Environment




Best LIFE Environment Projects 2009

EUROPEAN COMMISSION

environment

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Environment Directorate-General

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Foreword

Herlinde Vanhoutte

Selecting the 'Best of the Best' (BoB) LIFE Environment Projects has become almost a habit, as it is already the sixth year that these awards have taken place. The aim is to put the focus on those projects that are just that little bit better than the rest and can act as an example to others of what a successful, innovative, well-designed and well-executed project should look like.

The same procedure as usual has been applied. Following an initial review carried out by its external monitoring team, the Commission selected the 23 most outstanding LIFE Environment Projects. The Member States then reviewed these projects, using criteria focusing on real environmental benefit, long-term sustainability, transferability and innovativeness. This selection process resulted in a "top five", consisting of projects from diverse sectors, including: wastewater treatment, biogas production, cold storage technology, steel manufacturing, and the introduction of environmentally-friendly technologies in watershed management plans.

Together with "trainee" Chloé Besnard, I took up the co-ordination of this selection process, but most of the work has been done by my participating colleagues from 22 other Member States. Besides their work as National Focal Points they are willing to take up these evaluations and I would like to thank them all. I'm very happy to see that more and more National Focal Points are participating and maintaining their engagement, making the work easier and more valuable. I hope they will stay convinced – as I am – that by reading the actual results of those excellent projects, they can pass on this knowledge to new applicants, resulting into what LIFE+ is today: a very well managed programme, converting its funding as efficiently as possible into meaningful projects.

To shine a spotlight on all 23 Best Projects, the European Commission's LIFE Unit organised a well-attended award presentation session during Green Week in Brussels on 02 June 2010. I would also like to thank the project beneficiaries and their partners for their excellent work in favour of the environment.

The higher profile that the Best Projects receive through these awards ensures that more people know about the LIFE+ programme and the projects it sponsors. I hope that these awards continue into the future and continue to grow in stature and range in the coming years.

Herlinde Vanhoutt
LIFE Environment "Best of the Best" coordinator 2009-2010
Belgian Federal Public Service "Health,
Food Chain Safety and Environment"




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✪ "Best of the Best" projects

Introduction

For the last six years, EU Member States represented on the LIFE Committee and the European Commission's LIFE Unit have selected the Best LIFE Environment Projects for special attention. For the year 2009, Member States chose 23 projects that represent the most recent successful LIFE Environment Projects in terms of their contribution to immediate and long-term environmental, economic and social improvements; degree of innovation and transferability; relevance to policy; and cost-effectiveness. These projects are featured in this publication.

The 23 winners were presented with awards by Hervé Martin, the LIFE Environment and Eco-innovation Head of Unit, at a special awards ceremony held in Brussels during Green Week 2010. Mr Martin observed that resource efficiency, water efficiency and the management of waste and water featured strongly among this year's selection and said that these will continue to be priorities for LIFE+ programme co-funding. The concept of resource efficiency is also one of the three main priorities identified by Janez Potočnik, the new European Commissioner for the Environment. (The other priorities are biodiversity and the implementation and enforcement of European environmental legislation.)

The winners of the Best LIFE Environment 2009 awards held as part of the EU's Green Week. The ceremony provided an opportunity to reward the most successful recent LIFE projects and highlight their achievements

Selection criteria

The sixth Best LIFE Environment Projects exercise is the product of an established identification and evaluation process based on a set of best practice criteria. The projects cover all of LIFE Environment's main themes: land-use development and planning; water management; minimising the impact of economic activities; waste management; and Integrated Product Policy (IPP).

The objective of the exercise is to help improve the transmission of LIFE Environment project results by using a set of criteria to identify those projects with the highest potential for long-term environmental improvement. From the 23 projects that concluded in 2009, and that have been selected as 'best' projects, five have been awarded the title, 'Best of the Best'.

Scoring of completed LIFE Environment projects was launched in the summer of 2004. After a meeting at The Hague in May 2004, a set of 'best practice' criteria was developed by the Commission in co-operation with the Member States. These criteria included: projects' contribution to immediate and long-term environmental, economic and social improvements; their degree of innovation and transferability; their relevance to policy; and their cost-effectiveness. 'Beneficiaries', or project holders, are also required to provide an 'After-LIFE Communication Plan' and an analysis of the long-term benefits of the project with their final report. This information forms an integral part of the evaluation process.

Projects were initially technically assessed by the LIFE Unit's external monitoring team, provided by the Astrale consortium. The monitors ranked all the projects that ended by December 2009 to produce a first list. The final selection was undertaken by the Member States under the co-ordination of Herlinde Vanhoutte, using the agreed set of criteria to identify the projects to receive awards.

The 23 Best LIFE Environment Projects 2009

Land-use development and planning	
✪ EnviFriendly	Greece
NoMEPorts	The Netherlands
AIR-AWARE	Romania
GESMOPOLI	Spain
TREASURE	Denmark
Water management	
✪ WET	The Netherlands
PERBIOF	Italy
AGWAPLAN	Denmark
TOPPS	Belgium
INSIMEP	Belgium
Minimising the impact of economic activities	
✪ HVD	Germany
OZONECIP	Spain
Brine Recovery	The Netherlands
VOCless pulping	Finland
Waste management	
✪ MICROPHILOX	Spain
✪ BASHYCAT	France
RESITEX	Spain
OIL PRODIESEL	Portugal
CONWASTE	Germany
Integrated Product Policy	
HEIGHT	The Netherlands
Green Bearings	The Netherlands
SAPID	Italy
EFFERNERGY	Luxembourg

✪ "Best of the Best" projects

Photo: Erwyn van der Meer

Land-use development and planning

The Commission ensures that Member States take environmental concerns into account when putting together their land use development plans, through the Thematic Strategy on the Urban Environment, the Directive on Environment Impact Assessment (EIA) for projects, and the Directive on Strategic Environmental Assessment (SEA) for plans and programmes, in addition to initiatives such as INSPIRE (Infrastructure for Spatial InfoRmation in Europe) and GMES (Global Monitoring for Environment and Security).

These tools and initiatives all emphasise the need to harmonise a large number of cross-cutting environmental issues, such as air, water and soil protection; urban management and governance; integrated spatial planning; habitat conservation; economic competitiveness; and social inclusion.

In order to achieve sustainable and successful land-use planning and development, an integrated approach built upon cross-departmental and sector co-operation with all relevant stakeholders and integration of local, regional and national policies must be adopted.

EnviFriendly: Reducing pollution from agricultural lands

This Greek project mobilised local authorities and communities to implement environmentally friendly technologies for the minimisation of non-point source pollution from agricultural lands and their integration in the watershed management plan of the Evrotas river basin and its coastal zone.

Soil and groundwater pollution from agriculture and related activities is becoming an area of increasing public and regulatory concern. Groundwater contamination can have significant negative impacts on human health and ecological systems. The area targeted by the EnviFriendly project, in the eight municipalities of the region of Sparta, is characterised by agricultural activities (predominantly olive and orange groves) and their related industrial processes (olive mills and orange juice factories) that are carried out by small-scale, family-owned businesses. These small-scale businesses find it difficult to invest in environmental technologies to mitigate the impact of their agricultural practices, which have caused excessive nitrate and pesticide pollution in the soil and waters of the region.

With the EnviFriendly project, the prefecture of Lakonia decided to select and design technologies for the minimisation of non-point source pollution from agricultural lands. However, the Lakonia prefecture stressed how their implementation should not be carried out with a surgical approach, but, that they should be conducted in conjunction with the development of river basin management plans (RBMP) and remedial actions to improve the quality of surface, ground and coastal waters. By integrating agriculture with water policy, the project is also fully in line with the Water Framework Directive (WFD) (2000/60/EC) as it foresees the necessity to integrate activities on different horizontal issues whilst ensuring coherence amongst policies.

EnviFriendly strategies

The EnviFriendly project consisted of two distinct and complementary strategies. The first strategy was to demonstrate a series of methods and technologies that would reduce agricultural pollution from point and non-point sources in an environmentally friendly way.

The second strategy dealt with the social aspects of the region, aiming to identify potential changes in management practices towards sustainable development. By ensuring the involvement of all stakeholders and the buy-in of the farmers, the project wanted to ensure their collaboration in the development of the RBMP, ensuring the best use of water resources and the sustainable growth of the region.

"The Evrotas river basin was selected for the integration of the environmentally friendly techniques in the watershed management plan as it is a temporary river that is more sensitive to extreme climatic conditions (droughts and floods) and development of the plans is more difficult to implement," says Vassilis Papadoulakis of the Lakonia prefecture.

Natural attenuation of pollution

The first method that was applied by the LIFE project was Monitored Natural Attenuation (MNA), a remediation technology based on understanding and monitoring the naturally occurring processes that destroy or immobilise contaminants at a contaminated site. The project established monitoring stations to check the hydrological and physico-chemical parameters in the river basin. A risk assessment of

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Phytoremediation with poplar trees achieved a reduction of nitrate loads in the wastewater of 80%

environmental stresses was carried out and modelling scenarios conducted. The natural ability of the river basin to reduce the intensity of pollution - attenuation - was monitored and recorded and it was found to be able to reduce nitrogen and phosphorus loads by 96% and 98% respectively.

Wells were installed at two drainage canal sites at Skala-Vasilopotamos and systematic sampling of sediment, reeds, and ground and surface waters took place. Drainage canals decrease the levels of nitrates through denitrification and plant uptake and are also where plants - such as common reeds - grow. Appropriate management of the reeds resulted in the minimisation of nitrate pollution loads to surface waters. Poplar trees, planted in the riparian zones of the river, also decreased nutrient loads through uptake and enhanced denitrification.

The project also demonstrated phytoremediation in conjunction with river bank erosion controls as a combined remediation tool for non-point source pollution of nutrients. The main objective was to apply environmentally friendly solutions that will gradually merge into the natural environment and retain the equilibrium of the ecosystem. Results suggested that, with the appropriate management of reeds, approximately 77% of nitrate nitrogen and all phosphorus entering the drainage canal would be removed by plant uptake.

The EnviFriendly project designed technologies for the minimisation of non-point source pollution from agricultural land, such as olive groves

Managing waste from the olive industry

Pollutants enter the river basin from the area's 168 olive mills, 91 of which are located in the Evrotas river catchment area. These mills produce both olive oil (20 445 tonnes/yr) and table olives. They generate 60 000 m^3/yr of wastewater, 57 384 tonnes/yr of wet waste, and 6 337 tonnes/yr of phenolic compounds. Most mills are family-owned and small, and the area lacks a centralised wastewater treatment facility. Consequently, olive mill wastewater is disposed of directly into the Evrotas river.

Prototype units for treating waste from local olive oil mills and the wastewater from table olive producers were tested:

- One approach filtered olive wastewater before releasing the liquid residue into a newly planted area of poplar trees to be naturally degraded. Organic matter from the wastewater was not found below 80 cm deep and did not enter groundwater reservoirs. As the poplars and their root system grew, phytoremediation achieved a reduction of nitrate loads in the wastewater of 80%;
- A second technique used lime to help separate solid and liquid particles before composting the solid part and mixing the liquid with clean water. Both were then used on agricultural land, increasing yields of maize; and

One of the methods filtered olive wastewater before naturally degrading the wastewater

Thanks to LIFE funding the the Evrotas river basin will achieve by 2015 the "good ecological status" objectives foreseen by the WFD

- The third approach used electrolysis to treat wastewater with high biological oxygen demand (BOD) from processing olives in brine. This reduced the BOD content by 50%.

A report on the demonstration and evaluation of the agricultural waste management technologies was produced and included suggested amendments that could make the tested technologies even more effective. Based on the pilots, the Lakonia prefecture established a list of 10 'EnviFriendly' techniques (see project website for more details). The prefecture said that it would grant annual permits to olive oil mill owners only if they would adopt one of these techniques to control wastewater. The prefecture further committed to defining limits of pollutants that can be legally discharged in water bodies, in line with efforts to implement the WFD.

Successful stakeholder involvement

The second project strategy emphasised the need to facilitate the interaction between farmers and stakeholders. The objective was to determine a common basis for the management of natural resources in a sustainable way. A series of meetings was organised in five municipalities in which local authorities, large olive oil producers, farmers and their unions examined the following aspects that were then inserted in the management plan:

- Changing the existing cultivation to more dynamic and less water-intensive;
- Changing some of the riparian uses to more ecological ones;
- Gradual adaptation of organic ways of production, which that may lead to new markets (Protected Destination of Origin (PDO) as well as the Protection of Geographical Indication (PGI) and decrease in the use of fertiliser and chemical pollution;
- Development of less polluting industrial processes of agricultural products; and
- Development of ecotourism projects.

EnviFriendly's wider impact

The final integrated management plan for the Evrotas river basin took into account all the identified environmental and socio-economic elements. It had six axes covering: agricultural development; drinking water; irrigation; pollution reduction; flood and drought response; and biodiversity protection. A Local Development Observatory was officially established in Lakonia to ensure its effective implementation.

EnviFriendly has also contributed to Greece's first Integrated Water Resources Management Plan. The Central Water Agency of Greece's Environment Ministry nominated the Evrotas basin for the EU Pilot River Basin (PRB)-Agriculture network. The Lakonia prefecture states confidently that the Evrotas river basin will achieve by 2015 the "good ecological status" objectives foreseen by the WFD.

The project has empowered the local authorities to take actions, ensuring in this way the sustainability of the outcomes. The Prefecture of Lakonia has become a prototype prefecture for water management in Greece, having developed the country's first comprehensive management plan for water resources, according to the Central Water Agency. The results of this project are readily transferable to other regions of Greece and other Mediterranean countries. Furthermore, the beneficiary's participation in the Pilot River Basins (PRB-AGRI) consortium ensures the dissemination of knowledge derived in the LIFE project to other EU countries.

Project Number:
LIFE05 ENV/GR/000245

Title: Environmental Friendly Technologies for Rural Development

Beneficiary: Prefecture of Lakonia

Contact: Dimitros Liakakos

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Website: www.envifriendly.tuc.gr

Period: Dec-2005 To May-2009

Total Budget: €2 194 000

LIFE Contribution: €1 096 000

NoMEPorts: Making a racket about noise pollution in ports

The NoMEPorts project (Noise Management in European Ports) demonstrated a noise mapping and management system that enables evidence-based operational and environmental management and planning in ports to reduce noise pollution. It showed an innovative specific use of a new EU noise calculation method and database developed in EU research projects.

The EU Directive 2002/49/EC on the Assessment and Management of Environmental Noise (EU Noise Directive) requires that industrial port areas near large agglomerations are included in noise maps drawn up by competent authorities. The LIFE NoMEPorts project sought to meet the challenge of identifying how best to map and manage noise in ports characterised by both industrial and traffic activity.

The project, led by the Port of Amsterdam, started with the founding of local workgroups in six ports, in five EU countries. These contained selected local experts on noise pollution, the competent local authorities and relevant local industries. The project trained them to operate the noise mapping and management software.

Once trained, the groups examined the geographic and meteorological characteristics of each port, defining its boundaries and which noise sources to map. Additional information was collected on future spatial planning. The working groups then took responsibility for carrying out an inventory of local noise situations, studies and complaints from port and municipality archives.

The noise mitigation action plan for Amsterdam set out actions to reduce noise pollution by 30%

The activities enabled the teams to create local noise maps and acoustic models showing the noise generation and related annoyance caused to people living around ports. The maps provided five levels of complexity, from a general overview down to the noise coming from specific activities, ships on the quay and industrial facilities.

An inventory of technical and spatial planning solutions to reduce noise was carried out. By analysing the noise maps and discussing these potential solutions, each workgroup drew up an action plan to combat the negative impact of noise in its own port. The plans aimed to improve the balance between environmental protection and economic activities. The plan for Amsterdam, for instance, set out actions to reduce noise pollution by 30%.

Pooling the ports' knowledge

A central workgroup meeting enabled each workgroup to share its experiences. They jointly analysed the content of the action plans and the way they were created as well as the costs and effects of noise mitigation measures and how to count the people affected by noise. The project's noise management software was optimised based on these exchanges.

The major output of the project was a 'Good Practice Guide on Port Area Noise Mapping and Management'. This establishes a six-step methodology for the cost-effective and efficient creation of noise maps and mitigation action plans for ports. It includes recommendations for specification of the EU Noise Directive to create a common harmonised approach to noise management in EU ports.

The results were disseminated among the members of EcoPorts, a network of more than 150 ports. Furthermore, the system should be applicable in other 'simpler' industrial sectors and to the management of other significant port environmental issues such as air quality. A new project proposal to test this broader use is planned.

Project Number:
LIFE05 ENV/NL/000018

Title: Noise Management in European Ports

Beneficiary:
Port of Amsterdam

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Website:
http://nomeports.ecoports.com

Period: Mar-2005 to Aug-2008

Total Budget: €1 503 000

LIFE Contribution: €708 000

AIR-AWARE: LIFE support breathes better air into Bucharest

Romanian meteorology authorities have made effective use of LIFE support to co-finance essential new air quality monitoring and management systems that are being used to improve the quality of life for Bucharest's two million inhabitants.

Air quality is a vital part of our planet's life support system and for many years the EU has been actively working with Member States to help improve the quality of Europe's air. Such actions remain increasingly important as pressures from the likes of traffic-related pollution and expanding urban or industrial developments continue to adversely contaminate the air that we all rely on.

In response to these growing concerns, the EU has established a framework directive on urban air quality management as part of its strategy for improving air quality. The legislation requires cities to implement strict pollution monitoring standards and imposes a duty on authorities to prepare action plans for tackling air quality problems. All EU metropolitan areas over 200 000 inhabitants must comply with the directive and LIFE co-finance was used in the Romanian capital, Bucharest, to help the city introduce a state-of-the-art air quality management system.

Launched in 2005, as part of the country's EU membership process, this AIR-AWARE project amalgamated Bucharest's key environmental stakeholders and resulted in a highly successful sustainable development tool that continues to be used for monitoring, modelling and managing air quality in the Romanian capital.

Better air for Bucharest

Some 10% of the country's population is estimated to live in Bucharest and these two million people have suffered from a variety of different atmospheric pollutants caused by emissions from outdated power plants, heavy industry and intense traffic. The latter has been considered responsible for around 70% of the city's total pollution.

Prior to LIFE's intervention, air quality monitoring systems in Bucharest were limited. AIR-AWARE's 'Air Pollution Impact Surveillance and Warning System for Urban Environment' uses data from the LIFE-funded monitoring equipment, which scans and analyses air samples from different locations and altitudes to provide a 3D map of real-time emissions over the city. Eight fixed-position monitoring units were included in the LIFE project and these are supported by several mobile emission monitoring stations that can be moved to analyse problems in particular hot-spot zones.

All data are fed into a GIS platform, which provides forecasts and dynamic mapping material for decision-makers in the municipal authorities. Users of the system, which has been fully operational since early 2009, welcome the improvements and note how the AIR-AWARE technology provides more detailed information that allows easier forecasting, as well as daily health recommendations based on the air quality status.

Broader benefits

In addition to its day-to-day monitoring applications, the AIR-AWARE system has been used to inform the design of the city's 2010 urban development plan and also played a central role during the development of an 'Air Quality Management Programme for Bucharest'. This facilitates compliance with the EU directive and aims to reduce the city's air contamination load by 50%, leading to predicted economic savings in excess of €175 000/yr and significant benefits for biodiversity, built infrastructure and public health.

LIFE-funded monitoring equipment scans and analyses air samples from different locations providing a 3D map of real-time emissions over the city of Bucharest

Project Number:
LIFE05 ENV/RO/000106

Title: Air Pollution Impact Surveillance and Warning System for Urban Environment

Beneficiary: National Administration of Meteorology

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Website: http://life-airaware.inmh.ro

Period: Nov-2005 to Oct-2008

Total Budget: €1 113 000

LIFE Contribution: €460 000

GESMOPOLI: A model for sustainable mobility for industrial estates

Many regions of Europe, especially those with a long industrial history, have a high density of businesses and employees located in particular zones. In the majority of cases, these industrial estates have been developed without adequate planning for public transport. This is the case in the Catalonia region of Spain, where a LIFE project has established a model for more sustainable transport for six industrial estates.

Transport to and from the workplace currently generates considerable costs in environmental, economic and social terms. Private car usage is particularly high in Catalonia, with around 52% of workers using their private vehicles for journeys to and from the workplace. The project's aim therefore, was to promote a methodology for more sustainable transport suitable for six different industrial estates (varied both in terms of economic activities and in their locations).

The participating industrial estates were: El Pla (el Baix Llobregat region), Santiga (Vallès Occidental) and el Beuló (Osona) located in the province of Barcelona; Girona Airport; and el Segre and Agroreus in the provinces of Lleida and Tarragona, respectively. These areas all lacked overall mobility planning, although some of the estates had carried out sporadic activities targeting more sustainable transport solutions. Other relevant aspects were the inclusion of estates of different sizes and with different economic activities. Examples include: the El Beuló estate (services), the Agroreus estate (agricultural) and Girona Airport (work centre).

GESMOPOLI set up a management system for sustainable mobility. Awareness-raising activities were also carried out to encourage people working on industrial estates to change their behaviour

Having identified the main transport problems, a consensus was sought among all stakeholders on the project's proposals for more sustainable solutions. Examples included persuading employees to abandon their cars in favour of other solutions such as carpooling, or using buses. A management system for sustainable mobility was set up and awareness-raising activities were carried out to encourage behavioural changes by the workers and managers on the industrial estates. The sharing of experiences with all the stakeholders gave added value to the mobility management guidelines produced. A new post of 'mobility manager' was created to co-ordinate actions.

Free bus tickets

Pilot actions were carried out at each of the six project sites, including the distribution of free bus tickets to promote public transport, the addition of zebra crossings and other measures to improve pedestrian safety, and communication of the benefits of car pooling and alternative modes of transport. These actions also helped to improve accessibility, safety and mobility guidelines.

Key deliverables are available from the project website (below): these include mobility plans for the six estates, a comparative study, "Guide for the Creation and Start Up of the Mobility Pacts", the "Mobility Managers Manual", and the "Integrated Management of mobility in industrial estates and areas".

The project is now looking to transfer the management expertise gained to other industrial estates both in Spain and elsewhere. In the medium-to-long-term the project is also confident of achieving reductions in primary energy consumption, atmospheric emissions, noise pollution and land occupancy by transport infrastructure.

Project Number:
LIFE05 ENV/E/000262

Title: Integral mobility management in industrial estates and areas (GESMOPOLI)

Beneficiary:
The Diputació de Barcelona (Barcelona Provincial Council)

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Website: www.gesmopoli.net

Period: Nov-2005 to Oct-2008

Total Budget: €1 441 000

LIFE Contribution: €721 000

TREASURE: Urban run-off water treatment in Denmark

The TREASURE project demonstrated treatment methodologies for significantly reducing the pollutant content of urban run-off water. Some polluting substances were reduced by as much as 99% and others by more than 80%.

Urban run-off water, which can be particularly polluting and is largely untreated, has not hitherto been the subject of much research. A Danish project sought to address this issue, however, by bringing together three Danish water companies and two Danish universities.

The treatment of rainwater run-off presents three technical challenges:

- Rainwater comes in bursts and normal municipal wastewater treatment plants cannot cope with occasional large volumes;
- The pollutants in rainwater are mostly inorganic; and
- Many pollutants are dissolved in the water and are not removed by traditional technologies. Moreover, they are also the most mobile and most easily taken up by plants and animals.

As part of an initiative to treat storm water run-off, the project constructed three detention ponds in the urban environments of Odense, Silkeborg, and Århus. These were designed not only to remove small particles and colloidal and soluble bound pollutants from the surface waters collected from the catchment area, but also to be attractive showpieces as part of the local urban landscape. The ponds were equipped with facilities for online monitoring of the treatment performance.

Effective treatments

The most effective treatment process for reducing a broad range of dissolved and colloidal pollutants in the storm water run-off was found to be the wet retention pond with a sand filter and fixed-media absorption filter. While plants contributed only marginally to the cleaning processes, they ensured that the site became an integrated recreational area.

A wet retention pond with a sand filter and fixed-media absorption filter was used to remove pollutants from urban run-off water

The fixed-media absorption technology proved very efficient at managing high loads of dissolved heavy metals, allowing very low outlet concentrations regardless of the initial level of pollution. For all measured pollutants, the outlet concentration was consistently below the relevant water quality criteria. Copper was reduced from an average of 310 µg/l down to 4 µg/l, corresponding to an overall removal rate of 99%. Phosphorous was reduced from 0.27 to 0.025 mg/l, corresponding to an overall removal rate of 91%.

The process of iron enrichment of the bottom sediments and the dosing of aluminium to enhance coagulation/flocculation was not found to result in a general decrease in pollutant concentrations, but such actions did counteract the growth of algae in the pond, particularly the aluminium dosing. Such measures are thus effective for combating phosphorous and the consequent eutrophication of aquatic environments.

Despite the initial set-up costs for these treatment plants, the results are excellent and cost must be measured against the current lack of effective treatment for urban run-off water. Application is not restricted to a particular urban context and could also be expanded to other processes such as the treatment of contaminated drinking water and phosphorous-polluted surface waters. The methodology could play a key role in implementing the Water Framework Directive.

Project Number:
LIFE06 ENV/DK/000229

Title: Treatment and re-use of urban stormwater runoff by innovative technologies for removal of pollutants

Beneficiary: Silkeborg Spildevand

Contact: Jan Pederson

Email: jp@silkeborg.dk

Website: www.life-treasure.com

Period: Oct-2006 to Oct-2009

Total Budget: €3 932 000

LIFE Contribution: €1 966 000

Photo: Justin Toland

Water management

Protecting the quality of Europe's water resources has been a high priority for the European Union (EU) since it started adopting legislation in the area of environmental protection. It is a precondition for human, animal and plant life as well as an indispensable resource for the economy. Water also plays a fundamental role in the climate regulation cycle.

The Commission's Water Framework Directive (WFD) of 2000 sets out targets for Member States to achieve by 2015. The requirements of the WFD form a co-ordinated water policy together with other EU measures such as the Urban Waste Water Treatment Directive, the Nitrates Directive and the Directive on Integrated Pollution Prevention and Control (IPPC).

Individuals and citizens' groups have a crucial role to play in achieving these objectives. River basin management plans that have involved the local community have boosted a sense of ownership and responsibility for clean and safe water supplies.

Member States will continue to allocate significant funds for investments aimed at addressing WFD objectives, including new measures and technologies that enable sustainable river basin management.

WET: Improving wastewater treatment in line with the WFD

This Dutch LIFE project investigated advanced treatment technologies for wastewater. The WET (Wastewater & Effluent Treatment) project has led to the installation of a full-scale version of the trial technology at the Leiden-Noord sewage plant in South Holland.

The LIFE Environment WET project was a collaborative venture between the Rijnland District Water Control Board (Hoogheemraadschap van Rijnland), which is responsible for surface water quality in mid-west Holland, and STOWA (The Foundation for Applied Water Research), under the supervision of engineering consultants, Witteveen + Bos. The inspiration for the project came from the EU Water Framework Directive (WFD), which provides targets for the protection of surface water, coastal water and groundwater that are due to come into force in 2015.

Among the substances targeted by the WFD are the nutrients nitrogen (N) and phosphorous (P), which can cause excessive algal growth when present in extremely high concentrations in surface water, potentially leading to severe oxygen shortages and fish mortalities. A national screening exercise in the Netherlands indicated that modern wastewater treatment plants were only able to remove some 80% of N and P loads. Furthermore, as the water board's Jeffrey den Elzen indicates, "They are not designed at all to remove priority substances such as heavy metals, pesticides, medicines and endocrine disruptors."

Thus, the aim of the LIFE project was to investigate the further removal of nutrients and other pollutants from wastewater by adding subsequent treatment stages to existing wastewater treatment plants.

Testing the technology

The project took place in a specially constructed covered test area at the Leiden Zuid-West sewage treatment plant in Leiden, South Holland. Trials started in early 2007 and consisted of two phases:

1. Phase 1 looked at the possibilities for further removal of N (to below 2.2 mg N/l) and P (to below 0.15 mg P/l) using various sand filtration systems.
2. Phase 2 investigated the use of carbon filtration and oxidation techniques for removing heavy metals, pesticides and herbicides, medicine residues and endocrine disruptors.

BEST OF THE BEST 2009

Following successful trials of the technology by the LIFE WET project, this full-scale single-filter continuous sand filtration system was installed at the Leiden-Noord sewage plant. It will keep nitrogen and phosphorous loads within limits set by the Water Framework Directive

Photo: Justin Toland

During Phase 1, two test lanes were built in the test area and connected to the output of the existing treatment plant. Lane A used a single continuous sand filter aided by additives: a source of carbon for biologically removing nitrogen and a flocculant for chemically removing phosphorous. Lane B used two sand-filtration stages: the first stage was a continuous sand filter to remove N; the second stage employed a double-layer fixed bed sand filter to remove P.

The results of Phase 1 were very encouraging, indicating that further systematic removal of N and P to below the limit values is feasible even at higher filtration speeds (up to 20 m/h). The single-filter concept was found to perform as well as the two-filter approach, whilst costing some 50% less.

Phase 2 of the project tested three different technologies for removing the remaining pollutants: activated carbon filtration; and two oxidation techniques – ozonisation; and hydrogen peroxide with UV light.

With ozonisation, an ozone generator uses an electrical discharge to convert oxygen molecules (O_2) into ozone molecules (O_3). The ozone gas is then fed into the bottom of the columns so that gas bubbles can move upwards through the water, oxidising (i.e. cutting into smaller pieces) substances that they come in to contact with.

In the advanced oxidation process using hydrogen peroxide and UV light, hydrogen peroxide (H_2O_2) is added to the water. The water is led along two UV lamps, the light from which 'activates' the H_2O_2, which then forms radicals (H_2O_2 becomes 2OH). These radicals oxidise substances in the water, thereby cleaning it.

Activated carbon filtration requires a filter bed of activated carbon, a substance with a very porous surface. Substances that come into contact with it are often caught in its pores, meaning that when water is forced through the filter it comes out clean the other side.

Results of Phase 2

The three technologies tested in Phase 2 were all found to have certain benefits and drawbacks. Activated carbon filtration was shown to be effective at removing some heavy metals, but less effective with herbicides, pesticides, medicines and endocrine disruptors. Initial investment costs for a plant for 100 000 residents are high (€5.6 million), but running costs are comparatively low, giving a cost per resident of €8.4 per year. The two oxidation techniques were both found to be very effective at removing pesticides, herbicides, medicines and endocrine disruptors, with the added benefit that they can be used for disinfection. However, it is not possible to remove

The continuous sand filter is monitored from this control room

Photo: Justin Toland

heavy metals by oxidation. Of the two oxidation techniques, ozonisation offers considerably better value for money, with a treatment plant for 100 000 residents estimated to cost €4.2 per resident per year, compared with €21.9 per resident for one using hydrogen peroxide/UV.

Putting the results into practice

Following the successful trials of the LIFE WET project, The Rijnland District Water Control Board has implemented a full-scale single-filter continuous sand filtration process at its Leiden-Noord sewage plant. This facility, which treats wastewater for some 100 000 residents, was built in the mid-1980s and uses standard activated sludge treatment as well as biological phosphorous removal. Jeffrey den Elzen, who was involved in designing both the trial and full-scale technologies, explains that Leiden-Noord was chosen in preference to Leiden Zuid-West because it was not possible to extend the conventional water treatment plant at the former, and the effect on surface water from continuous sand filtration was calculated to be greater. "A very positive point of the trial was that we were already using full-size units. We just added more of them for a working plant – it was very easy to scale up," says Mr. den Elzen.

The sand filtration section, which uses iron chloride as a flocculant and acetic acid as a carbon source, became operational in March 2010. Leiden-Noord is one of two treatment plants under the aegis of the Rijnland District Water Control Board that has implemented a sand filtration system, although the only one with a single-filter concept (Alphen-Noord is using a two-step process to remove nitrogen). "We were planning to add sand filtration to 12 wastewater treatment plants, but are now only doing two, because we saw we could optimise existing effluent treatment processes (e.g. through online sensors)," explains Mr. den Elzen. "Measurement technology has improved a lot in the last few years."

Photo: Justin Toland

Jeffrey den Elzen from the Rijnland District Water Control Board in front of the canal in which treated water from Leiden-Noord is discharged

Nonetheless, he believes that the results obtained by the LIFE project are highly transferable, having generated a lot of new information and experience with regard to the further removal of nitrogen, phosphorous and other relevant contaminants. "Another water board has built a double sand filter at one of its plants. I'm sure this (single-filter concept) will have spinoffs within the Netherlands as well," says Mr. den Elzen.

Award brings mixed emotions

Collecting the LIFE Environment 'Best of the Best' award in Brussels was a time of mixed emotions for Mr. den Elzen: "When I heard that we would get this award I was of course very proud of the project. On the other hand, there were also a lot of mixed feelings, because I was doing this project with my colleague and friend Wouter Dijksma. Sadly, at the end of the project he got ill and in December 2009 he passed away. As project manager, Wouter played a very significant role in making the project a success. It's a shame he could not be in Brussels with us to receive the award."

Project Number:
LIFE06 ENV/NL/000167

Title:
Wastewater & Effluent Treatment

Beneficiary: Rijnland District Water Control Board (Hoogheemraadschap van Rijnland - HHR)

Contact: Jeffrey den Elzen

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Website:
www.rijnland.net/wet-project

Period: Dec-2005 to June-2009

Total Budget: €2 815 000

LIFE Contribution: €1 176 000

PERBIOF: Innovative 'fill and draw' biofilter improves wastewater treatment efficiency

This Italian LIFE project has developed a new biofilter technology for treating wastewater that could be 10 times more efficient than conventional systems.

Europe's homes and businesses produce vast quantities of wastewater, which needs to be properly treated. Treatment standards are controlled by legislation including the EU's Water Framework Directive and Urban Waster Water Directive. Compliance with these legal requirements remains a costly operation for Member States, and as wastewater volumes continue to increase, alternative technologies are required to improve the efficiency of conventional treatment plants.

An Italian LIFE project has developed a new type of treatment system that is capable of significantly improving the cost-effectiveness and environmental protection capacity of wastewater treatment plants throughout Europe. Implemented by the government's National Research Council, this pioneering project's success centres on an innovative biofilter that is able to combine multi-treatment phases using a special 'fill and draw' methodology.

Once submerged in the wastewater, the PERBIOF (PERiodic BIOFilter) technology becomes active and assimilates all phases of a traditional biological treatment process within a single operative unit. Results of tests during the LIFE project showed that PERBIOF's system was able to remove carbon and nitrogen in the same treatment tank. This avoids the need for the extra tanks found in many existing treatment plants.

The project received an award during the Italian edition of the European Business Awards for the Environment, which were organised by the Italian Environment Ministry

Success factors of the new treatment technology are attributed to PERBIOF's use of new biological treatment agents (i.e. microorganisms) that grow as granules inside the biofilter. These granules are up to 10 times more concentrated than biomass growing in conventional wastewater treatment plants, which means that concentrated wastewater can be treated faster, in smaller reactors and with less solid waste residue produced.

Significant success

Three years of LIFE co-finance were provided for the PERBIOF project which tested the new biofilters in a number of wastewater environments. Outcomes from the tests provided consistently good results and confirmed that the technology possesses extremely high depuration efficiencies (up to 10 times higher than conventional ones). As an added advantage PERBIOF also produces very low levels of sludge. Even in difficult waste streams, such as from tanneries, the new technology gave excellent results when used in conjunction with a chemical oxidation stage to help transform complex pollutants into simpler biodegradable compounds.

Gains from the project include: a reduction in sludge production of up to 90% in comparison with traditional technologies; a 50% reduction in treated effluent toxicity; an 80% reduction in area required (footprint); a 40% saving in operating costs; a 70% reduction in overall environmental impact (resource use); and a 90% reduction in global warming contributions

LIFE's commitment to co-finance this type of applied research has paid off well and PERBIOF technology offers real opportunities for mainstreaming within wastewater treatment plants from around the EU and beyond. The technology's cost-effectiveness and appropriateness for small-scale treatments is also particularly attractive for SMEs and interest has already been shown in PERBIOF by Italy's textile processing industry. Wider uptake is predicted to follow as the beneficiary continues to test the new biofilters in other depuration processes.

Project Number:
LIFE05 ENV/IT/000868

Title: A new technology for treating municipal and/or industrial wastewater with low environmental impact

Beneficiary: Istituto di Ricerca Sulle Acque Consiglio Nazionale delle Ricerche

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Website: www.perbiof-europe.com

Period: Nov-2005 to Nov-2008

Total Budget: €625 000

LIFE Contribution: €295 000

AGWAPLAN: LIFE combating agricultural eutrophication in Denmark

Good farming practices and new integrated advisory services have been successfully combined by a LIFE project to help reduce eutrophication risks in Danish watercourses.

Water quality levels in many Danish lakes and rivers have been recorded at levels below the standards anticipated by the Water Framework Directive (WFD). For example, previous assessments by regional authorities have found that only around 12% of lakes sampled were considered to have acceptable water quality conditions and only around half of the sampled streams met required quality goals. Eutrophication linked with agriculture was judged to be a major contributory factor to the poor water conditions and LIFE funds were used to demonstrate how farm-led action can help improve the quality of Danish water resources.

Led by the Danish Agricultural Advisory Service, the LIFE AGWAPLAN project demonstrated and quantified the impact of good agricultural practices (GAPs) on reducing nutrient content on surface and groundwater in three different pilot areas in eastern Jutland. This integrated approach was based on the participation of farmers, environmental authorities and agricultural advisors and researchers. It showed how farmers can work together with advisory services and municipalities to implement WFD objectives within a collaborative framework.

Core aspects of the project involved demonstrating the potential of integrated approaches, and incorporating targeted GAPs for reducing eutrophication levels. These were developed by the LIFE project team through an extensive research exercise that brought together all available environmental knowledge relating to agri-eutrophication within a comprehensive GAP manual for farmers. Preparation of the manual covered a full range of

AGWAPLAN demonstrated the impact of good agricultural practices on reducing nutrient content in surface and groundwater

Danish farm activities and took account of commercial factors concerning productivity gains or losses from the different farming practices.

Pilot farms

Following collation of the proposed GAPs, the project then tested its hypotheses in the three different pilot sites. Located relatively close together in eastern Jutland, the areas were selected to provide comparative farm-based results and also allowed modeling of potential impacts on nitrogen (N) and phosphorous (P) levels in watercourses over a larger catchment scale. Each of the sites was carefully investigated to identify baseline data regarding eutrophication levels and associated use of farm fertilisers.

Pilot versions of the GAP guidance were applied in practice on the test farms using the project's 'integrated advisory system'. This novel agri-advisory tool helped facilitate an agreed eutrophication management plan for each farm. The planning process proved particularly popular with farmers since it afforded equal priority to their economic objectives and balanced business efficiency requirements against water quality aspirations.

Results from the pilots showed the farmers have reduced leaching of nutrients to a certain extent. For example, in one of the areas, Norsminde Fjord, it has been calculated that there was a 20-25% reduction at farm level of total N-leaching. This was achieved using integrated advising and the project's GAP advice (examples included using ammonium instead of nitrate fertiliser, early sowing of winter cereals, catch crops, spring ploughing of grasslands, and constructed wetlands).

However, the project findings also demonstrated that the WFD environmental goals could not be met in all places through voluntary initiatives. Farms and farming systems vary considerably between areas, as do the environmental challenges faced. The AGWAPLAN approach focused on making local, i.e. farm level, aspirations a central part in the process towards achieving the objectives of the WFD.

Project Number:
LIFE05 ENV/DK/000155

Title: Integrated Protection of Surface and Groundwater in Agricultural Regions

Beneficiary: Danish Agricultural Advisory Service, National Centre

Contact: Irene Asta Wiborg

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Website: www.agwaplan.dk

Period: Nov-2005 to Mar-2009

Total Budget: €1 982 000

LIFE Contribution: €991 000

TOPPS: Keeping on top of point source pollution

The TOPPS (Train the Operators to Prevent Pollution from Point Sources) project successfully developed common European best management practice (BMP) guidelines for preventing point source losses of plant protection products (PPP) to water and promoted these BMP principals to users and relevant authorities.

The need to protect harvests against pests, diseases and weeds is often met by spraying PPPs onto fields or crops. However, these products can end up in surface waters if not handled carefully or during bad weather. Several small pilot projects had achieved reductions in PPP concentrations in water of 50-90% by better handling of potential point sources. The TOPPS project sought to go beyond these efforts to create co-ordinated, consistent and internationally transferable recommendations for operators to avoid point-source pollution.

TOPPS established four work clusters based on geographical regions of Europe: Southern; Nordic; Eastern European and Western European countries (15 Member States took part). A cluster co-ordinator was appointed for each one and a cluster committee established consisting of national key stakeholders and expert representatives. A TOPPS Steering Committee managed the specific objectives of the LIFE project.

TOPPS prepared an inventory of existing PPP management practices and implementation tools by cluster. It also drew up an inventory of organisations active in the field, such as farm advisory services, water associations, distributors and farmers' organisations. These inventories were collated into a database of 1 400 experts and 1 334 organisations working on PPPs and water. It found 74 references to training and advice on how to prevent point-source pollution.

The TOPPS team conducted training workshops on the safe use of PPPs, reaching more than 4 000 farmers

BMP guidelines

Interdisciplinary exchanges at national and international levels led to the agreement at a European workshop of EU-wide BMP guidelines for the safe use of PPP and sustainable mitigation of water contamination. These guidelines relate to all relevant working processes, including transport, storage, handling and filling, spraying, cleaning, and the disposal of remnant spray solution, and were translated into 12 languages, filling knowledge gaps which existed in many countries.

The BMP guidelines were the basis for comprehensive information, training and demonstration materials focused on the key risk areas. More than 300 000 brochures (in 15 languages) were disseminated, providing information on how farmers could audit their practices.

The four regional clusters implemented the guidelines considering their specific local context based on the European core of the guidelines. Specific work focused on remnant and technical residue management and examined the critical success factors for the implementation of the TOPPS recommendations. This resulted in a proposal of suggested organisational requirements for implementing the guidelines in any EU country.

The project set up 10 demonstration farms in eight countries. The TOPPS team conducted 138 training workshops on safe use of PPPs, reaching more than 4 000 farmers and 1 500 advisors. It also created displays, stands and videos for awareness-raising at events. The value of the guidelines and brochure was shown by some national authorities and stakeholders sponsoring their dissemination and adopting the BMPs as the national recommendation. The TOPPS BMPs are recognized at EU level in the catalogue of measures needed to define the River Basin Management Plans (RBMP) under the Water Framework Directive. They are also being considered in the National Action Plans required by the Framework Directive on Sustainable Use of Pesticides.

Project Number:
LIFE05 ENV/B/000510

Title: Train the operators to prevent pollution from point sources

Beneficiary: ECPA - The European Crop Protection Association

Contact: Stuart Rutherford

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Website: http://www.topps-life.org/web/page.asp

Period: Nov–2005 to Oct–2008

Total Budget: €2 603 000

LIFE Contribution: €1 259 000

INSIMEP: In-situ remedies for contaminated groundwater

LIFE has helped demonstrate the feasibility of a new environmentally-benign treatment method for cleaning European groundwater from non-ferrous metal contaminants by using technology that operates up to 60 metres below ground.

Member States are now required by law under the Water Framework Directive's River Basin Management Plans to protect, enhance, restore and prevent the pollution or deterioration of EU groundwater quality. Non-ferrous metals, such as zinc, cadmium, cobalt and nickel, have been associated with groundwater contamination, particularly around the estimated 1.5 million EU sites where soils or industrial areas are known to contain these metals.

Traditional treatment methods for contaminated groundwater have previously proved expensive because the process involves pumping water to the surface where it is then cleaned using different treatment techniques. This 'pump and treat' (P&T) approach has been shown to have negative effects on groundwater equilibriums and it often fails to meet groundwater quality standards. Furthermore, water treatment facilities can also create additional pollution risks because the procedures rely on hazardous chemicals and produce metal-containing waste sludge.

In-situ solution

One solution to these problems is to treat the groundwater contamination in-situ, underground, and a private sector-led LIFE project from Belgium has demonstrated that this approach is both feasible and cost effective. The INSIMEP project brought together specialists in metal recycling and application, with experts in drilling techniques and in-situ engineers. This resulted in a highly successful set of outcomes that are relevant for businesses and environmental authorities across the EU involved in tackling groundwater contamination.

INSIMEP's methodology was tested in two different locations in Flanders and findings highlighted the technique's capacity to treat groundwater at depths of up to 60 m below the surface. Key to the overall decontamination technique is a process that accelerates naturally-occurring geochemical events, whereby the toxicity of the metals is neutralised as they bind with other elements to form more stable compounds. Such 'precipitation' processes only occur under certain conditions, when specific types of sulphate-reducing bacteria are present and active. The INSIMEP team was able to induce these bacteria to reduce sulphate into sulphides, which subsequently immobilised metals in the groundwater as they formed solid metal sulphides.

Glycerol and lactate laced with nutrients, non-hazardous and completely biodegradable products, were identified as effective agents for stimulating the bacteria. The LIFE project's monitoring showed that sustained metal removal was fully achieved for zinc and cadmium at one test site. 'Irreversibility' was almost achieved at the other site, where less than 2% of the immobilised cobalt was recorded as being re-released at low water concentrations. Overall the project was able to greatly reduce zinc, nickel, cadmium and cobalt levels in groundwater.

The new technology not only provides a more environmentally-friendly method of treating groundwater (by stimulating natural ecological systems, avoiding hazardous chemical inputs, producing zero sludge and using less energy), it is also faster and more economical: operational costs of the in-situ method are 40% lower than conventional P&T methods. The beneficiary was so impressed it may apply the technique on a large-scale at other contaminated sites in Belgium.

The project analysed groundwater at three sites to construct hydrological models

Project Number:
LIFE05 ENV/B/000517

Title: In Situ Metal Precipitation for remediation of groundwater contaminated with non ferrous metals

Beneficiary: Umicore NV

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Website: www.vito.be/insimep/

Period: Sept-2005 to Sept-2009

Total Budget: €2 765 000

LIFE Contribution: €758 000

Minimising the impact of economic activities

The environmental impact of industrial processes is managed through a wide range of EU policy initiatives. The recently amended Directive on Integrated Pollution Prevention and Control (IPPC) is one piece of legislation that strongly aims at improving the whole environmental performance of large-, medium- and small-scale industrial plants throughout the EU, by covering emissions to air, water and land; generation of waste; use of raw materials; energy efficiency; noise; prevention of accidents; and site restoration upon closure.

The IPPC Directive is strongly concerned with the reduction of negative environmental impacts and sustainable management of toxic substances. It also defines common rules on the authorisation of permits for industrial installations, which have to be based on Best Available Techniques (BAT). BAT refers to the most advanced techniques that can be used to achieve a high level of environmental protection for the industrial sector in question.

HVD: Physical de-scaling in the metal industry

The traditional method of de-scaling steel rollers used in metal working has a significant impact on the environment. A German project demonstrated an effective process on an industrial scale for replacing the existing chemical process with a physical one.

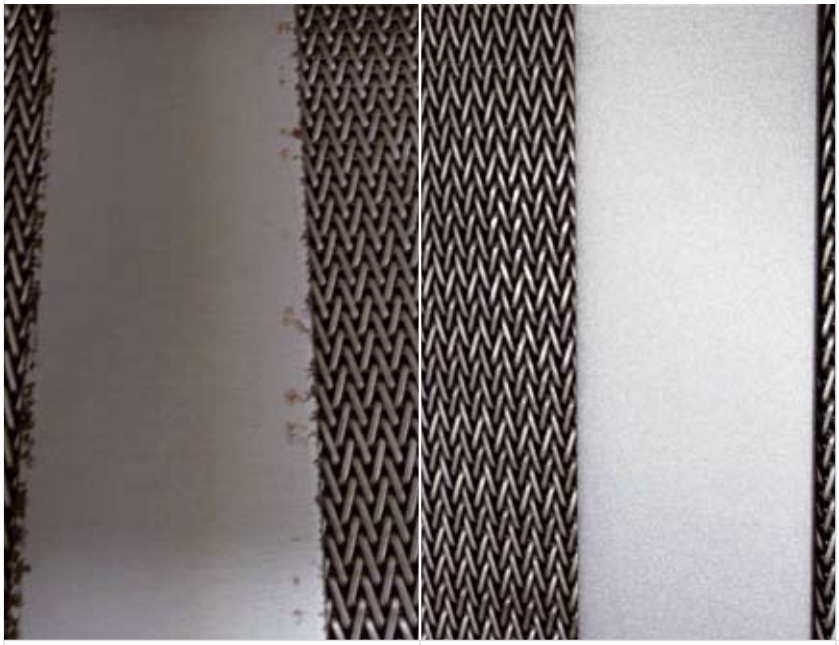
A competitive European steel industry is crucial for the development of major industrial sectors, such as the automotive sector and construction. The major issues affecting the competitiveness of the steel sector are higher costs compared with some other competing regions, and access to raw materials and energy. Furthermore, the expected tightening of EU-specific environmental legislation, such as the Emissions Trading Scheme (ETS) is likely to place a substantial burden on the EU steel industry.

The steel sector should adjust to the demands posed by the EU's climate change policies, in particular, through continuous investment in technological innovation and improving the energy efficiency of production. The industry should also improve the efficiency of raw materials use in order to reduce its sensitivity to imbalances in their supply. Steel manufacturers are faced with the challenge of investing in greener technologies whilst still remaining competitive on the global market and LIFE funding has contributed in finding innovative environmentally-friendly solutions.

Traditional hot rolling creates health risks

Hot rolling is a process for working metal into particular forms, notably sheets or rods. Large pieces of metal are heated and then passed between rollers which generate thinner cross-sections. Hot rolling is able to produce greater deformations of the metal than cold rolling for the same number of rolling cycles and typically avoids residual stress building up in the material.

Photographic comparison of the surface appearance before and after HVD treatment



However, hot rolling of steel leaves a layer of scale on the surface. The scale forms as the steel reacts with the atmosphere on cooling from its high temperature. Scale on the surface can cause significant problems for subsequent use and coating of the steel.

For decades, de-scaling of steel has been performed by pre-crushing the scale and then removing it in a pickle with hot hydrochloric (HCl) and sulphuric acid (H_2SO_4) – dip or spray pickling. After pickling, the strip is rinsed, dried and oiled.

This process has a significant environmental impact. It uses large amounts of polluting and potentially dangerous acids such as hydrochloric acid and sulphuric acid (equivalent to 4.5 kg H_2SO_4/tonne) at high temperatures, thus producing toxic gas emissions and creating health risks in the working environment. Furthermore, large volumes of water (0,8 m^3/tonne) are consumed in the pickling phase, for conveying the acids and during the rinsing and cooling processes. The polluted process water has to undergo treatment before being discharged.

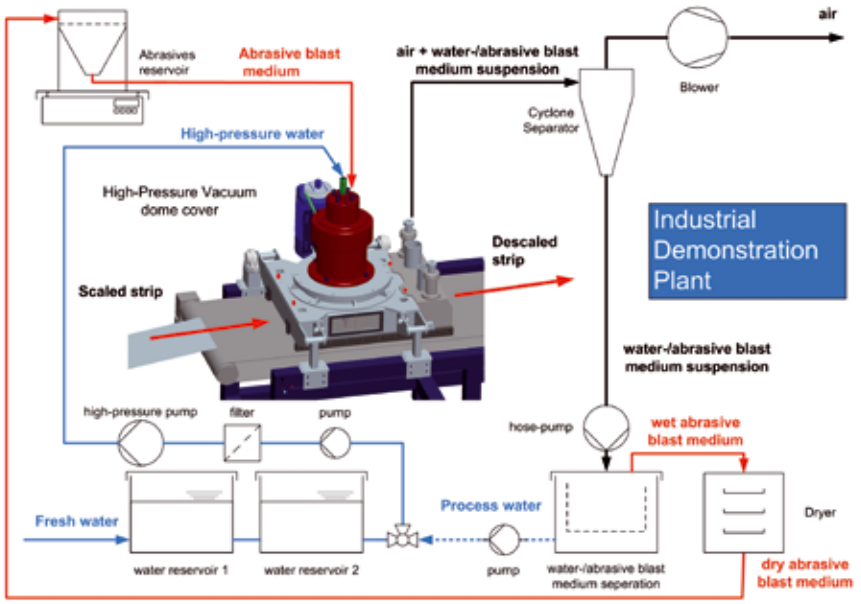
Hazardous wastes that are produced during the process include effluents containing industrial lubricants and acid sludge, both of which can present serious health and safety risks for Europe's wire-production workforce. Furthermore, energy consumption (500 MWh/yr) is also high

as a result of the complexity of the industrial process necessary to obtain the final product.

Hydro-mechanical process

The LIFE Environment HVD project focused on developing a de-scaling process that would totally or partially by-pass the pickling phase, thus avoiding the use of acids and the production of hazardous waste. It did so by demonstrating the feasibility of de-scaling with an effective hydro-mechanical process that consists of physical abrasion and a high-pressure vacuum. It also used the removed scale as an abrasive in further de-scaling cycles, improving the sustainability of the process. According to steel industry experts, the technology may be the most innovative optimisation in the steel industry in the last 40 years.

The hydro-mechanical process blasts abrasive particles onto the scale-coated steel with high-pressure water jets. The mixture of scale:



The scale layer is partly removed and perforated, which increases its dissolving rate in the pickling-bath, thus reducing the consumption of energy, water and acid per tonne of steel

Scale can be used as an abrasive blast medium and does not negatively influence the surface quality of the treated steel grades

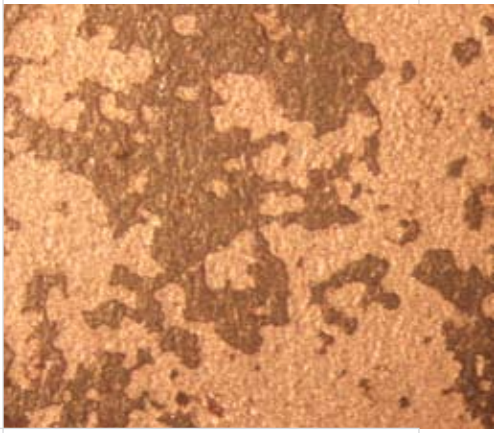
water is about 1:6 by volume – or 1:2 by weight – with about 70 litres of the mixture being applied per minute. The resulting water-scale suspension is sucked off under vacuum. After de-scaling, the water and scale are separated in a simple procedure. Both media may then be reused in the next cycle of the same process; the scale is used as an abrasive medium i.e. it can be blasted against the steel to remove the scaling. “You fight against the enemy with the enemy,” says Stefan Pöschel, from project beneficiary, Airmatic: “We use the same material to remove the scaling from the steel. The big advantage is that you don’t have any additional material to separate and dispose.”

The recycling of materials extends to other marketplaces too. After repeated use of the abrasive matter, the deposits become too small to use further. They then can be separated and sold as non-hazardous raw material (iron oxide) for concrete production and as iron for recycling in the steel industry.

Minimal environmental impact

The HVD technology has a minimal impact on the environment. The results demonstrated that the technology is suitable as a complete substitution for pickling in cases where 95% removal of the scale is sufficient (i.e. for steel that is zinc-coated afterwards) or as a pre-pickling stage to reduce pickling

Fine scale particles deliver an excellent descaling effect without any negative impact on surface quality. Pictured is the effect on 58CrV4 steel at 300 bar, 32-45 µm. The dark brown patches are the scale and the light brown is the steel.



by at least 50% where greater reduction is needed.

The new process has significant economic and environmental benefits. In all cases, the physical de-scaling process reduces water consumption. Furthermore, the water is circulated back through the system and the scale for blasting, a waste product of the process, is reused as an abrasive medium. Use of pickling chemicals and heating gas is reduced by at least 50% and often, the reduction is between 70 and 80%. In cases where no further pickling is needed – for example with construction steel which is zinc coated afterwards – the savings are 100% (see box - Testing the process).

The beneficiary calculates that a pickling plant with a capacity of 1.1 million tonnes/yr using the HVD pre-scaling process combined with pickling would achieve a 50% reduction in pickling time, and reductions of 1 500 000 m^3/yr in natural gas, 10 000 tonnes/yr in acid and 800 000 m^3/yr in water use. While the high-pressure pump requires electricity, total energy consumption of the HVD process is estimated to be 40% lower than for the traditional pickling process.

The market for the technology covers around 600 plants worldwide. While the steel industry is considered one of the most conservative sectors – core technologies have not changed for many decades and equipment lasts for a long time – the interest of the sector in the new technology is already very high. As of June 2009, 12 different steel types from five companies had been tested. In all cases the tests were successful: the particle size of scale is now less than 50 µm and reduction of pickling time is always greater than 50%.

Testing the process

After initial tests proved the viability of the HVD process, the beneficiary, Airmatic, constructed an industrial scale demonstration plant at its facility in Hemer, North Rhine-Westphalia, Germany. There trials of the new descaling process were carried out with international steel producers in respect of two different applications: as an alternative to pickling and as a pre-descaling process combined with pickling. The producers were not looking to replace existing pickling plants, but rather to increase steel output or reduce the specific consumption of operating resources (fresh water, acid, energy) of their existing pickling lines.

Initial results were as follows:

User: A
Steel grade: NO electric strip
Objective: Reduction of pickling time (sulphuric acid)
Result: 77% reduction of pickling time

User: B
Steel grade: St-37
Objective: Replace pickling line (hydrochloric acid)
Result: 100% reduction of pickling time (free from scale, oil, grease)

User: C
Steel grade: 58CrV4
Objective: Reduction of pickling time (hydrochloric acid)
Result: 77% reduction of pickling time

User: C
Steel grade: DX52
Objective: Reduction of pickling time (hydrochloric acid)
Result: 66% reduction of pickling time

User: C
Steel grade: H180BD
Objective: Reduction of pickling time (hydrochloric acid)
Result: 100% reduction of pickling time

User: D
Steel grade: DD14
Objective: Reduction of pickling time (hydrochloric acid)
Result: 50% reduction of pickling time

User: D
Steel grade: 12MnCrMo 8-4
Objective: Reduction of pickling time (hydrochloric acid)
Result: 50% reduction of pickling time

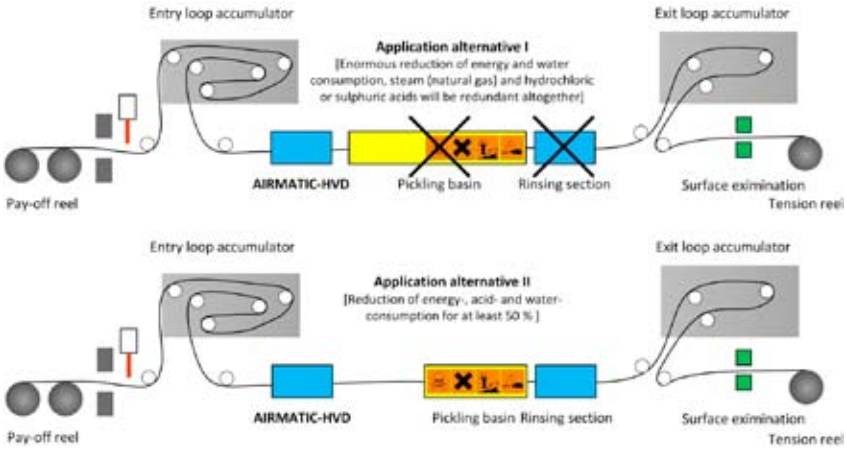
User: E
Steel grade: St-37
Objective: Replace pickling line (hydrochloric acid)
Result: 100% reduction of pickling time.

The HVD project developed an industrial demonstration plant for continuous descaling of steel strips

Transferability of the new process

Further dissemination of the technology is encouraged by the clear economic incentives for the beneficiary and the involvement of Andritz Sundwig, a supplier of steel industry equipment. Establishing the demonstration plant at the beneficiary's premises was also important. Steel companies have access to see demonstrations of the technology and run tests on their own type of steel.

In fact, the conservatism of the steel industry represented a major challenge for the project, according to Mr. Pöschel. "Everything that is new seems strange," he says. Without European Commission funding the new technology would never have been developed. "The Commission gave a chance to conduct this research and acquire the scientific base – we co-operated with the University [*Universität Siegen Lehrstuhl für Energie und Umweltverfahrenstechnik (LEUVT)*] at every stage – to show our customers that it really works. European companies would never have invested in something that they were not sure about, but now they have seen the results," he says.



The new HVD descaling process allows the application as a pre-treatment step in existing and future pickling lines or as an alternative technology to these chemical processes.

The project looks set to have a long-term legacy. Project manager Hubert Schulte says that his company is already working on reducing costs for the innovative and greener solutions developed under LIFE. He explains that Airmatic is in advanced discussions with some of the major players in the global marketplace with a view to offering its new technologies – A new plant using HVD technology is set to open in Germany soon and the process could be implemented in such countries as Russia, China and Turkey in the near future. Thus, the impact of this project is not limited to the European Union, but is also an important example of eco-innovation that can decouple economic growth and environmental pollution in developing and emerging countries.

Accepting the Best LIFE Environment Projects award in Brussels on behalf of the whole project team, Mr. Schulte said: "We'd like to thank the European Commission for giving us the chance to demonstrate innovative advances even in traditional sectors such as European steelworks."

LIFE Environment and Eco-Innovation Head of Unit, Hervé Martin (left), presenting Hubert Schulte of Airmatic with the 'Best of the Best' award in Brussels

Project Number:
LIFE05 ENV/D/000207

Title:
Hydro-Mechanical Descaling Process based on High-Pressure Vacuum Technology Using Scales as Abrasive Blast Medium

Beneficiary: Airmatic

Email:
geschaeftsleitung@airmatic-systeme.de

Website:
http://www.hvd-life.eu

Period: Dec-2005 to May-2009

Contact: Hubert Schulte

Total Budget: €1 907 000

LIFE Contribution: €536 000

OZONECIP: Where ozone makes good environmental headlines

The OzoneCIP project demonstrated an innovative technique using ozone as a cleaning agent in a closed process for disinfecting food-processing plants. It went beyond the current Best Available Technology (BAT) to disinfect without currently used chemicals and produce significant water savings and improvements in wastewater quality.

Clean-in-Place (CIP) systems are closed processes in which a recirculating cleaning solution is used to disinfect food-processing plants. Existing CIP systems were considered BAT for maintaining hygienic conditions by the European reference documents (BREFs). However, they still had significant environmental impacts, particularly high water consumption and production of highly polluted effluents.

OzoneCIP sought to go beyond the current BAT by using ozone as an alternative cleaning agent in a CIP system. The project started by studying the BAT reference documents for cleaning in food industries as well as examining the state-of-the-art in ozone technology and CIP techniques. It carried out an environmental diagnosis of 15 industrial food installations.

Testing ozone-based disinfection

The project team then designed and constructed a prototype installation to test CIP processes with traditional chemical cleaning agents and the ozone alternative. They experimented in a laboratory setting with the prototype to obtain data for different CIP protocols to demonstrate the environmental benefits of the ozone-based techniques in three food industries.

The CIP protocols with and without ozone were tested on raw wine inoculated with cultures of acid lactic bacteria and brettanomyces. Similar tests were carried out on both beer and whole milk inoculated with aerobic and anaerobic bacteria and yeasts. Wastewater samples were taken during the tests and the inner surfaces of the prototype swabbed before and after the cleaning cycle to monitor the effectiveness of disinfection. Last rinse sampling was also performed in all tests.

OzoneCIP went beyond the current BAT by using ozone as an alternative cleaning agent in a clean-in-place system

The data enabled the identification of environmental indicators and representative values for BAT documents for the wine, beer and dairy processing industries. Although actual results in manually operated CIP operations will vary, the tests found that using ozonated water as a cleaning agent can result in reductions of up to 50% per cycle for both water consumption and the organic load by weight of wastewater. Dairy-related tests showed the highest reductions, followed by beer and then wine.

The fact that ozone quickly breaks back down into oxygen leaving no residues meant that effluents could be treated in the same way as urban wastewater. Although there are initial costs for setting up the OzoneCIP system, environmental and economic benefits arise from the non-use of chemical cleaners, reduced water consumption, energy savings compared with hot water or steam disinfection, low maintenance costs and reduced environmental taxes on the wastewater.

The environmental benefits were obtained without any detriment to the efficacy of the cleaning and disinfection process. The results should make it possible to consider the OzoneCIP technology as the new BAT for the sectors studied by the project in the next version of the BREF.

Project Number:
LIFE05 ENV/E/000251

Title: Ozone clean in place in food industries

Beneficiary: AINIA (Instituto Tecnológico Agroalimentario)

Contact: Andrés Pascual

Email: apascual@ainia.es

Website:
http://www.ozonecip.net/index.htm

Period: Dec-2005 to Dec-2008

Total Budget: €811 000

LIFE Contribution: €395 000

Brine Recovery: Reducing the need for new salt in polycarbonate production

This innovative Dutch-based project achieved major reductions in salt and water use in the production of chlorine for polycarbonate manufacture.

Polycarbonates are plastics used in a wide range of industrial and consumer products, from mobile phones and compact discs, to pipes and cylinders used in construction and other sectors. Polycarbonates are in demand because they are tough and heat resistant, and can be moulded easily into different forms. But their production comes at an environmental cost.

In particular, production of polycarbonates requires chlorine, which in turn requires large volumes of high-purity salt (NaCl). The negative environmental impacts are felt before chlorine production has even started, because of the need to mine and transport large volumes of salt. The environmental cost is compounded by the production of brine as wastewater. As chlorine plants had no way of treating or reusing this, it would typically be flushed out to sea.

This changed with a pilot project carried out by SABIC Innovative Plastics from 2001 to 2003 in Bergen op Zoom, the Netherlands. The project tested the reuse of brine, showing it could be recycled through a closed loop, thus reducing the need for new inputs of salt. Specifically, the pilot project overcame a problem with impurities in the recycled brine that damaged membranes used in chlorine production.

Building on the pilot project's successful results, with LIFE backing SABIC undertook to build a full-scale production plant at Bergen op Zoom implementing brine recycling. The plant was duly finished and went into production in 2007. Since then, the results have been outstanding.

Reuse and reduce

The closed loop system means that 73% of the brine waste stream generated by the plant can be reused. This translates to a massive reduction in the requirement for salt of 72 000 tonnes/yr, and an overall reduction in the volume of wastewater discharged to the sea of 14%, or 225 000 m^3/yr. The amount of salt in this wastewater has been reduced by 65%. Energy savings have also been significant: 144,000 GJ/yr, according to SABIC, with accompanying reductions in greenhouse gas emissions.

The project has also produced indirect benefits, because of the reduced need to mine salt and transport it to the plant: SABIC estimates that there has been a 75% indirect energy saving on water and road transportation movements.

Underlying the environmental achievements is the financial viability of the scheme. The cost of the full-scale production plant was significant: €11 million. But the annual savings on salt and demineralised water are €3.8 million, meaning the new plant will have more than paid for itself by the end of 2010. SABIC said it plans to transfer the new technology to two sister plants in the United States.

SABIC's European president Heiner Markhoff summed up the impact of the project when he called it, "An outstanding example of how technological creativity combined with government partnership can make a major difference in several environmental areas – conservation of natural resources, reduction of energy use and emissions,

The brine recovery finishing unit was made up of salt removal columns and a carbonate destruction system

and less wastewater discharge into the ocean. We are grateful to the EU LIFE programme for crucial support of this successful project."

Mr. Markhoff made his comments as the Brine Recovery project picked up a 2007 national ENERGY GLOBE award. The project was chosen from among five Dutch nominees, and was recognised at a ceremony at the European Parliament.

Project Number:
LIFE06 ENV/NL/000178

Title: Brine Recovery in the production of polycarbonate

Beneficiary: SABIC Innovative Plastics

Contact: Paul Eijsbouts

Email: paul.eijsbouts@sabic-ip.com

Website: http://www.sabic.com/corporate/en/newsandmediarelations/news/20080528.aspx

Period: Dec-2005 to Dec-2008

Total Budget: €7 986 000

LIFE Contribution: €1 200 000

VOCless pulping: Reducing emissions from mechanical pulping

This Finnish-led project tested innovative volatile organic compound (VOC) abatement technologies for mechanical and semi-chemical pulp plants at pilot scale. Results indicate a possible reduction in VOC emissions of 6 000 tonnes/yr in Europe.

VOCs are known to contribute to the greenhouse effect, toxicity and odour problems, as well as playing a role in producing ozone in air polluted by nitrogen oxides. Mechanical and chemi-thermomechanical pulping processes are a significant source of airborne VOC emissions. The LIFE 'VOCless pulping' project set out to develop a viable VOC and odour abatement solution capable of guaranteeing emissions below 50 mgC/m^3, the usual requirement for exhaust gases according to the VOC Solvents Directive (1999/13/EC).

The project team analysed selected airborne VOC emissions from four different pulping processes: thermomechanical pulping (TMP), groundwood pulping (GWP), pressure groundwood pulping (PGW), and chemi-thermomechanical pulping (CTMP). The mills selected for these measurements were Stora Enso Anjalankoski (TMP and PGW) and M-real Lielahti (CTMP), both in Finland, as well as Raffin Portonogaro (GWP) in Italy.

Testing the technologies

Based on the results of these initial analyses, the project beneficiary built pilot plants testing two of the proposed VOC abatement technologies, namely a catalytic incinerator plant at Anjalankoski and a biofilter-based pilot plant in Italy.

The catalytic incinerator demonstrated efficient operation and good cleaning results on both the TMP and PGW lines at the Stora Enso mill. Results indicate that the technology will allow a 90-94% reduction of VOC emissions and also eliminate odour problems.

The project analysed selected airborne VOC emissions from different pulping processes and tested VOC abatement technologies, namely a catalytic incinerator plant in Finland and a biofilter-based pilot plant in Italy

The results from the biofilter pilot plant in Italy suggest that the most volatile of VOCs can be degraded biologically, with an efficiency level similar to other abatement technologies. The overall VOC elimination capacity of the biofilter was 83% at an average filter space loading of some 70 m^3/h, with an odour reduction efficiency calculated at 88%. The VOC concentration fell from 45 mg C/m^3 on average before the biofilter to below 10 mg C/m^3 after it.

Although the use of hardwood tree species at Portonogaro mill means low VOC concentrations and no regulatory need to add a VOC abatement system to the GWP plant, the pilot test results were used to simulate the effects of a biofilter for TMP, PGW and CTMP plants.

These simulations indicate that a biofilter is the most cost-efficient abatement technique for reducing VOC emissions from TMP plants, increasing the cost of producing pulp by €0.6/tonne, compared with €0.9/tonne for a catalytic incinerator. However, the latter technique is estimated to be superior for use in a PGW plant.

As a result of M-real's decision to close its CTMP plant at the Lielahti mill in March 2008, it was only possible to simulate catalytic incinerator and biofilter tests for this technology based on the results of the pilot tests performed in the other plants. These simulations indicate a significantly higher cost of operating VOC abatement systems as a result of the higher exhaust gas airflow of the CTMP plant. Of the two technologies tested in the simulation, the biofilter was adjudged to be the most cost efficient for CTMP production.

In addition to the two technologies tested, research carried out by the project identified condensation as a feasible abatement technology for VOC emission control in pulp production.

Project Number:
LIFE06 ENV/FIN/000201

Title: Control of VOC emissions from mechanical pulping beyond BAT

Beneficiary: AX-LVI Consulting

Contact: Markku Tapola

Email: markku.tapola@axcons.fi

Website: http://voclesspulping.com

Period: Oct-2006 to Sept-2009

Total Budget: €579 000

LIFE Contribution: €286 000

Waste management

The EU's Thematic Strategy on the prevention and recycling of waste contributes to reducing the overall negative environmental impact of resource use. Preventing waste generation and promoting recycling and recovery of waste will increase the resource efficiency of the European economy and reduce the negative environmental impact of use of natural resources. Achieving these goals will contribute to maintaining the resource base, essential for sustained economic growth. The basic objectives of current EU waste policy – to prevent waste and promote reuse, recycling and recovery so as to reduce negative environmental impacts – will be supported by this impact-based approach.

The long-term goal is for the EU to become a recycling society that seeks to avoid waste and uses waste as a resource.

MICROPHILOX: Energy recovery from landfill biogas

The Spanish MICROPHILOX project successfully demonstrated important technological innovations including the use of microturbines for biogas recovery, an innovative biogas upgrading system and the development of a proven methodology for siloxane analysis.

The Landfill Directive (1999/31/EC) makes the recovery of landfill gas mandatory ("biogas shall be collected, treated and used"). If the collected gas cannot be used to produce energy, it must be flared. However, recovery of landfill gas can be a difficult process because of the equipment involved, biogas quality and the methodology for detecting contaminants present in the biogas.

The most commonly used technology for landfill gas energy recovery is a combined heat and power (CHP) plant. However CHP plants are only technically and economically feasible when the generated power is over 600 kW and when biogas has a methane content of at least 40%. Landfill sites with low biogas flow or low methane content (such as small landfills or those that are at the initial or final stage of exploitation) cannot profit from this source.

Prior to combustion and the generation of electricity, the biogas has to be upgraded in order to remove undesirable substances such as hydrogen sulphide (H_2S) and siloxanes. The latter come from waste such as cosmetics, shampoos, deodorants, detergents, pharmaceuticals, inks and adhesives and are highly volatile. If siloxanes are not removed during combustion, silicon is released which can combine with oxygen or other elements to form silica and silicates (SiO_2 and SiO_4). These silicon-based deposits can seriously damage the microturbines. For this reason siloxanes should be removed from the biogas before it enters the combustion chamber. It is also important to determine the quantity of siloxanes present in the biogas (which will depend on the nature of the waste) in order to evaluate the upgrading process efficiencies.

Biogas was upgraded with the use of biofilters and an activated carbon filter, which removed hydrogen sulphide (H_2S) and siloxanes

The project beneficiary CESPA, a provider of environmental services, including waste management and treatment, understood the urgency of finding an innovative solution for all of these problems. The company sought to develop and demonstrate the first microturbine in Spain working with biogas from a landfill in Orís, managed by CESPA and owned by Consell Comarcal d'Osona. Project partners were the Austrian technology centre, PROFACTOR, which developed the biofilters, and the Institut Químic de Sarriá y Peinusa (IQS), which obtained a method for siloxane detection and monitoring.

The MICROPHILOX project sought to emonstrate the first microturbine in Spain using biogas from a landfill in Orís

Biogas recovery in the Orís landfill

The biogas is sucked from the landfill to the treatment unit at a high temperature by the blower. The regulating valve then diverts the correct amount of biogas that is necessary to operate the microturbine, whilst the remaining amount is flared. The gas passes through an exchanger, where its temperature is reduced to approximately 7°C, in order to condense the water. It then leaves the chiller and is circulated through a condensation trap. The biogas moves to the next stage whilst the water is captured in a column and is collected in a drain. The biogas passes through a second exchanger where it is heated so that it can enter the biofilter in a dry state, so that the filter does not quickly become saturated with humidity.

The biogas is, at this stage, ready for upgrading. There are several biogas upgrading technologies that can achieve similar efficiencies to physical-chemical methods, including biofilters, bioscrubbers and biotrickling filters, the latter being the most important. Project partner PROFACTOR designed and built a prototype for biological biogas cleaning (BBCS) for the removal of sulphide acid and siloxanes. The system consisted of two biotrickling filters: desulphuration takes place in the first column where the microorganisms (i.e.*Thiobacillus sp.*) are fed with oxygen, through a bubble column, and an aqueous solution necessary for the metabolic reaction, whereas for the siloxane degradation, which takes place in the second column, the microorganisms (i.e. *Pseudomonas fluorescens*) are fed with oxygen directly injected in the biogas.

The target was to reduce the H_2S concentration at the outlet to less than 10ppmv and to reduce siloxanes by 50%. The biological biogas cleaning system was in operation at the Orís landfill for nine months. Monitoring indicated that whilst H_2S removal efficiencies reached values up to 95%, the 50% target for siloxane removal couldn't be achieved with biological cleaning.

The BBCS system designed and built by PROFACTOR had a treatment capacity of 15 m^3 for H_2S and 2 m^3 for siloxanes, while microturbines needed a flow of 50-60 m^3/h. As Elena Jiménez of CESPA explains, "For the removal of siloxanes, we opted for the use of activated carbon due to its simplicity of operation and high efficiency." The porous surface of the activated carbon filter was able to capture most of the siloxanes, reducing their concentration to 5ppb, and thereby reducing the costs of removing silicon formations from the microturbines.

Generating electricity with microturbines

After the gas leaves the carbon filter it is compressed to a pressure between 5 and 7 bar. The biogas leaves the compressor at a high temperature (approximately 75°C), undergoes another cooling and heating process to eliminate excess water and is finally sent to the microturbines. Biogas is injected in the combustion chamber where compressed air is present at a high temperature to increase process efficiency, and the mixture is then ignited and combustion takes place. Hot gases coming from the combustion are expanded in the turbine blades, turning the axle where the generator and the compressor are assembled. The turning of the generator produces a high frequency electric current.

Two 30 kW microturbines were installed on the Orís landfill and operated successfully with gases with a methane level as low as 35% (although it was shown at Orís that they can function with a methane content as low as 31%). "One of the main features of a microturbine is that it allows the electrical energy to be exported very easily thanks to the fact that its power electronics means it synchronises immediately with the supply network (at 45 000 rpm)," explains Elísabet González from CESPA. "For the moment, the electricity that is produced is used by the

Two 30 kW microturbines were installed on the Orís landfill and operated successfully with gases with methane levels of 35% or lower

Orís plant itself, mainly to operate the leachate treatment plant (60-70 kW). If the leachate treatment plant will consume less, then we could envisage selling the energy to the electricity supply network," she adds.

Innovative analysis of siloxanes

Project partners IQS and Peinusa carried out a study of existing methods of capturing and analysing siloxanes in landfill biogas, with the objective of obtaining an appropriate sampling and analysis methodology, both for simple and continuous testing. Siloxane sampling was carried out using solid adsorbents with activated carbon tubes. Mr Francesc Broto from IQS said that "Once the procedure for siloxane sampling and qualitative and quantitative analysis was developed and validated, we then proceeded to analyse real biogas samples obtained from three different landfills located in Orís, Palautordera and Hostalets de Pierola. The objective was to determine the variability of siloxane concentration in different landfills and to complete the validation of the developed procedure with samples of different origins." In this way it is possible to determine a *priori* the upgrading process that is necessary to implement to reduce the percentage of siloxanes to the point where they will not damage the equipment in a significant way.

Impressive results

The MICROPHILOX project demonstrated that microturbines are a feasible technology for the generation of power and heat from landfill biogas, being the best alternative for the energy recovery in landfills with low biogas flow or with biogas with low methane content. According to CESPA's economic analysis, "Benefits tend to be negative when biogas is flared (- €7 000/yr), however, good economical and environmental results are clearly achieved when biogas is used for energy generation and a biological system is used to upgrade biogas (+ €21 500/yr). These gains are related to the lower costs that the plant has to face due to energy recovery and to lower machinery maintenance and operations costs," notes Ms. Jiminez.

In addition to its LIFE Environment 'Best of the Best' award, the Microphilox project has won the IX Garrigues Medio Ambiente-Expansión Award (in the Innovation, Development and Application of Best Technologies category) and The Energy Globe Award.

Steps for the future

"The MICROPHILOX project will not remain an isolated event," says Ms. Jiménez. "There are future plans for the 14 landfills owned by CESPA. Biogas is recovered with CHP units in only nine of them, so the microturbines could be a valid alternative to produce electricity from biogas in the remaining five landfills."

Furthermore, the project methodology for siloxane capture and analysis is not only to be incorporated in the CESPA protocol for biogas quality control, but in March 2009, MKS Instruments (one of the project partners) presented a technology for instant in-situ measurement of siloxane concentration. "This system may well be installed in the Orís landfill in order to compare the results with the ones obtained through the MICROPHILOX project," explains Ms. Jiménez.

Project Number:
LIFE05 ENV/E/000319

Title: Energy recovery from landfill's biogas by the use of microturbines and biological removal of hydrogen sulphide and siloxanes

Beneficiary: CESPA Gestión de Residuos S.A.

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Website: www.microphilox.com

Period: Oct-2005 to Mar-2009

Total Budget: €1 303 000

LIFE Contribution: €582 000

BASHYCAT: Eco-industrial partnership for recycling of used catalysts

This French 'Best of the Best' partnership project developed a sustainable and profitable alternative to the scrapping of used catalysts – a very hazardous waste used in the petrochemical industry. Thanks to LIFE support, the BASHYCAT project is already demonstrating impressive environmental and socio-economic benefits. The technology also offers significant export potential.

In Europe, the National Emissions Ceiling (NEC) Directive (2001/81/CE) restricts the emissions of pollutants such as sulphur dioxide and nitrogen oxides into the atmosphere. As of 2009, the levels of sulphur in petrol and diesel should not exceed 10 ppm (parts-per-million). As a result, the quantity of used catalysts – used by oil companies to transform crude oil into petrol or diesel – is increasing year on year. Solutions are therefore required for recycling spent catalysts that are compatible with environmental protection and that can help preserve the valuable metals they contain.

The hydrotreatment catalysts are placed in what are known as refining columns. The crude oil extracted from the ground passes through these columns and is cleaned of all the harmful elements. If these elements were not removed before using the petrol in our cars, for example, they would be released in the exhaust gases and would pollute the atmosphere.

When the crude oil goes through the refining column, the catalysts therefore generate a reaction for extraction of:

- Sulphur, avoiding sulphur dioxide (SO_2) emissions; and
- Metals, avoiding the emission of fine metal particles.

As the catalyst is used, it wears out and can no longer extract all the harmful elements. The used catalysts therefore contain the elements they are composed of (alumina, sometimes silica, molybdenum, nickel and phosphorus) and the harmful elements captured during the refining process (nickel, vanadium, arsenic, etc.). In Europe, there are an estimated 25 000 tonnes/yr of used NiMo, CoMo and nickel-molybdenum-vanadium (NiMoV) catalysts polluted with high levels of vanadium and 1 000 tonnes/yr of used NiW.

Numerous harmful effects are associated with used catalysts (see box). The three-year LIFE Environment "Basic hydrometallurgy on catalysts" (BASHYCAT) project was launched in 2006, to find a viable alternative to:

- Scrapping used catalysts, which poses considerable environmental problems because of high leaching levels of the metals contained in the

Raw materials such as molybdenum, tungsten, vanadium and nickel have been recovered and marketed, thus generating income and saving on natural resources

What is a catalyst?

A catalyst is a substance that can cause a change in the rate of a chemical reaction without itself being consumed in the reaction. In the petrochemical industry, the catalyst takes the form of small elements similar to granules, known as "hydrotreatment catalysts" (they are different shapes and colours, depending on their composition). These are composed of an aluminous or silica base on which metal oxides are deposited, for example, nickel-molybdenum catalysts (NiMo), cobalt-molybdenum catalysts (CoMo), nickel-tungsten catalysts (NiW). They participate in several chemical reactions, making it possible to transform the crude oil into petrol or diesel that can be used in our vehicles.

The regeneration of used catalysts is carried out in a modified furnace that restores the catalyst's original properties

catalysts. These elements can enter the food chain by groundwater infiltration and can be a danger to human health and the environment; and

- Exporting to countries that don't apply as rigorous social and environmental standards for disposal as the EU.

Lyonel Picard and Sophie Comte, the project managers, are keen to emphasise that this was very much a "partnership project", involving not only the project beneficiary Valdi (specialists in recycling batteries and recycling metals from industrial wastes), but also Eurecat France (whose main activities are the regeneration and pre-conditioning of refinery catalysts) and L'Electrolyse (whose main activities are surface treatment and the treatment of chemical waste).

The overall aims were (i) 'regeneration' (i.e. they have a second life in a refinery) of used nickel-molybdenum-vanadium NiMoV and NiW catalysts; and (ii) recycling of the chemical elements they are composed of through a combination pyrometallurigical and hydrometallurgical processes. Specific targets were to regenerate a minimum of 10% of the used catalysts; and to recycle over 80% of the metals they contain via new marketable raw materials.

Key actions

The project involved four key elements:

Regeneration of the used catalysts – carried out in a technical furnace that restores the catalyst's original properties.

Roasting – the first stage in recycling used catalysts, whereby the sulphur is removed. The sulphur is captured by a system of fume filtration and is transformed into sodium sulphate powder.

Hydrometallurgy – involving:

i) an initial sub-stage during which the catalysts are plunged into a bath allowing certain metals they

Several raw materials are obtained through through pyrometallurgy (e.g. calcination and fusion)

contain to go into solution. After this operation, the leaching liquor is separated from the residual solids;
ii) a 2nd sub-stage that allows the leaching liquor to be purified of substances such as phosphorus or arsenic; and
iii) a 3rd sub-stage that allows the metals contained in the leaching liquor to be recovered in the form of a mud with a concentrated metal content.

Pyrometallurgy – this can be:
i) calcination (dehydration of the mud concentrated in metals);
ii) fusion (melting of the residual solids) to separate the mineral content 'slag' and the metal content (metal ingots).

Several raw materials are obtained as a result of these thermal treatments: metal concentrates (calcium molybdate, calcium tungstate, or vanadium oxide depending on their composition), slag and metal ingots (for example, iron alloys of nickel-molybdenum).

Good results lead to recycling channel

Over the course of the project, 3 900 tonnes of used catalysts were sourced: The industrial feasibility of regenerating NiMo catalysts polluted with vanadium and NiW was proved. Over 16% of the tonnage was regenerated during the project and the remainder was recycled.

A complete used catalyst recycling channel is now in place. A particularly innovative aspect is that new raw materials (patents registered No. EU 06794235.9 and 04.356204.0) have been produced and marketed, allowing the metals recovered by the process, such as molybdenum, tungsten, vanadium and nickel, to be sold – generating income and saving on natural resources.

The catalyst recycling is carried out in compliance with the environmental standards for clean gas emissions applicable to centres for the incineration of dangerous waste, thanks to the innovative treatment of the fumes and recycling of the resulting by-products (the second of the two patents). This gas treatment plant is recognised as a best practice by the French inspection authorities.

Implemented on an industrial scale, the innovative technology offers a viable, clean and long-term alternative to the scrapping of used catalysts. It also presents considerable export opportunities (internally as the technologies are patented). Since January 2010, Valdi is now part of the French mining and metallurgical group, Eramet. This opens up new markets as Eramet is the world's leading recycler of such catalysts, with its US subsidiary, GCMC.

Significant positive impact

According to Mr Picard and Ms Comte, marketing and R&D managers for Valdi, the three-year project has already had a "significant positive impact" on the environment and for industry: Valdi's catalyst turnover for 2010 is forecast to be €12– €15 million and the forecasts are that the turnover figure will triple by 2015. Around 40 people worldwide are currently involved in this project and it is hoped that this figure will double by 2015.

From an environmental point-of-view, the NEC Directive was the principle driver of the R&D work: "The law is the law and we have to apply it," says Mr Picard. He adds, however, that LIFE has enabled the development to "Gain time: to achieve in only three years, what may otherwise have taken six-to-nine years."

Summarising the success of the project, he says the partnership worked well right from the offset and continues to operate efficiently. Another reason is that the technology, brought to market in just three years, is "highly innovative: it is good for the environment and for industry," he says.

Finally, on behalf of all the project team, the project managers expressed their delight at receiving the 'Best of the Best' award. Valdi plans to host an official event later in 2010 to celebrate this achievement. Held at the factory premises, just outside Limoges in west-central France, it will bring together stakeholders, environmental organisations, customers and the media.

Harmful effects of used catalysts

- Nickel, molybdenum, vanadium and tungsten in the form of sulphur compounds are extremely toxic to humans (carcinogenic, mutagenic and affecting reproduction) and the environment (highly mobile) if they get into the food chain or nature.
- If the sulphur is not captured, it can cause acid rain or salt waste to contaminate surface and underground water.
- The heavy and light hydrocarbons can affect air, water and soil if they are not treated.
- The toxicology of poisonous elements such as arsenic, selenium or fluoride in low concentration is well-known.

Project Number:
LIFE06 ENV/F/000125

Title: Bashycat - Basic hydrometallurgy on catalysts

Beneficiary: AFE Valdi (since January 2010, part of Eramet Group)

Contact: Lyonel Picard

Email: l.picard@valdi-feurs.fr

Period: Jan-2006 to Dec-2008

Total Budget: €11 315 000

LIFE Contribution: €2 733 000

ZERO PLUS: Combining BATs to reduce liquid effluent to zero

The Zero Plus project improved and integrated various best available techniques (BATs) for the treatment of liquid effluent from the surface finishing of metals, successfully demonstrating a model for reducing the final discharge of liquid effluent from the surface treatment industry to near-zero.

The surface treatment of metal products generates a number of often hazardous liquid wastes that can be one of the product's major environmental costs. The LIFE Zero Plus project focused on seven typical processes in the electroplating industry (A-G) where the use of the existing BATs was considered inefficient, arguable, or at least improvable. These processes are part of the three basic facilities of the electro-plating plant:

1. Surface cleaning and preparation (A: Degreases and rinses; B: Acid pickling and rinse).
2. Copper-nickel-chromium rack installation or copper-nickel barrel installation (C: Cyanided Cu rinses; D: Bright Ni rinses; E: Decorative Cr rinses).
3. Zinc-nickel barrel installation and chromate conversion (F: Zn-Ni rinses; G: Chromic passivated baths and rinses).

The project defined a baseline of environmental risks for these seven electroplating processes using the existing BREF guidelines. The Zero Plus partners then laboratory tested various modification options, making use of well-known techniques such as skimming, vacuum evaporation, electrocoagulation, filtration, ion retardation, aeration, catalytic anodic oxidation and ion exchange. This testing process allowed the consortium to address weaknesses within the BATs and to identify the technical feasibility of planned treatment processes and the optimal conditions to achieve the best yields.

In the acid pickling and rinse stage, the tests found that the high concentrations of Fe-II rendered the proposed electro-coagulation useless. This led to its replacement with a neutralisation-aeration-flocculation process to oxidise Fe-II and subsequent precipitation of iron hydroxide.

The Zero Plus project demonstrated a model for reducing the final discharge of liquid effluent from the surface treatment industry to near-zero

Integrated BATs

The seven applications were then tested at industrial scale in industrial partner GALOL's electroplating plant, which enabled further optimisations. In the degreasing stage, the problem of the low recovery rate of non-ionic surfactants was overcome by replacing a micro-filtration system with a new process using vacuum evaporation technology.

The results enabled the project team to make recommendations or changes to each BAT to improve its environmental performance. It proposed effective physical treatment technologies as alternatives to treatments with reagents or incineration or evaporation-incineration. The proposals improved the potential for reuse and recycling of waste constituents.

By combining these improved BATs into an integrated process, the project defined a model that achieved near-zero liquid-waste discharge as well as eliminating much of the hazardous content. It separated all recoverable materials and allowed dedicated treatments to be applied to each type of effluent.

The main environmental results were: a 95-100% reduction in waste volume; a 2 580 m^3/yr reduction in water consumption; a 17 tonne/yr reduction in acid consumption; a 7 800 m^3/yr reduction in effluents; recovery of 800 kg/yr of salts and potash, 320 kg/yr of nickel salts, and 50 kg/yr of boric acid; and 100% elimination of nickel complexes (amines, nitriles and cyanides). The project also reduced waste storage, transport and management requirements and increased the projected life span of the rinse baths.

Moreover, the results enabled the team to make recommendations or changes to each proposed BAT to improve its environmental performance.

Project Number:
LIFE05 ENV/E/000256

Title: Integral liquid residuals management model for surface treatment industries through BATs (ZERO PLUS)

Beneficiary: The Metal–processing Technology Institute (AIMME)

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Website: www.zeroplus.eu

Period: Dec-2005 to Jul-2009

Total Budget: €2 568 000

LIFE Contribution: €1 278 000

OIL PRODIESEL: Adding value to household waste cooking oil

Portuguese LIFE beneficiaries have demonstrated demand from domestic households for recycling used cooking oil as an effective source of biofuel and the project results have led to useful savings in both waste management costs as well as municipal emissions.

Volumes of used cooking oils (UCO) represent an increasing source of waste in the EU and options exist to convert UCO into biofuel. Such environmental management opportunities offer win-win solutions for both the Waste Framework Directive (2008/98/EC) as well as the EU Biofuels Directive (2003/30/EC), which aims to replace 5.75% of all transport fossil fuels (petrol and diesel) with biofuels by this year (2010).

Waste managers from the Portuguese municipality of Oeiras secured LIFE support to help the municipality test an innovative scheme that collected domestic UCO for use as biofuel by the municipality's vehicles.

Legislation requires catering companies and other commercial businesses using cooking oil to dispose of the oil in a controlled manner, however, no similar regulations apply to domestic UCO. As such, the LIFE project aimed to identify a voluntary method for reducing negative impacts of household UCO on wastewater treatment plants and landfill sites.

Creative waste collection

Initial work involved assessing the scale of UCO that was discarded by residents from the mainly urban municipality which neighbours Lisbon. Creative thinking and modern technology was then applied to the challenge of collecting the UCO for recycling. Dedicated UCO containers were designed and placed at 20 different residential locations. Each container had a built-in micro-computer system to measure the amount of UCO and alert the municipality's waste services, via remote sensing and GIS mapping, when full.

Eleven municipalities from other parts of Portugal are ordering UCO containers and setting up similar voluntary collection schemes in residential areas

LIFE funds were also used to develop a prototype centre for converting the UCO into biodiesel. This involves a heat-intensive process that reduces the oil's viscosity to a similar structure to fossil fuel diesel. Achieving the correct viscosity is essential to ensure proper combustion of the fuel and avoid damage to the vehicle engine from excessive carbon residues.

The 1 000 litre prototype processor successfully converted residential UCO into biofuel suitable for municipal vehicles. More detailed analysis of the LIFE project results indicated that the 11 155 kg of UCO collected by the LIFE containers up until June 2009 significantly reduced the load of oils and fats (e.g. 52.0 mg/l, compared with 103.2 mg/l) and hydrocarbons concentrations (e.g. 3.3 mg/l, compared with 11.1 mg/l) in the wastewater treatment plant. This represented savings of approximately €4 000 in the maintenance costs of the urban sewage system and sewage treatment plants. Collection of UCO in the municipality continues after the end of the project and has reached some 14 tonnes/month.

Carbon dioxide savings from the bio-friendly fuel were also noteworthy and led to an estimated 15% reduction of CO_2 emissions, plus up to 20% reductions of hydrocarbons. Sulphur dioxide emissions in the municipality were also reduced because biodiesel doesn't contain sulphur.

Chain reactions

The project has had a high demonstration value: 11 municipalities from other parts of the country are now ordering the high tech UCO containers and setting up similar voluntary collection schemes in residential areas. Furthermore, one of the project partners plans to introduce biofuel in up to 20% of its transport fleet, as a measure to reduce the company's carbon footprint by 2020.

Project Number:
LIFE05 ENV/P/000369

Title: Integrated Waste Management System for the Reuse of Used Frying Oils to Produce Biodiesel for Municipality Fleet of Oeiras

Beneficiary: Instituto de Soldadura e Qualidade

Contact: Marco Estrela

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Period: Oct-2005 to Mar-2009

Total Budget: €1 202 000

LIFE Contribution: €588 000

CONWASTE: Demonstrating green sealing of landfill sites in Germany

The CONWASTE project demonstrated the feasibility of using specific volumes of waste material to produce site-specific sealing and cultivation layers for the closing down of old industrial landfill sites, without needing to use valuable natural resources.

The closing of landfill sites requires substantial amounts of technically defined material. The project's demonstration area, two large landfill sites near the towns of Leuna and Schkopau in eastern Germany, account for a surface area of 5 million m^2 and require more than 8 million m^3 of construction material to obtain the surface profile and sealing, and more than 6 million m^3 of top soil for the recultivation layer. The large-scale closing of landfills under the EU Waste Disposal Directive and national legislation in Germany will require companies to make a major effort over the next few years.

Moreover, green alternatives have been tested to cut down on the amount of natural resources consumed. One such possibility is to convert the waste into substitute construction material, an impervious disposal substance that can store carbon dioxide.

This system, which had already been confirmed in laboratory and small-scale experiments, was demonstrated on a wider scale during the CONWASTE project. The LIFE project introduced an efficient surface sealing system for reducing vertical infiltration of precipitation. The sealing system consists of a mix of mineral waste, industrial ashes and sludge from wastewater treatment plants. The material mix was processed by a treatment plant located on the site of the landfill.

Seeking the apply the findings in other landfills

Based on the findings of the project, the beneficiary has officially applied for permits to use the sealing and cover system in other landfills that it owns in Saxony-Anhalt. If the authorities grant permits for this sealing system, other landfill sites will also be able to introduce such a system. The newly developed surface sealing system is considerably cheaper than conventional methods and under real production conditions with heterogeneous source materials the quality of substitute construction materials based on waste consistently meets the required standards.

The project introduced an efficient surface sealing system for landfills that reduces use of natural resources (e.g. soil) and the dispersion of pollutants (e.g. sewage waste) in natural surroundings

The environmental benefits of the project are:

- Utilisation of waste materials by combining their special characteristics, thus preventing their disposal in other dumps;
- Elimination of the use of natural resources, such as clay, sand and cultivated soils;
- Reduction of the spread of waste materials in natural surroundings (e.g. sewage waste as fertiliser) and thus reduction of the dispersion of pollutants;
- Creation of a spatially tight network of waste producers and waste material exploiters and thus significant reduction of the dispersion of pollutants and reduction of transportation; and
- Production of a cultivation layer biomass for renewable energy.

The innovative aspect of the project is that the production of the substitute material depends on the location and type of waste of the disposal. Landfills, in particular large old industrial landfill areas all over Europe, can benefit by adapting the concept and saving natural soil resources.

Project Number:
LIFE06 ENV/D/000488

Title: Conversion of Waste for use as construction material for environmentally friendly closing of industrial landfills

Beneficiary: MDSE

Contact: Markus Einecke

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Website: www.conwaste.eu/

Period: Jan-2006 to Dec-2008

Total Budget: €4 473 000

LIFE Contribution: €1 204 000

Integrated Product Policy (IPP)

The EU's Integrated Product Policy (IPP) strategy seeks to minimise the environmental impacts that are associated with the manufacturing, use or disposal of many products, by looking at all phases of a product's lifecycle and taking action where it is most effective. This could be at any stage from the extraction of the raw materials that go into a product, through to its design, manufacture, assembly, marketing, distribution, sale and waste management. The driving idea is that it is essential to integrate environmental impacts at each stage of a product's lifecycle and that this should be reflected in the decisions of stakeholders, such as designers, manufacturers, marketers, retailers and consumers. IPP attempts to stimulate each of these individual phases to improve their environmental performance.

Given the complexity of products and actors there cannot be one simple policy measure for everything. Instead there are various tools – both voluntary and mandatory – that can be used to achieve this objective.

HEIGHT: Optimal cooling of fresh fruit without HFCs

This innovative Dutch LIFE co-funded project designed and built a new type of cold storage warehouse for fruit that demonstrates energy savings of up to 75% compared with conventional cold stores. The system also uses 'natural refrigerants' (ammonia and CO_2) in place of the extremely powerful and persistent greenhouse gases, hydrofluorocarbons (HFCs).

In Europe, fresh fruit and vegetables are commonly kept in cold store warehouses. These cold stores are very energy intensive – in the EU, refrigeration accounts for 10-15% of all industrial electricity use – giving rise to high carbon dioxide (CO_2) emissions. They also leak HFCs, the fastest growing source of environmental pollution in the European Union.

The project was implemented by the newly-named De Jong Coldstores, a Dutch family-owned firm, which under its former name (HM de Jong), has been specialising in the storage of fresh and frozen local and imported fruit and vegetables for over 60 years. Working with Wageningen University and consultancy firms, the cold storage and logistics firm targeted significant reductions (70%) in CO_2 equivalent emissions for traditional cold stores through the design and construction of a new type of fully-automated cold store warehouse.

The new facility was double the height of a standard warehouse and incorporated a specially-designed air circulation system to guarantee a microclimate throughout. An ammonia and CO_2 refrigeration system replaced the HFC refrigerant.

The main advantages are:

- More efficient air distribution – saving ventilation energy and the use of ammonia and CO_2 to avoid HFC refrigerants;
- Less heat transfer through the walls with a smaller surface/content ratio;
- Minimal energy losses through open doors;
- Minimal lighting;
- Better use of space so the capital intensive automated systems become reasonably priced; and
- A central refrigeration system with high quality components and energy efficient control system.

The HEIGHT project demonstrated that a high rise cold store using ammonia and CO_2 technology offers energy savings of around 75% compared with conventional cold stores

'Considerable energy savings'

The HEIGHT technology is successfully operating in the company's new cold store in Ridderkerk, close to the port of Rotterdam. It demonstrates that a high rise cold store using an ammonia and CO_2 technology offers considerable energy savings – of around 75% compared with conventional cold stores. This figure surpassed the original target of 70% savings.

The concept is highly transferable as it is applicable to all newly-built cold stores. Although the initial investment costs are very high compared with building a standard cold store, the project showed that with these savings – an estimated 5 million kWh/yr, worth around € 500 000 annually – a reasonable payback period can be achieved in 6.5 years.

To date, the new cold store warehouse has also resulted in the creation of 13 jobs. These jobs are for the most part more highly skilled (process operators) than those connected with conventional cold stores (mainly forklift drivers).

Project Number:
LIFE05 ENV/NL/000020

Title: HM de Jong – Energy-efficient by Innovative Geometry and HFC-replacing Technology

Beneficiary: De Jong Coldstores (formerly HM de Jong Koelen Vrieshuis)

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Period: Feb-2005 to Feb-2008

Total Budget: €6 566 000

LIFE Contribution: €640 000

Green Bearings: Developing a new generation of eco-friendly bearings

This Dutch LIFE Environment project has led to the production of a new generation of high efficiency bearings for use in motors, pumps, fans and other machinery.

There are thought to be as many as 50 billion of them in use worldwide, but they are largely invisible, even though they are a crucial engineering component. Bearings are used in practically any technology, from CD-players to cars, from locomotives to wind turbines.

Bearings are ubiquitous and this means that the environmental problems associated with them are also widespread. During their production, energy and resources are consumed and greenhouse gas emissions produced. During their use, there is further energy consumption, and risks arise from leaking lubricants or defective parts. When they reach the end of their life-cycle, bearings must be disposed of, causing a waste problem, because old bearings may transfer hazardous substances into the environment.

The world's leading supplier of bearings and related products is SKF Group, headquartered in Gothenburg, Sweden, but with facilities worldwide. With assistance from LIFE funding, SKF aimed to co-ordinate development of a new type of high-performing environmentally friendly bearing at its Engineering & Research Centre in Nieuwegein in the central Netherlands. This was done through the Green Bearings project, which ran from the beginning of 2006 to the end of 2008.

Friction reduction is key

To produce the green bearings, SKF brought together a number of technologies, including advanced coatings and sealants, lightweight polymer materials, and long-lasting, highly efficient lubricants. Reducing friction was an important goal, because this results in a reduction of heat, better lubrication conditions (meaning fewer requirements for lubricants) and thus improved energy efficiency and longer life for the bearings. The precise shape of the bearings was therefore closely examined and modified and low-friction greases were tested and introduced.

The project covered preparatory activities, production and demonstration of prototypes, analysis of prototype results and subsequent improvements, and the building of a test facility for large bearings at Nieuwegein. The result was "green" ball and roller bearings for use in motors. One potential application is in wind turbines, and SKF estimates that use of the bearings in a standard two megawatt turbine would help it generate an extra 2.6 million gigawatts of electricity annually. If the green bearings were used in motors worldwide, the environmental savings could be massive: SKF estimates that energy consumption could be reduced by 2 460 gigawatt hours annually, while the reduction in waste lubricants could amount to 400 000 tonnes/yr within five years.

The project demonstrated that the bearings could deliver energy savings of 30-70% depending on the type of bearing and load. For motor manufacturers they also offer a significant benefit in that they reduce power loss at higher speeds, thus improving fuel efficiency, and enabling the manufacturers to offer more efficient products to their clients.

SKF is now marketing the bearings to its customers. The company notes that they may be used in electric motors, pumps, conveyors and fans, and that they significantly extend the lifespan of lubricants, thus cutting down on resource use. Because they reduce friction by around 30% compared with standard SKF bearings, they run for longer periods and save energy. "The potential for energy savings on a global scale is huge," believes SKF.

The project produced "green" ball and roller bearings used in motors for wind turbines. The beneficiary estimates that use of the bearings in a standard 2 MW turbine would help it generate an extra 2.6 Million GW/yr of electricity

Project Number:
LIFE06 ENV/NL/000176

Title: Demonstrating innovative technologies that significantly improve the environmental performance of bearings

Beneficiary: SKF B.V.

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Period: Jan-2006 to Dec-2008

Total Budget: €4 623 000

LIFE Contribution: €1 072 000

SAPID: Preventing GMO contamination of crops

The SAPID project focused on preventing contamination of non-GMO crops with genetically modified organisms (GMOs). It devised tools for developing effective measures to prevent cross-contamination and demonstrated that contamination levels below 0.9% are possible.

The use of GMOs in crop modification is a particular concern. Our understanding of genetic flux – the diffusion of GMOs into the natural environment, changing the genetic makeup of other crops – is inadequate. It is impossible for agri-food processors to guarantee totally GMO-free products and tools are vital for ensuring that levels of contamination are within legal limits.

As a first step towards improving knowledge of GMO contamination, the project examined the entire agricultural chain from production to product commercialisation. Its team analysed the use of GMOs in the agricultural sector and prevention of contamination of non-GMO foods. They then identified possible monitoring, control and survey methods aimed at preserving the genetic identity of non-GMO foods. On-site experiments were carried out at the 1 000 ha project site in the Marche region of Italy to assess the validity of these methods. The project brought together multiple stakeholders to work towards its ambitious aims.

The project identified critical aspects of the co-existence of GMOs and non-GMOs to develop tools for providing information about measures to prevent contamination. The tools can be applied to all agricultural sectors – and geographical locations – and also to the commercialisation stage.

Risk index

Another success of the project was the creation of an Index of Contamination Risks from GMOs, which takes into account the particular characteristics of the given landscape and agriculture.

The project team developed tools for providing information about measures to prevent GMO contamination

It also developed an Identity Preservation System, which is a practical tool for identifying the necessary measures to avoid contamination of non-GMO crops. These tools, together with ad hoc software (MARCO) that was also produced, are especially useful for designing co-existence plans for GMOs and their subsequent monitoring and improvement. Moreover, they are highly transferable.

The project concluded that the only way to be 100% certain of preserving non-GMO products is to avoid co-existence and create GMO-free districts, covering the entire chain from agricultural production to product commercialisation. The beneficiary, the public agency ASSAM (Agenzia Servizi Settore Agroalimentare Marche), produced guidelines for creating such districts, which can be used everywhere in Europe. Where co-existence could not be avoided, the beneficiary demonstrated that, by adopting appropriate measures, GMO levels below the threshold of 0.9% are achievable in the food chain. Based on estimates of how much it would cost to implement the Identity Preservation System, the project believes that consumers would be willing to accept price increases for produce protected in this way. This should allow farmers to preserve organic and conventional production and related incomes.

The SAPID project analysed the technical and juridical aspects of co-existence in agriculture, which was complicated by changing national and European regulations on GMO use. However, such developments presented an opportunity: the Marche region intends to approve a new law based on the project's findings. The law will cover the establishment of GMO-free districts and, as proposed by the beneficiary, will refer to the chain "from the seed to the consumer" and thus go beyond existing EU recommendations, which run "from the seed to the first commercialisation step".

Project Number:
LIFE05 ENV/IT/000937

Title: Strategy for agricultural products identity defence. Wide area protection of agriculture products identity from Gmo pollution

Beneficiary: ASSAM (Agenzia Servizi Settore Agroalimentare Marche)

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Period: Nov-2005 to Apr-2009

Total Budget: €812 000

LIFE Contribution: €400 000

EFFENERGY: Insulating against climate change

The Effenergy project successfully developed two new products for improving the thermal performance of existing buildings. A panel containing a phase change material and reflective insulation technologies were successfully demonstrated as means of reducing energy consumption for the heating of buildings, a key requirement for meeting Europe's climate change objectives.

Supplying buildings with heat and light consumes over 40% of the energy used in the EU: heating and cooling buildings accounts for 70% of this total, producing 35% of all EU greenhouse gas emissions. The LIFE Effenergy project sought to meet the challenge of improving the energy efficiency of existing buildings, one of the most cost-effective means of contributing to the EU's Kyoto commitments.

Thermal-mass panels

The project developed a thermal-mass panel based on a wax-polymer blend. It consists of a compound containing paraffin wax, a phase change material. The wax melts, absorbing heat, as temperatures rise and re-solidifies, releasing heat back into the internal environment, as temperatures cool.

The project partner, Polytechs, used a batch process to test and optimise production of the blend. A new tumble blender was installed to enable a continuous mixing process and increase productivity, coupled with a system for granulation of the rubbery compound.

The Effenergy project successfully developed new technologies for improving the thermal performance of existing buildings

Another partner, ETEM, developed and improved the panel-production process of feeding through two aluminium foils. The dies were modified to ensure the correct thickness of 5.2mm was achieved and other techniques introduced so that the panels could be cut cleanly and damage avoided.

The panels were independently tested using a house with two identical attics. The panelled attic enjoyed a temperature decrease of up to 7°C in the summer, whilst over the winter the total energy required to keep it at a constant temperature of 20°C was 8% less. The panels also successfully passed rigorous independent fire, compression and ageing tests. The panels may be retrofitted into existing buildings and the return on investment would most often remain under 10 years, not including any green subsidies available.

Reflective technology insulation

The project partners designed a breathable weather-barrier membrane - DuPont Climate Systems - as a reflective insulation technology for roofs and walls. The membrane's insulation envelope is designed to reflect external heat away from the building in summer, reduce radiant heat losses from the building in winter and prevent uncontrolled air filtration through the building. The high vapour permeability of the materials used in the insulation envelope prevents any risk of interstitial condensation.

Independent testing found that the thermal performance of the wall cavities with the new metallised products was impressive, particularly for roofs set up with the outside reflective underlay. The conclusions suggested that the current ISO 6946 standard greatly underestimates the potential thermal benefits from reflective technologies.

Following the success of the tests, DuPont has proposed to include emissivity as a new property in the European Standard EN 13859-1/2 that covers the application of flexible sheeting as a roof underlay or wall membrane. DuPont is participating in a CEN working group on this topic.

The challenge in the Effenergy project was to achieve acceptance of an innovative concept in the (rather conservative) construction market. Creating awareness and understanding among architects and engineering offices is a long process. LIFE enabled the partners to bring this concept to market, bridging the time from product development to product commercialisation.

Project Number:
LIFE06 ENV/L/000121

Title: Energy Efficient Building Systems

Beneficiary: DuPont Luxembourg

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Period: Dec-2005 to Nov-2008

Total Budget: €5 610 000

LIFE Contribution: €1 510 000

Available LIFE publications

LIFE-Focus brochures

LIFE building up Europe's green infrastructure: Addressing connectivity and enhancing ecosystem functions (2010 - 60 pp. - ISBN 978-92-79-15719-6)

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Other publications

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Best LIFE Environment projects 2007-2008 (2008 – 44 pp. – ISBN 978-92-79-09325-8 – ISSN 1725-5619)

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Environment Policy & Governance Projects 2009 compilation (2010, 125 pp.-ISBN 978-92-79-13884-3)

Information & Communication Projects 2009 compilation (2010, 14 pp.- ISBN 978-92-79-16138-4)

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A number of LIFE publications are available on the LIFE website: *http://ec.europa.eu/environment/life/publications/lifepublications/index.htm*

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*

The programme

LIFE+ "**L**'**I**nstrument **F**inancier pour l'**E**nvironnement" / 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 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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LIFE Unit – BU-9 02/1 – B-1049 Brussels – Internet: http://ec.europa.eu/life

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