used tyres create a serious risk of hazardous fires. The high energy content of tyres means they can burn for long periods and are virtually impossible to extinguish. The burning of tyres has a serious environmental impact through vast quantities of harmful emissions to the air and water.

Encouraging recycling

Recycling and re-use of scrapped tyres is the environmentally



The innovative treatment turns recycled rubber into an attractive product for new uses such as synthetic football pitches

preferred option. The EU imposed a ban on the dumping of whole scrap tyres in landfills in 2003, followed by a similar ban for shredded tyres in 2006. However, recycling tyres is complicated by the fact that they are designed to be extremely durable and are therefore difficult to break down into their constituent parts.

Many initiatives have looked at making use of granulated or shredded tyres, for example, as fuel in cement or power plants. An interest-

ing alternative re-use is as an additive in asphalt and sports surfaces. However, this recycled rubber has limited adhesive qualities - due to oil residues - and retains its unpleasant rubber smell, which is a significant negative factor when trying to use the material for a playground surface, football field, or mat.

The LIFE project SuperRubber sought to develop new technology to produce recycled rubber without these disadvantages. "We had an

idea to develop a revolutionary and unique high pressure CO₂ technique to treat rubber for recycled use that we thought could benefit the environment and our company. But we needed finance to develop it,” explains Jan Damgaard, research and development leader at Nanon, the beneficiary.

The project was based on the cooperation of four technological innovators in Northern and Central Europe. The Danish project coordinator Nanon specialises in nano-surface manipulation. Natex in Austria produces equipment and turnkey plants based on supercritical CO₂. Linde/AGA is a German/Swedish company specialised in gas production and supply. SCF Technologies in Denmark develops and engineers dense-phase processes.

Together, they set out to demonstrate that a laboratory-developed process for enhanced milling of rubber could be used on a semi-industrial scale. Jan Damgaard expresses particular satisfaction that “the group of small companies

The successful recycling of used rubber provides important alternatives to dumping used tyres



were able to work consistently well together, combining their respective expertise to deliver an ambitious final product, despite their everyday pressures and distractions.”

A two-stage process

The project developed a new two-stage process to clean and impregnate polymeric materials, such as granulated vulcanised rubber, in a way that removes odours and with the additional ability to create a nano-coating or interpenetrating network. This enabled the production of new, tailor-made surfaces and bulk material, which maintain the original product characteristics - such as flexibility and resilience - but without residual odours or loss of adhesive qualities.

The first stage is to treat the surface of rubber granulate from scrap tyres using a high-pressure CO₂ cleaning technique. The CO₂ selectively removes certain chemical compounds and extender oils and greases that are used as softeners in tyres and which not only make rubber granulate to lack adhesive properties. The use of CO₂ also avoids the need to use other, potentially harmful, chemicals in the treatment of rubber.

The principle behind the high-pressure, heated extraction process is that supercritical fluids resemble gases in terms of penetration properties, but feature densities that are more like liquids. By increasing pressure, density is increased accordingly, which in turn increases the power of the solvent. By increasing temperature, density is decreased, yet the vapour pressure of the solute increases.

For many applications - such as creating a component for asphalt or flooring - this first stage surface modification of the rubber may be sufficient. It removes the

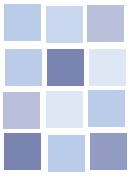


High-pressure CO₂ is used to remove odours and improve the adhesive qualities of the recycled rubber



odour, whilst improving the elasticity and impact strength. The rubber granulate will also be more adhesive with other substances such as asphalt, plastic and paint, through the removal of oily residues.

For other uses - such as roofing membranes and paints - the rubber can be further improved by impregnating it with monomers or pre-polymers. This second processing stage makes the rubber product compatible with the matrix material in which it will be used. If supercritical impregnation is to be performed, monomers or pre-polymers are added immediately after the extraction step by adding the appropriate chemicals to the CO₂ before depressurising the vessel.



Automobile tyres contain a number of chemical compounds, including antioxidants, vulcanisers, plasticisers, aromatic oils, carbon black, plus rubbers and other chemicals. The success of this process comes from its ability to extract the 'bad' compounds and retain the 'good' ones. This leaves the 'SuperRubber' product, an odourless material that is easily and inexpensively integrated into new products.

Results

The Cohancement™ methodology, which has been successfully patented by the beneficiary, offers a genuine opportunity to even up the 'energy balance'. The technology increases the value of basic granulated rubber by opening up a range of potential commercial applications, thus making it more economically attractive to collect and shred unwanted tyres.

SuperRubber is well-suited for use as a replacement for virgin rubber in making final products, including tyres, competition-approved sports surfaces, rubber mats, playgrounds and asphalt. It could also be used as an economically viable replacement of traditional 'bulk' materials and fillers, notably in paint products or in applications from floor coverings and roofing membranes to footwear and raingear. It is particularly well-suited as a functional filler in SBR – the most widely used synthetic rubber in the world.



The problem:

- Over a billion tyres are produced worldwide each year
- 34% of used tyres are currently landfilled
- Dumping and burning tyres releases hazardous compounds into the environment
- Dumping tyres creates an additional fire risk
- Only 21% of used tyres are currently recycled
- The poor quality of recycled rubber has limited its range of uses

The SuperRubber solution:

- A two-stage recycling process produces different grades of rubber for re-use
- A first stage based on high-pressure CO₂ cleaning treatment produces odourless recycled rubber with good adhesive properties
- A second stage based on impregnation with monomers or pre-polymers makes the rubber compatible with a matrix material in which it can be used
- The final rubber product is called SuperRubber
- SuperRubber is well-suited for use as a replacement for virgin rubber in making final products, including tyres and sports surfaces
- SuperRubber can be used as an economically viable replacement of traditional 'bulk' materials and fillers in products such as paint

Franck Gautier, Vice-President for Sales at Nanon, highlights the commercial potential of 'Super Rubber': "Calculations show that the cost of reprocessed rubber granulate is competitive with that of virgin rubber and the other main alternatives." Furthermore, the product has been tested by commercial users who have found it to be "an interesting option" as a performance component in plastics, resins, and coatings of various types.

The challenge for the future use of SuperRubber is in finding a company to lead the up-scaling of production. To be able to manufacture a football pitch from the new recycled product would require a large-scale plant with the capacity to manage the process and deal safely with the extracted chemicals. Nanon has used its expertise to develop the product, but is not the best placed to bring the product to market.

SuperRubber: an ideal component in playground surfaces such as artificial football pitches.

Nanon is therefore in contact with major industries engaged in the production of tyres and artificial football pitches to convince them of the great potential of this new technology and product. As Jan Damgaard explains, "we have demonstrated the feasibility of the product; we know it works. Now we are hoping that a company interested in contributing to improved environmental performance will buy the technology and take it forward so that in a couple of years we will see football pitches made from SuperRubber."

Project Number:
LIFE04 ENV/DK/000070

Title: Complete Conversion of scrap tyre powder to superior rubber products by dense phase techniques

Beneficiary: Nanon A/S

Total Budget: € 2,457,000

LIFE Contribution:
€ 1,228,000 (expected)

Period: Dec-2003 to Feb-2007

Website: www.superrubber.dk

Contact: Jan Damgaard

Email: JD@nanon.dk

RENOFAP: Pioneering the treatment and re-use of diesel particulate filters

Diesel particulate filters need to be replaced several times during the life of a vehicle. Through the development of an environmentally friendly process for the treatment of these filters, the French RENOFAP project demonstrated the potential to boost recycling rates and reduce dependency on disposal.

The diesel particulate filter (DPF) is a cylinder assembled on the exhaust pipe of a diesel engine just after the catalytic converter. It cleans the exhaust emissions from the vehicle, trapping more than 99% of the particulates produced by the engine. During use, it fills up with soot, increasing the backpressure in the exhaust line.

At a certain point - after every 500-1000 km - an automatic 'regeneration' process is triggered to burn away the soot. However, each time, 2 or 3 grams of incombustible elements remain from the oil, fuel oil and additive used to decrease the burning temperature of the soot.

The accumulation of these particles in the channels means that after approximately 80,000 km, the efficiency of the device is compromised and it must be replaced. Common practice was to dump these used components.

Recycling diesel particulate filters

The beneficiary, Faurecia, set up a unit to remove the particles from used DPF in an environmentally friendly way. During the project, 83% of the 9,204 DPFs treated were successfully remanufactured for re-use. This enabled the recycling of 30 tonnes of ceramic and 30 tonnes of metal with only one tonne of compact mud produced as final waste.

The DPFs unsuitable for remanufacture - because of envelope corro-

sion (4%), ceramic cracks (10%), or deficient washing of the filter (3%) - were processed to minimise their environmental impact. This generated six tonnes of metal for recycling and six tonnes of ceramic and mat waste for disposal.

Each DPF was heated gradually to 600°C to burn the soot. The resulting gases were canalised into an incinerator for purification to within regulatory limits before release into the air. High pressure water was then used to extract the ashes. The 'dirty' liquid was collected and taken to a nearby water treatment station; 80% of the water was recycled with the remaining 20% released into the environment in compliance with current standards.

The future of the product

The beneficiary was processing 1,800 DPFs each month by the end of the project and its capacity has increased since, thanks to the construction of a second demonstration unit.

The market for the product and the potential to expand the use of DPF recycling is clear. Performance tests - validated by Peugeot SA - showed the average efficiency of the remanufactured DPFs to be an excellent 95%. Daimler Chrysler ordered the remanufacture of 40 filters and UMICORE agreed to test the remanufacture of DPFs for lorries.

Furthermore, the process is interesting for consumers: a remanufactured filter is about 50% cheaper than a



Dunking and washing of the particulate filters

new one. The regular dumping of used filters should, therefore, be increasingly replaced by this innovative recycling approach in the future.

Project Number:
LIFE03 ENV/F/000263

Title: Industrial pilot project for remanufacturing and re-using of diesel passenger cars particle filter

Beneficiary: FAURECIA Systèmes d'Echappement

Total Budget: € 315,000

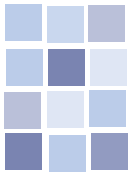
LIFE Contribution: € 251,000

Period: Jan-2003 to Apr-2004

Website: www.faurecia.com/pages/products/environment.asp

Contact: Thibault Viguerie

Email:
thibault.viguerie@faurecia.com



KYPROS: Sustainable management of end-of-life vehicles in Cyprus

Aimed at fulfilling the requirements of European waste stream management legislation, the Cypriot Ministry for Agriculture, Natural Resources and Environment used a complex multi-criteria assessment tool to identify the optimum waste management process for end-of-life vehicles (ELVs) in Cyprus.

As Cyprus approached membership of the EU, its waste management procedures did not meet standards required by European legislation, such as Directive 53/2000 on ELVs. The LIFE project KYPROS therefore aimed to identify improved systems for the country to manage waste appropriately for the protection of the environment and public health.

The KYPROS team identified ELVs as one of three priority waste streams and collected primary data on the characteristics, composition, principal sources, and potential environmental impact of each. They used questionnaires, the existing data of relevant services and meetings with experts to collect the information, which was then saved in an updatable database.

A key finding of the project team was the lack of integrated systems for the collection and management of ELVs in Cyprus. Furthermore, companies managing ELVs and sites for the temporary storage of ELVs were often operating without legal permission. Numerous ELVs were being abandoned in open sites constituting a significant threat to the environment and public health.

The data was used to estimate trends in the quantity of ELVs being produced - in numbers and in tonnes. A mathematical model was then applied to give estimates of future waste generation. This work suggested that the rate of ELV production was increasing steadily and would continue to do so in the years to come.

Identification of an optimised, viable management process

The PROMETHEE method - a preference ordering multi-criteria assessment method - was chosen and then used to compare six different waste management procedures used in Cyprus or other European countries. Social, environmental, economic and technical assessment criteria were set, described and calibrated to enable a comparison that was specific to Cyprus.

Taking into account, for example, that Cyprus did not yet have the required infrastructure for the utilisation of combustible and non-combustible shredding residue, the model concluded that its optimum ELV management system consisted of: partial disassembling; the shredding of hulk; separation of materials; recovery of ferrous and non-ferrous metals; and land-filling of shredding residue.

A techno-economic study was carried out to examine the viability of the alternative management schemes. Plants that de-pollute and partially disassemble ELVs, two-stage shredding plants, direct shredding plants, and integrated plants with de-pollution, partial disassembly and shredding units were all found to be viable given a critical mass of ELVs.

The project gave the competent authorities in Cyprus a new and clear vision of the current ELV situation and the comparative benefits



Based on a multi-criteria decision analysis, an optimum management system for ELVs in Cyprus was selected

of the different management systems. This informed the development of a national management plan for ELVs, which will reduce the environmental and public health impact of ELVs, recover important secondary raw materials and save key resources and energy in a way that will continue long after the end of the project.

Project Number:
LIFE03 TCY/CY/000018

Title: Development of best management systems for high priority waste streams in Cyprus

Beneficiary: Ministry of Agriculture, Natural Resources and Environment - Environment Services

Total Budget: € 600,000

LIFE Contribution:
€ 420,000 (expected)

Period: Jan-2004 to Jun-2006

Website: www.uest.gr/kypros

Contact: Costas Papastavros

Email: cpapastavros@environment.moa.gov.cy

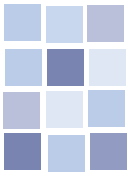
Hazardous waste

Hazardous waste only makes up 1% of the total waste generated in Europe. However, although a comparatively small waste stream, hazardous waste poses particular risks to the environment and human health due to the dangerous substances it contains. Hazardous waste requires specific management and treatment before it can be safely disposed of and some can only be disposed of in special sites for toxic waste.

The challenges posed by this particular waste stream are growing. Although a limited number of economic sectors are responsible for producing most of Europe's hazardous waste, total generation has increased by about 13%, from 51.8 million tonnes (115kg/person) in 1998 to 58.4 million tonnes (129kg/person) in 2002.

In the face of these significant and growing risks, hazardous waste requires a stricter control regime, which is laid down in the hazardous waste Directive. Numerous LIFE projects have supported this policy by demonstrating improved management and collection procedures and innovative recycling technologies for hazardous waste.





Picked: Reducing nitrate discharges from the steel industry

The use of electro dialysis to remove hazardous nitrates from stainless steel industry effluent in this LIFE project in Sweden demonstrated clear environmental and economic benefits.

Pickling of stainless steel is a chemical process in which a mixture of nitric and hydrofluoric acid is used to de-scale undesired oxide deposits on the stainless steel surface. The waste acid is neutralised with lime, which reduces the metal and fluoride content through the chemical process of precipitation. However, the nitrates from the nitric acid remain and are discharged in the effluent.

In the mid-1990s, the Swedish Parliament adopted requirements for industry to help reduce nitrates in the Baltic by 20% compared to 1990 levels. The Outokumpu plant at Nyby/Torshälla produces 3,500 tonnes of stainless steel every week. It was discharging 250 tonnes of nitrogen per year in the form of nitric acid into the nearby Lake Mälaren and was identified as the biggest single polluter.

Accordingly, the firm decided in 1998 to undertake research in collaboration with the Swedish Environmental Research Institute (IVL) to find new ways of recycling its wastewater.

Electrodialysis to treat nitric acid

Electrodialysis (ED) is an electrochemical process in which an aqueous solution is passed through several membranes which alternately let through positive and negative ions. This enables particular ions to be extracted from the water. Thorsten Schneiker, the young German chemical engineer responsible for coordinating this research recalled that, "We already knew that ED was the most efficient technique to treat nitric acid."

In the laboratory, this process virtually eliminated metals and reduced the amount of residual sludge. It proved able to reduce 45g of nitrate to 4g and recover 55% of nitric acid and 25% of hydrofluoric acid. Furthermore, it was able to collect the recycled acid in a concentration reusable in the pickling process. However, no full-scale system existed for use in the steelmaking industry.

Key to the development of this technology for industrial use was to find the right balance in the process and the right materials for the membranes and electrodes. As Mr Schneiker explained, "It took two years before the system was stable. The electrodes used to erode very quickly. Nowadays they need to be changed only every three months." The electrode rinse water is changed on a regular basis to avoid electrode corrosion.

Electrodialysis enabled the project to recycle nitric acid from a waste acid stream and concentrate the recycled acid to a concentration reusable in the pickling process.

AvestaPolarit decided to apply for LIFE funding to help the company construct a full-scale version of the system developed in the laboratory. Per Nymark, Quality and Environment Manager at the Nyby/Torshälla site explains, "The investment was risky and we were competing with other investments within the group but in the end it was our project which obtained financing."

Through the LIFE project, a building was constructed adjacent to the waste water treatment unit at the beneficiary company's pickling facility in Torshälla. The €1,281 million investment housed the dialysis equipment and started operating in January 2002.



Per Nymark went on to explain that through the project, the plant aimed “to minimise and in particular to reutilise its waste. The project thus formed part of the wider plan to strive to work in a closed loop, not only with the waste but also the energy and everything that enables the harmonisation of ecology and economy.”

Environmental and economic benefits

The fully functioning and optimised process demonstrated that ED could provide impressive environmental results beyond the laboratory. The technique diminished the discharge of nitrates from the pickling facilities by 55%.

IVL carried out an analysis of the water quality in Lake Mälaren after the implementation of the technology. This showed that there was a notable reduction of eutrophying pollutants in the water, in particular through a reduction in nitrate waste.

Improvements in implementation of the technology should enable further reductions. Per Nymark points out that they have “not yet found the ideal solution: we still discharge 100 tonnes of nitrogen a year but we will try to decrease from that level.”

The partial recycling of hydrofluoric acid diminished the need for a precipitation agent in the neutralisation step: the amount of hydrofluoric acid used in the process was cut by 23% and lime by 33%. The total sludge from precipitation needing to be deposited in landfill was reduced by 32%. Furthermore, energy consumption was less in the new process.

The reduction in the consumption of non-renewable materials also reduces costs for the industry. Per Nymark emphasises that, “Thanks to recycling, our annual purchase of nitric acid has diminished from 2,100 to 1,000 tonnes and hydrofluoric acid



Membrane modules are the vital parts in the electrodiolysis process.

from 1,000 to 750 tonnes. We have also greatly reduced our purchases of lime.” In terms of financial amortisation, the final estimations of the project were that the process will generate an annual return on investment of about 10%.

Best Available Techniques

The European Directive on integrated pollution prevention and control (IPPC Directive) has compiled and published BATs in sectoral technical reference documents, known as “BREF” documents. The BREF devoted to ferrous metal processing of December 2001 stated that electrodiolysis technology was much too young, not proven and too expensive to be considered a BAT, particularly due to short membrane life.

The process developed by this LIFE project was therefore a new BAT in the treatment of industrial nitrates, prompting a revision of the BREF in 2005. Thorsten Schneider is particularly pleased with this impact of the project: “Over and above the technical success, I am proud of the knock-on effects we seem to have, in particular thanks to LIFE.”

Furthermore, the process is eminently transferable. Nitric acid recycling through electrodiolysis has been adopted at other units within the Nyby steel group and the process has attracted a lot of attention from international stainless steel producers, especially as governmental pressure to reduce the discharge of nitrates increases.

The LIFE programme helps the chances of the technology being seen and taken up elsewhere. “What LIFE has contributed is first and foremost external recognition,” Thorsten Schneider confirms.

Project Number:

LIFE00 ENV/S/000853

Title: Recycling of Nitric Acid from Waste Pickling Acid by Electrodiolysis

Beneficiary: AvestaPolarit AB

Total Budget: € 1,933,000

LIFE Contribution: € 367,000

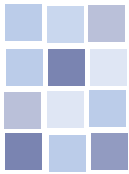
Period: Dec-2000 to Aug-2002

Website: http://www.outokumpu.com/pages/Page___5780.aspx

Contact: Per Nymark

Email:

per.nymark@avestashffield.com



SPENT-PERCUS: Recovering valuable raw materials from spent alkaline etchant



This Spanish LIFE project developed electrochemical techniques to recover copper powder from spent alkaline etchant. Using a modular unit it also enabled the re-use of hydrochloric acid by-product on site, thus eliminating the need to transport or treat this otherwise hazardous waste.

Alkaline etchant is a substance used by manufacturers of printed circuits which has a limited lifespan. More than 48 million litres of spent etchant - a compound of hydrochloric acid and copper - are produced in Europe each year. The scarcity of treatment facilities has meant that this dangerous and polluting industrial waste is typically transported large distances by road from the main production sites.

Copper can be recovered from the solution, but the presence of the chloride ion generally means that non-electrochemical techniques are used. These focus exclusively on obtaining copper salts - hydroxide, oxychloride and oxide - with no useful by-products.

The SPENT-PERCUS project designed and developed a prototype of an innovative electrochemical process for extracting copper from the spent solution. The unit successfully produces copper in metal form, which is a more valuable raw material than

copper chloride and less hazardous to transport. Hydrochloric acid is also obtained as a by-product, which can be used again as a raw material in the manufacturing process of printed circuits.

A fixed cathode cell made of fifty identical titanium rods is 80% submerged and connected to a solid titanium busbar that acts as a current collector and supports a fixed-frequency vibrator element. The electro-deposit of non-adherent copper metal at the cathode is produced at the same time as hydrochloric acid. The catholyte recirculates by passing through a clarifier unit where the copper separates out by gravity.

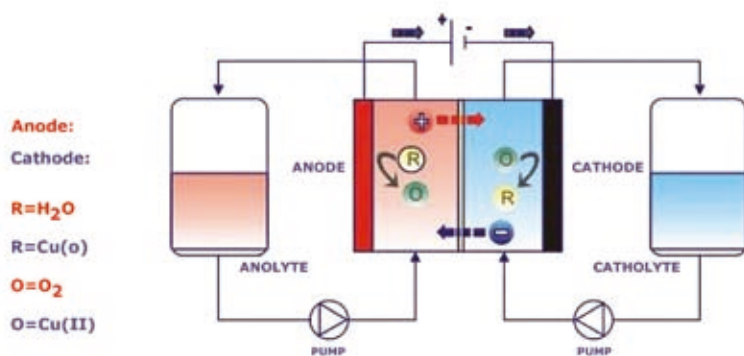
Separately, in the anolyte - which is connected to a small gas washer to trap traces of chlorine - oxygen is produced. A selective membrane is needed to separate the processes of oxidation and reduction. To ensure this does not touch the rod group, the project team operated the catholyte

in overpressure with regard to the anolyte.

It is important to ensure the correct and continuous evacuation of the solids throughout the process. However, since higher vibration frequency facilitates the expulsion of spongy copper from the cell but is less efficient, the project found that there has to be a compromise between the vibration frequency and the yield. Nevertheless, the process runs with high current efficiency, resulting in high production at low electrical cost.

The modular nature of the unit means that it can be used on-site at printed circuit plants. This both eliminates the need to transport hazardous spent solution to treatment plants and means that the resulting hydrochloric acid can be re-used on site. The project enables compliance with Community legislation on hazardous waste and the shipment of waste and is highly transferable.

Reactions taking place in the electrochemical treatment of spent alkaline etchant.



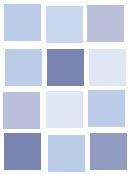
Project Number: LIFE02 ENV/E/000237
Title: Electrochemical Process for the Recovery of Copper in metal form, contained in SPENT-PERCUS
Beneficiary: Industrias Químicas del Vallés, S.A.
Total Budget: € 1,155,000
LIFE Contribution: € 346,000
Period: May-2002 to May-2004
Website: www.recuperacionelectroquimicadecobre.com
Contact: José M. Santana
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Further waste-related projects

The table below presents some of the numerous past and current LIFE projects focussing on recycling, re-use and recovery. For more information on individual projects, visit the online LIFE database at: <http://ec.europa.eu/environment/life/project/Projects/index.cfm> or the section 'LIFE by theme: Waste' at: <http://ec.europa.eu/environment/life/themes/waste/index.htm>.

| Start | Country | Number | Acronym | Title |
|---|----------|----------------------|---|--|
| 1. Packaging and plastic waste | | | | |
| 2003 | Spain | LIFE03 ENV/E/000106 | RECIPLAS | Recycling plastic from vehicle factory waste to produce packaging and pallets |
| 2003 | Spain | LIFE03 ENV/E/000076 | GENPLAST  | Integrated Recycling plant for agricultural plastics |
| 2002 | Germany | LIFE02 ENV/D/000398 | Recypol | Large-Scale Polyurethane Recycling |
| 2002 | Denmark | LIFE02 ENV/DK/000155 | PVC Hydrolysis | Innovative demonstration project for chemical recycling of PVC waste through the use of thermal hydrolysis |
| 2002 | Italy | LIFE02 ENV/IT/000112 | GIDUT | Divided Packaging Management for Tourist Use |
| 2002 | France | LIFE02 ENV/F/000301 | PLASTAGRI | Optimising agricultural plastic waste management |
| 2000 | Sweden | LIFE00 ENV/S/000867 | Eurocrate | Integrated reusable plastic crates and pallets, eliminating package waste, for sustainable distribution ... |
| 2000 | Spain | LIFE00 ENV/E/000483 | PPB-COLREC | Environmentally collection and recycling of pesticide plastic bottles using advance oxidation process |
| 2. Organic and biodegradable waste | | | | |
| 2005 | Morocco | LIFE05 TCY/MA/000141 | MOROCOMP | Design and Application of an Innovative Composting Unit for the Effective Treatment of Sludge and other Biodegradable Organic Waste in Morocco |
| 2004 | Spain | LIFE04 ENV/ES/000263 | BIOSOIL | Project to demonstrate the feasibility of compost bioremediation technology for the reclamation and sustainable urban management of brownfields |
| 2003 | Greece | LIFE03 ENV/GR/000223 | DIONYSOS | Development of an economically viable process for the integrated management via utilisation of winemaking industry waste ... |
| 2003 | Greece | LIFE03 ENV/GR/000205 | COMWASTE | ProMoTion and Implementation of Systems for the Production of High Quality Compost from Biodegradable |
| 2003 | Spain | LIFE03 ENV/E/000114 | BIOVID | Alternative to wine shoots'incineration |
| 2002 | Italy | LIFE02 ENV/IT/000089 | fertiLIFE | Sustainable fertilisation of an intensive horticultural basin through an innovative management system of |
| 2002 | Romania | LIFE02 ENV/RO/000461 | ENVACTCRB  | Activated carbon manufacturing using xylite charcoal for environment application |
| 2002 | Portugal | LIFE02 ENV/P/000421 | SEIXAL.COMP.COM | ProMoTion of Community Composting in Seixal |
| 2000 | Italy | LIFE00 ENV/IT/000223 | TIRSAV | New technologies for husks and waste waters recycling |
| 2000 | Spain | LIFE00 ENV/E/000543 | COMPOSTDIS-SEMINATION  | Co-composting procedures and its use on afforestation, landscaping and forestry and agricultural crops in |
| 2000 | Denmark | LIFE00 ENV/DK/000369 | CCA wood | Electrodialytic remediation of CCA-treated waste wood |
| 2000 | Spain | LIFE00 ENV/E/000555 | BIOCOMPOST | Demonstration Plant for composting municipal sewage sludges and rice straw, and evaluation the agronomic |
| 2000 | Portugal | LIFE00 ENV/P/000829 | PIGS | PIGS- Pig-Farm Integrated Management Project |
| 3. Waste oil | | | | |
| 2004 | Sweden | LIFE04 ENV/SE/000770 | Waste reduction | Converting Wastes into Secondary Raw Materials : an innovative method for material recycling of underground cable and condensates containing oil |
| 2004 | Greece | LIFE04 ENV/GR/000110 | ECOIL | Life Cycle Assessment (LCA) as a decision support tool (DST) for the eco-production of olive oil. |
| 2003 | Estonia | LIFE03 ENV/EE/000194 | OSELCA | Introduction and Implementation of Life Cycle Assessment Methodology in Estonia: Effects of Oil Shale |

 'Best Projects' award



| Start | Country | Number | Acronym | Title |
|---|-------------|----------------------|-----------------------|---|
| 2003 | Sweden | LIFE03 ENV/S/000596 | REUSEOIL | Recovery of Used Oil filters generating recyclable metal and oil fractions |
| 2002 | Spain | LIFE02 ENV/E/000253 | ECOBUS | Collecting used cooking oils to their recycling as biofuel for diesel engines |
| 2000 | Greece | LIFE00 ENV/GR/000671 | MINOS | Process development for an integrated olive oil mill waste management recovering natural antioxidants and producing organic fertiliser |
| 2000 | Greece | LIFE00 ENV/GR/000723 | Elaiocycle | Establishment, operation and demonstration of an innovative closed-cycle system of oil milling waste |
| 4. Waste from the construction and demolition sector | | | | |
| 2003 | Portugal | LIFE03 ENV/P/000506 | REAGIR | REAGIR - Recycling and re-use of CDW as a part of Integrated Waste Management |
| 2003 | Belgium | LIFE03 ENV/B/000019 | APPRICOD | Assessing the Potential of Plastic Recycling in the Construction and Demolition Activities. |
| 2002 | Netherlands | LIFE02 ENV/NL/000133 | Wadden Water House | Wadden Water House |
| 2000 | Greece | LIFE00 ENV/GR/000739 | DIACHIRISI ADRANON | Management of earthquake construction and demolition waste in the municipality of Ano Liosia |
| 2000 | Austria | LIFE00 ENV/A/000243 | S-House | S-House: innovative use of renewable resources demonstrated by means of an office and exhibition building |
| 5. Waste electrical and electronic equipment | | | | |
| 2003 | UK | LIFE03 ENV/UK/000612 | Batman | Project to demonstrate an innovative automated battery breaking system to deal with end of life battery management ... |
| 2003 | Hungary | LIFE03 ENV/H/000272 | IT-RECYCLING | Selective collection of wastes of the information society - pilot testing in Central Eastern Europe |
| 2002 | Greece | LIFE02 ENV/GR/000373 | Green Batteries | Development of a Pilot Separate Collection and Management Scheme in Crete for Batteries and Accumulators |
| 2000 | Spain | LIFE00 ENV/E/000484 | PC-NEW | Personal computers new equipments |
| 6. End-of-life vehicles | | | | |
| 2005 | UK | LIFE05 ENV/UK/000118 | TREAD | Tyre Recycling for Environmental Advantage |
| 2005 | France | LIFE05 ENV/F/000059 | Pamela | Process for Advanced Management of End of Life of Aircraft |
| 2005 | Spain | LIFE05 ENV/E/000317 | ELVES | Development of a system for high-quality separation of metal alloys from end-of-life-vehicle engines ... |
| 2000 | Hungary | LIFE00 ENV/H/000933 | REGUM-UTR | Used tyres recycling |
| 2000 | France | LIFE00 ENV/F/000593 | E.D.I.T. | Eco Design Interactive Tools |
| 7. Hazardous waste | | | | |
| 2005 | Lebanon | LIFE05 TCY/RL/000138 | | Infectious medical waste management national network in Lebanon |
| 2004 | Sweden | LIFE04 ENV/SE/000774 | Biomal | Demonstration of a new concept for a safe, environmental advantageous, economical sustainable and energy ... |
| 2004 | UK | LIFE04 ENV/GB/000803 | HAZRED | Demonstrating a European Method for Hazardous Waste Management Including Targets for Prevention and Reduction of Waste |
| 2004 | Netherlands | LIFE04 ENV/NL/000653 | ECO-DOCK | Eco-dock - Recycling of single hull tankers and end-of-life ships containing hazardous wastes |
| 2004 | Hungary | LIFE04 ENV/HU/000362 | UTINKDUST | Utilisation of waste ink-dust for the production of bituminous isolation plates |
| 2004 | France | LIFE04 ENV/FR/000344 | SMAD | SMAD |
| 2003 | Italy | LIFE03 ENV/IT/000323 | FALL | Filtering of Asbestos fibres in Leachate from hazardous waste Landfills |
| 2003 | Greece | LIFE03 ENV/GR/000214 | ASBESTMINE | Utilisation of MABE Asbestos Mine as a Disposal Site for Hazardous Wastes |
| 2003 | UK | LIFE03 ENV/UK/000618 | Recover All | Develop to demonstration level an industrial process aimed at reducing the impact on the environment of recovering plastic (PET), silver and paper from X-Ray and other PET based films |
| 2002 | Hungary | LIFE02 ENV/H/000435 | UWH | Utilisation of exhausted metallurgical pickling acids qualified as hazardous waste |

'Best Projects' award

Available LIFE publications

LIFE-Focus brochures

A number of LIFE publications are available on the LIFE website:

LIFE and Europe's rivers – Protecting and improving our water resources (2007 – 52pp. ISBN 978-92-79-05543-0 – ISSN 1725-5619)

<http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/rivers.pdf>

LIFE and Energy – Innovative solutions for sustainable and efficient energy in Europe (2007 – 64pp. ISBN 978 92-79-04969-9 - ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/energy_lr.pdf

LIFE and the marine environment (2006 – 54pp. ISBN 92-79-03447-2- ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/marine_lr.pdf

LIFE and European forests (2006 - 68pp. ISBN 92-79-02255-5 - ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/forest_lr.pdf

LIFE in the City – Innovative solutions for Europe's urban environment (2006, 64pp. - ISBN 92-79-02254-7 – ISSN 1725-5619) http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/urban_lr.pdf

Integrated management of Natura 2000 sites (2005 - 48 pp. – ISBN 92-79-00388-7) http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/managingnatura_lr.pdf

LIFE, Natura 2000 and the military (2005 - 86 pp. – ISBN 92-894-9213-9 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/military_en.pdf

LIFE for birds - 25 years of the Birds Directive: the contribution of LIFE-Nature projects (2004 - 48 pp. – ISBN 92-894-7452-1 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/birds_en.pdf

The air we breathe - LIFE and the European Union clean air policy (2004 - 32 pp. – ISBN 92-894-7899-3 – ISSN 1725-5619) http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/lifeair_hr.pdf

LIFE-Nature: communicating with stakeholders and the general public - Best practice examples for Natura 2000 (2004 - 72 pp. – ISBN 92-894-7898-5 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/natcommunicat_lr.pdf

A cleaner, greener Europe - LIFE and the European Union waste policy (2004 - 28 pp. – ISBN 92-894-6018-0 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/waste_en.pdf

Industrial pollution, European solutions: clean technologies - LIFE and the Directive on integrated pollution prevention and control (IPPC Directive) (2003 - 32 pp. – ISBN 92-894-6020-2 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/cleantech_en.pdf

LIFE and agri-environment supporting Natura 2000 - Experience from the LIFE programme (2003 - 72 pp. – ISBN 92-894-6023-7 – ISSN N° 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/agrienvironment_en.pdf

LIFE for Natura 2000 - 10 years implementing the regulation (2003 - 108 pp. – ISBN 92-894-4337-5)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/lifefornatura_en.pdf

A sustainable approach for the environment - LIFE and the Community Eco-Management and Audit Scheme (EMAS) (2003 - 32 pp. – ISBN 92-894-0543-0)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/emas_en.pdf

Other publications

Best LIFE-Environment Projects 2006-2007 (2007, 44 pp.-ISBN 978-92-79-06699-3 ISSN 1725-5619)

<http://ec.europa.eu/environment/life/publications/lifepublications/bestprojects/documents/bestenv07.pdf>

LIFE-Third Countries 1992-2006 (2007, 64 pp. – ISBN 978-92-79-05694-9 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/TCY_lr.pdf

Best LIFE-Environment Projects 2005-2006 (2006, 40 pp. ISBN 92-79-02123-0) http://ec.europa.eu/environment/life/publications/lifepublications/bestprojects/documents/bestenv06_lr.pdf

LIFE-Environment 1992 – 2004 “Demonstrating excellence in environmental innovation” (2005, 124 pp. – ISBN 92-894-7699-3 – ISSN 1725-5619)

http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/lifeenv92_04.pdf

LIFE-Environment Projects 2006 compilation (2006, 56 pp.-ISBN 92-79-02786-7) <http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/compilations/documents/envcompilation06.pdf>

LIFE-Nature Projects 2006 compilation (2006, 67 pp. – ISBN 92-79-02788-3) <http://ec.europa.eu/environment/life/publications/lifepublications/compilations/documents/natcompilation06.pdf>

LIFE-Third Countries Projects 2006 compilation (2006, 20 pp. – ISBN 92-79-02787-5)

<http://ec.europa.eu/environment/life/publications/lifepublications/compilations/documents/tcycompilation06.pdf>

A number of printed copies of certain LIFE publications are available and can be ordered free-of-charge at: <http://ec.europa.eu/environment/life/publications/order.htm>

LIFE “L’Instrument Financier pour l’Environnement” / The financial instrument for the environment

Period covered (LIFE III) 2000-2006.

EU funding available approximately EUR 945 million.

Type of intervention co-financing actions in favour of the environment (LIFE projects) in the Member States of the European Union, in associated candidate countries and in certain third countries bordering the Mediterranean and the Baltic Sea.

LIFE projects

- > **LIFE Nature projects** improve the conservation status of endangered species and natural habitats. They support the implementation of the Birds and Habitats Directives and the Natura 2000 network.
- > **LIFE Environment projects** contribute to the development of innovative and integrated techniques or methods to support environmental progress.
- > **LIFE Third Countries projects** support environmental capacity building and initiatives in non-EU countries bordering the Mediterranean and the Baltic Sea.

LIFE+ “L’Instrument Financier pour l’Environnement” / The financial instrument for the environment

Period covered (LIFE+) 2007-2013.

EU funding available approximately EUR 2,143 million

Type of intervention at least 78% of the budget is for co-financing actions in favour of the environment (LIFE+ projects) in the Member States of the European Union and in certain non-EU countries.

LIFE+ projects

- > **LIFE Nature projects** improve the conservation status of endangered species and natural habitats. They support the implementation of the Birds and Habitats Directives and the Natura 2000 network.
- > **LIFE+ Biodiversity projects** improve biodiversity in the EU. They contribute to the implementation of the objectives of the Commission Communication, “*Halting the loss of Biodiversity by 2010 – and beyond*” (COM (2006) 216 final).
- > **LIFE+ Environment Policy and Governance projects** contribute to the development and demonstration of innovative policy approaches, technologies, methods and instruments in support of European environmental policy and legislation.
- > **LIFE+ Information and Communication projects** are communication and awareness raising campaigns related to the implementation, updating and development of European environmental policy and legislation, including the prevention of forest fires and training for forest fire agents.

Further information further information on LIFE and LIFE+ is available at <http://ec.europa.eu/life>.

How to apply for LIFE+ funding The European Commission organises annual calls for proposals. Full details are available at <http://ec.europa.eu/environment/life/funding/lifeplus.htm>

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