LIFE III

Environment




Best LIFE-Environment Projects 2006-2007

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environment

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Foreword

Nicole Kerkhof
LIFE BoB co-ordinator
The Netherlands

The European Commission is justifiably proud of all the environmental projects it has funded across the union. However, some projects are just that little bit better than the rest. Indeed, they can be held up as models for others as to what a successful, innovative, well-designed and executed project should look like.

With this in mind, the Commission has selected, for the third time, a group of 22 of the most outstanding LIFE-Environment projects completed in 2006. This year, following an initial review carried out by the LIFE Unit's external monitoring team, Member States reviewed the top 22 of the 62 projects that finished within the reference period.

The objective was to find out which projects were the 'Best of the Best' (BoBs) of those projects that completed their final reports before January 2007. Out of the top 22, five were selected as the very best - the Best of the Best, or 'BoBs'.

Let me take this opportunity to describe how the selections were made.

This year, I had the honour to be the co-ordinator for the BoB selection and I must say that it was very nice to work with the already approved documents and ranking forms that had been created by the LIFE authorities over the two previous years. Since we had agreed upon the criteria and were satisfied with them, I didn't have to make any changes to perform the ranking and simply continued the work of my more-than-able predecessor, Robbie Craig from the UK.

With the criteria set out, we then identified the best projects from an initial list prepared by the external monitors. The 22 projects were distributed among evaluators on a random basis in a workable language for the national authority and with only one reviewer from the Member State in which the project beneficiary was based.

The results were again very encouraging: no projects were considered 'below average' and although only five projects could be included in the final BoB selection, the margin between the top five and the top ten was very close.

To shine a spotlight on the top five, we decided this year to have a proper award session during the EU's Green Week, in Brussels on 14 June. At this ceremony, it was great not only to hear what the projects had achieved, but also to hear how they sometimes struggled to overcome problems and that in the end they are very proud of their achievements.

I personally can say, along with all the attendants at the Green Week, that this was a very rewarding afternoon and I think that the memories of their proud and happy faces will aid me next year when we go through the sometimes arduous BoB selection again.

Additionally, I would like to express my sincere gratitude to all my national authority colleagues who gave up valuable time for the sake of this process. A number of individuals in particular deserve a special thank-you: Herlinde Vanhoutte, Isabelle Lico, Eleni Stylianopoulou, Ralf Tegeler, Gotfried Lamers, Anita Moberg, Pekka Harju-Autti, Artemis Gryllia, Nicolas Sornin-Petit and, of course, Robbie Craig. Thanks also to the staff of the LIFE Unit, the external monitors and to all the project beneficiaries.

Nicole Kerkhof
LIFE BoB coordinator
The Netherlands

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Introduction

The EU Member States represented on the LIFE Committee and the European Commission's LIFE Unit have announced the Best LIFE-Environment Projects 2006-2007. The results of the selection, as approved by the LIFE Committee in the spring of 2007, are the 22 projects featured in this publication. These projects represent the most recent successful LIFE-Environment projects in terms of their 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.

The 22 best LIFE-Environment projects 2006-2007

Land-use development and planning	
PEDRA TOSCA	Spain
RAVE	Italy
Smurf	United Kingdom
Zantecoast	Greece
SIDDHARTA	Italy

Water management	
✪ MEMBRANE BIOREACTOR	The Netherlands
VIRU-PEIPSI CAMP	Estonia
USS	Germany
ECORIVER	Portugal
TANWATER	Sweden
RECYCLAQUA	France

Impact of economic activities	
✪ REF	United Kingdom
✪ PVTrain	Italy
Vapo	Germany
SoNatura	Portugal
EMAS-EDIN	Greece

Waste management	
DOL-EL	Germany
Humification of sludge	Greece

Integrated Product Policy	
✪ Empereur	The Netherlands
✪ Microfinishing	Italy
S-House	Austria
TANEFTREAT	The Netherlands

✪ "Best of the Best" projects

This, the third Best LIFE-Environment Projects' exercise, is the product of an established identification and evaluation process based on a set of best-practice criteria, developed by EU Member States in collaboration with the European Commission. The projects with 'beneficiaries', or project holders, from across the then EU-25, 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.

The objective of the exercise is to help improve the transmission of LIFE-Environment project results by establishing 'best practice' criteria within the LIFE programme.

Of the 62 projects that concluded in 2006, 22 were selected as 'Best' projects. This is the third time the best LIFE-Environment projects have been identified. A similar exercise was carried out last year (in 2005-2006) and in the previous year (2004-2005), with the results published in the Best LIFE-Environment project compilations, available on the LIFE website.

Meet the BoBs

Of the 22 'Best' 2006-2007 projects, five have been awarded the title, 'Best of the Best' (BoBs). Commenting on the results of this year's selection process – announced on 14 June at Green Week 2007 in Brussels – LIFE committee member and BoBs' co-ordinator, Nicole Kerkhof, of the Dutch Ministry of the Environment (VROM), said: "All the projects that were selected were very successful, but the five 'Best of the Best' scored highest overall, which made the final selection easy. We offer our congratulations to all the awarded projects, and in particular, congratulate the top five."

How were the best projects selected?

Scoring of completed LIFE-Environment projects was launched in the summer of 2004. The system was introduced by the Commission, following an initiative taken by Sweden and the Netherlands. After a meeting at The Hague from 11-12 May 2004, a set of 'best practice' criteria was developed in collaboration with the Member States. These criteria included project's contribution to immediate and long-term environmental, economic and social improvements; its degree of innovation and transferability; its relevance to policy; and its cost-effectiveness. In view of the importance of these aspects to project success, project beneficiaries 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 also 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 during the reference period (autumn 2005 to spring 2006), to produce a first list. The final selection was undertaken by the Member States under the coordination of Nicole Kerkhof, using the agreed set of criteria to identify the best projects.

Land-use development and planning

The Commission's Thematic Strategy on the Urban Environment calls for an integrated approach to environmental management, land-use and transport planning at the local and regional level. To be sustainable, land-use planning and development must harmonise a wide array of cross-cutting aims, ranging from water, air and soil protection to the promotion of economic development; from the conservation of natural habitats to the fulfillment of transport needs; and from managing local climate-protection measures to reducing social segregation. Entailing partly contradictory objectives, land-use planning processes are often conflict-ridden. Sustainable land-use therefore requires integrated approaches, which take into account the economic and social, as well as environmental concerns of the many different stakeholders involved.

Thematic Strategy on Urban Environment (adopted on 11 January 2006).
http://ec.europa.eu/environment/urban/thematic_strategy.htm

PEDRA TOSCA: Protecting environmental resources by promoting their sustainable exploitation

In the ecologically important 'Bosc de Tosca' (Tosca Forest) in northern Spain, one LIFE project showed that sustainable tourist and agricultural activities could be developed in a way that resists pressures from human action and restores ecological and environmental value.

The 'Bosc de Tosca' lies within the Volcanic Area of la Garrotxa natural park in northern Spain. Once a major European forest, it later developed into a mix of forest and 'artigas' - farmland plots - linked by innumerable volcanic dry-stone walled paths. This extraordinary landscape provided a suitable environment for a rich variety of vegetation, fauna and traditional crops and was made the subject of a Special Protection Plan in 1985.

However, the aggressive urban growth of the nearby town of Olot and the loss of traditional crops were degrading this special environment. Improvised constructions - including shelters and huts - and illegal dumping were having a negative impact on the area's visual appearance and its biodiversity. Meanwhile, irrigation problems and changes in agricultural practice led to abandoned fields and the proliferation of alien species.

The project sought to improve the management of human interaction with the site through co-operation between private landowners and public and private bodies. It aimed to introduce more culturally and environmentally favourable agricultural practices and preserve the area's natural heritage to maintain biodiversity and consolidate the area as a peri-urban park for local citizens.

First, dense vegetation, thorn beds, bushes and rubbish were removed from the target site. This in turn facilitated the recovery, protection and restoration of walls, shelters and artigas that make up the architectural heritage of the site and form a rich biotope for both flora and fauna.

Ecological agriculture, without the use of fertilizers or pesticides, was implemented and complemented by a well and tank system to retain and distribute underground water. This alleviated short-term drought conditions in the artigas and facilitated a return to traditional agricultural practices.

Reforestation took place in key areas and specific crops were integrated to improve the nutrient balance of the soil and to produce food and aromatic and medicinal herbs. A particularly innovative arrangement saw eight local restaurants agree to offer at least one dish including common buckwheat (*Fagopyrum esculentum*) to encourage the viability of its cultivation.

Some crops - such as crimson clover (*Trifolium incarnatum*) - were introduced for their aesthetic qualities to restore the artistic value of the park. Cultural and artistic tools such as an exhibition by a local painter and poetry readings were then used to promote ecological tourism and promote environmental education.

The project established thematic signposted walking routes and organised guided trips in the park to improve local awareness of the richness of the site and to promote the sustainability of tourism in the area. A series of key promotional events were held to coincide with important moments of the year and an old wayside train station was adapted as an information, documentation and educational resource centre.

School pupils on a trail through the Bosc de Tosca

Overall, the project achieved the restoration of 26 hectares of the Bosc de Tosca for tourist use and natural conservation. The invasion of the environment was stopped and a clear limit defined between the city and the natural area. During the final 18 months of the project, more than 30,000 people visited the park or participated in the activities undertaken in a new, sustainable way.

Project Number:
LIFE02 ENV/E/000263

Title: Pedra Tosca Park

Beneficiary:
Ajuntament de Les Preses

Total Budget: €820,000

LIFE Contribution: €279,000

Period: Sept 2002 to Sept 2005

Website: www.lespreses.cat/Parcdepedra/cartell2.htm

Contact: Laura Cañada Sierra

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RAVE: Local transport and urban planning

Car usage and waste creation are ever-growing threats to the environment in most urban areas. This LIFE project showed how a comprehensive local strategy for managing transport and planning can bring public and private organisations together in reducing pollution - particularly of air and noise - in urban areas.

Extra stops were added to encourage greater use of buses

Novara, a medium-sized town of 100,000 inhabitants in northern Italy, was experiencing urban decay with growing levels of noise and air pollution. To confront the challenges posed notably by city traffic, the local authorities undertook a 'Programme of Urban Regeneration and Territorial Sustainable Development' and an 'Urban Development Plan'. These plans allocated financial resources for the development of local infrastructure.

Project Number:
LIFE02 ENV/IT/000106

Title: The Green Ray of Novara

Beneficiary: Comune di Novara - Servizio pianificazione urbana

Total Budget: €4,325,000

LIFE Contribution: €1,060,000

Period: Dec 2002 to Dec 2005

Website: http://life.comune.novara.it

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Email: urbanist@comune.novara.it

In this context, the town's urban planning service developed the LIFE Novara Green Ray project - RAVE - to test the use of a 'slow mobility' transport system, with complementary waste disposal measures. It sought to develop co-operation between the public and private sectors to reduce pollution and improve the quality of life in the town.

A key focus of the project was to make the town's citizens 'active' and responsible for their actions and behaviour. A public awareness campaign discouraged car use and promoted waste recycling. The "Va…lentina" snail logo was used as a recognisable symbol to promote all the project's activities and objectives.

The project created a 'slow mobility' system to increase the attractiveness of public transport. It established 5km of protected footpaths and 25km of cycle paths together with designated bicycle parking stations. To improve the user-friendliness of buses, extra stops were added to routes and computerised timetables were introduced providing real-time information about the arrival of buses at each stop. Furthermore, six sets of intelligent traffic lights were installed that give automatic priority to public transport.

The environmental quality of the public transport infrastructure was improved through the introduction of six buses powered by methane and the extension of the electric shuttle bus routes as far as the train station. Important complementary environmental measures were the creation of local 'eco-points' and the implementation of a door-to-door refuse collection system to achieve the sorting - and recycling - of household urban waste.

A particularly interesting result of the project was the development of an innovative urban planning tool. Developed by the partner university, this is a methodology for assessing the likely long-term effects of a new factory or other construction. This strategic environmental evaluation uses key indicators such as the cohesion of social networks, the use of resources and the protection of bio-diversity to consider urban development simultaneously from the environmental, economic, social and cultural points of view. By going beyond a simple assessment of the immediate environmental impact, this permits a greater focus on sustainable development within urban planning.

The project succeeded in increasing the efficiency, reducing the pollutant emissions and improving the long-term sustainability of the local transport system. It increased safety and security for pedestrians and cyclists and generally improved the quality of life in the area. The engagement of public and private bodies with a high degree of citizen participation produced tangible results that benefited both the environment and responded to citizens' needs.

The results - including the urban planning tool - have a clear potential to be copied in other urban settings, particularly those of up to 500,000 inhabitants. Several EU cities involved in the final conference of the project have already started developing similar initiatives.

SMURF: River management in the West Midlands

The SMURF project in the West Midlands, England, demonstrated a computer-modelling diagnostic approach to river management, and the benefits of engaging the local community in measures to improve the River Tame.

The large West Midlands conurbation, including the city of Birmingham, lies in the 1515 km catchment area of the River Tame, a tributary of the River Trent. The river suffers from industrial pollution, damaged habitats and poor accessibility. It has also been extensively modified and re-routed.

The LIFE project, Sustainable Management of Urban Rivers and Floodplains, applied sustainable land-use planning and water-management techniques to tackle the problems commonly associated with urban rivers. In 2002, the beneficiary, the UK Environment Agency, began to involve the public in the development of a vision for river management, which could be applied to a demonstration stretch of the River Tame at the Perry Hall playing fields.

During the first phase of the project, Birmingham University co-ordinated the establishment of three groups for two rounds of evening meetings to develop the vision for river management for all rivers in the city.

Interest in the project was high, and measures included the construction of a gravel path alongside the river, the location of rubbish bins to prevent littering, and the re-creation of riverside habitats through the lowering of the banks at certain points where reeds and wild flowers were planted.

The aim of the project at Perry Hall, however, was social as well as ecological. School children and more than 100 local residents helped plant wild flowers on a new patch of meadow created with earth taken from a bend in the river. The measures undertaken over the course of the project open up the river to people and their pets.

The River Tame and the Perry Hall playing fields

The overall legacy of the project is difficult to quantify, but the organisers believe its influence will be far-reaching. Since the project closed, the local council has provided the Perry Hall site with a park ranger, an appointment that could have resulted from the heightened awareness the project generated. The site also serves as an example of good practice that other councils can follow. The university will conduct a follow-up study of the area to determine what effect the project has had on the river habitat.

The innovative river modelling aspect of the project is continuing to be evaluated. The project used a geographical information system (GIS), which links data to spatial information and can produce maps visually representing this data. A full version of the system was delivered to the main project partners and requires specialist software, but two other less sophisticated versions – one on a CD-ROM and the other provided online – were made available to the public.

The project included several conferences to increase awareness of its results and the development of the habitat assessment tool. A representative from Prague attended two of these conferences and was inspired to test the method in her home city.

Project Number:
LIFE02 ENV/UK/000144

Title: Sustainable Management of Urban Rivers & Floodplains

Beneficiary: Environment Agency, UK

Total Budget: €3,027,000

LIFE Contribution: €1,130,000

Period: Aug 2002 to Jul 2005

Website: www.smurf-project.info

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Zantecoast: Turtles or tourism?

Pleasure boats, deckchairs and tourist debris threatened loggerhead turtle habitat near the island of Zakynthos until a LIFE project brought together visitors, local businesses and the managers of the National Marine Park to solve the problem.

Tourism can be a threat to loggerhead turtle habitat

Tourism has exploded over the last twenty years on the Greek island of Zakynthos. The new businesses and foreign tour operators who set up shop have been a wonder for the economy of the island, but not such a wonder for one particular turtle that also happens to make his home there. The endangered loggerhead turtle (*Caretta caretta*), which grows to an average weight of 200kg and length of 1m, often saw its habitat in Laganas Bay come under threat from such things as tourists' deck chairs spread out on the very beaches where the turtles make their nests, as well as rubbish and other tourist debris.

The turtle is a priority species listed in Annex II of the EU's Habitats Directive, and was the focus of national legislation introduced by the Greek government for the first time in 1984. This took the form of a Presidential Decree concerning the land use in the surrounding area of the nesting beaches. But this law was poorly enforced. Few people, including tourist business operators, had much awareness of the conservation importance of the species or the area's environmental significance.

The Zakynthos National Marine Park, which was established in 1999, is located in Laganas Bay, in the southernmost part of the island, and encompasses sea turtle nesting beaches and a section of adjoining land, the wetland of Keri, together with the two small islands of Strofadia. Together, these make up the most important loggerhead sea turtle breeding ground in the EU. In order to protect the turtle's habitat, the park managers devised a plan that involved awareness-raising, wardening and a range of on-site actions.

One very successful aspect of the project was the raising of environmental awareness amongst the public. The project managed to achieve this by actively involving both locals and visitors in integrated coastal management and sustainable development actions such as the construction of the basic infrastructure (warden huts and information panels), the implementation of codes of conduct and the certification of local operators.

Furthermore, the project undertook several actions to improve the environmental management and protection of the area, including the placing of buoys, training of local staff, and a programme of wardening – which was the first time a systematic wardening programme had been launched in the country.

Trespassing by visitors and local people was significantly reduced, and the demarcation of the marine area with the buoys gradually improved the control of recreation and visitors' boats. This delineation of the marine section of the park, in collaboration with the port police, decreased the dangers to the turtles and also to the rest of the area's unique marine habitats by aiding the enforcement of the legal limits for speed and access. The carefully chosen anchoring system for the buoys also avoided the destruction of high-biodiversity *Posidonia* seagrass beds (themselves a priority conservation habitat classified under Annex I of the Habitats Directive).

The project has brought greater visibility to Greece's first fully operational marine park and, most notably, for the first time in Zakynthos' long history of environmental conflict, the project team was able to gain partial acceptance and support for integrated coastal zone management (ICZM) and sustainable development measures. This was mainly thanks to a participatory and co-management process involving various stakeholders: NGOs, local businesses, farmers and fishers.

Project Number:
LIFE00 ENV/GR/000751

Title: ICZM: Demonstration actions in the National Marine Park of Zakynthos

Beneficiary: Management Agency of National Marine Park of Zakynthos

Total Budget: €1,438,000

LIFE Contribution: €638,000

Period: Jun 2001 to Nov 2004

Website: www.nmp-zak.org

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Siddharta: Flexible on-demand buses fight transport pollution in Genoa

The European Union has focussed on transport as a significant contributor to the reduction greenhouse gases, and in Genoa, one LIFE project demonstrated that through co-ordinated action, this can lead to significant improvements in the quality of the urban environment.

The Smart and Innovative Demonstration of Demand Handy Responsive Transport Application (Siddharta) project implemented an innovative transport service to reduce air pollution in the Italian port of Genoa. Improving the quality of air in the city not only benefits the health of city dwellers, but also helps meet the goals of the Kyoto Protocol on climate change.

Community legislation aims to cut emissions from road vehicles through

- The use of catalytic converter and roadworthiness tests;
- Greater fuel efficiency of private cars (in collaboration with car manufacturers); and
- The promotion of clean vehicles (via tax incentives).

The Siddharta project aimed to reduce emissions by bringing about a shift from private to public transport.

Project Number:
LIFE03 ENV/IT/000319

Title: Smart and Innovative Demonstration of Demand Handy Responsive Transport Application to improve the quality of the urban environment

Beneficiary: Azienda Mobilità e Infrastrutture S.p.A.

Total Budget: €1,327,000

LIFE Contribution: €573,000

Period: Jun 2003 to Dec 2005

Website: www.ami.genova.it

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To encourage this shift, it introduced a demand-responsive transport system operated by low-emission vehicles (DrinBus). The new flexible system replaced existing public transport routes (operated with diesel buses in Genoa). This system increased the efficiency of the public transport network, requiring fewer trips for the same number of passengers. Moreover, the new arrangements brought about a 44% increase in the number of passengers.

Other significant results of the project included a reduction of carbon monoxide emissions by 1%, of total suspended particles by 0.3%, of nitrogen oxides by 4.1%, of sulphur dioxide by 3.7%, and of volatile organic compounds by 0.3% (by replacing oil-powered buses with ones powered by natural gas). Additionally, there was a reduction of noise as a result of fewer cars as an increased number of locals were using the public bus service.

The project also evaluated the potential of replicating the system in other areas and raised awareness of urban air quality while encouraging greater use of public transport. To support this part of the project, guidelines on best practices for the development of environmentally friendly and flexible public transport services in urban areas were produced.

The project was developed together with the Municipality of Genoa and D'Appolonia, a consultancy.

The beneficiary, Azienda Mobilità e Infrastrutture (AMI), is developing similar systems in the province of Genoa, Savona and La Spezia. As a result of the new transport system, AMI estimates that health costs in the former area will be reduced by €34,500 a year and €187,744 a year in these latter two areas. AMI presented a report of its activities at several EU workshops and conferences on innovation in urban transport.

Finally, the project was supported by a very successful advertising campaign promoting the DrinBus service throughout the city (bus stops, brochures, posters and tickets etc.). The DrinBus scheme has proven so popular that the beneficiary has since exploited both the technology and the know-how in the city of Krakow in Poland.

The DrinBus scheme in operation

Water management

The Water Framework Directive 2000 sets out a timetable of actions for Member States to follow in order to achieve good status of waters by 2015. It has introduced an objective of achieving sound ecological status for surface waters and has therefore emphasised the need to understand and monitor water resources from a different perspective.

Any activities which have a negative impact on a water body in terms of it reaching good status must be identified and addressed. Intrinsically therefore, integrated river-basin management is advocated, and issues such as water pricing; water and wastewater treatment and transport; flooding and irrigation; and pollution prevention and planning are covered by the directive.

WFD Directive (2000/60/EC) http://europa.eu/scadplus/leg/en/lvb/l28002b.htm

MBR Varsseveld: Membranes improve wastewater effluent quality

This project has achieved remarkable success in demonstrating the first full-scale membrane bioreactor for the treatment of municipal wastewater in the Netherlands. Using specially-developed membranes through which the biologically purified wastewater is drawn, the new Varsseveld wastewater treatment plant (WTTP) delivers a maximum of 755,000 litres of clean water an hour.

In the membrane tanks, water is separated from the bacteria-rich sludge by sucking it through membranes

Located in the east of the Netherlands in the province of Gelderland, the Varsseveld WWTP is one of fourteen managed by the Rhine and Ijssel Water Board (the LIFE project beneficiary). Wastewater from the plant is mainly commercial and domestic water, but it includes rainwater that enters the sewers via street drains. In the Netherlands, where combined sewer systems prevail, there is a huge difference between wet-weather and dry-weather supply. At Varsseveld for example, three times as much water arrives at the plant after heavy rainfall than during dry weather.

There was an urgent need to replace the old Varsseveld WTTP, which was built in the 1970s. The treatment process used bacteria for biological decomposition or pollution extraction, which were then separated from the purified water in sedimentation tanks. However, this process was not always entirely effective – allowing bacteria to be discharged with the treated water into the nearby small river Boven Slinge – causing problems of water turbidity and some accumulated pollution.

Project manager Philip Schyns says the "less risky" option would have been to simply replace and/or expand the old plant. However, due to the sensitivity of the Boven Slinge, which in the summer time receives only water discharged from the WWTP, there was a need for improved effluent quality. The plant's relatively small size – the maximum amount that can be produced daily equals the water produced by 25,000 people – also made it an ideal size to experiment with emerging MBR technology.

"We could have used sand filtration as the final treatment. But then there was the possibility of applying 'new' membrane technology to our business," says Schyns, explaining that although the technology had been around for some time, it was initially considered "too expensive" and also "used too much energy". However, the emergence of new, less energy-intensive, low-pressure membranes would help to bring down the costs. In addition, with the approaching 2015 deadline for the EU's Water Framework Directive (2000/60/EC)[1], he says there was a need to be thinking

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1 http://ec.europa.eu/environment/water/water-framework/index_en.html

Close-up of the membranes: a type of plastic reed impregnated with miniscule holes

about future, more stringent requirements for 'ecologically sensitive' water."

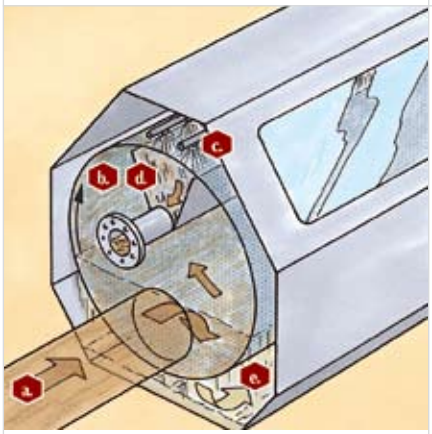
Partnership for innovation

In 2002, the innovative water board, together with the Dutch Foundation for Applied Water Research (STOWA) and consultancy and engineering firm DHV, obtained LIFE-Environment co-financing for the design and implementation of the MBR. The overall objective was to treat the wastewater in the membrane bioreactor and to demonstrate its effectiveness at full-scale. The project aimed to show that the effluent would meet current and future regulations and to show that MBR technology would enable both new and existing WWTPs to build more compact and modular installations (requiring up to 50% less space than conventional purification plants). Other expected results included a reduction of odour and noise emissions and, eventually, a decrease in sludge production.

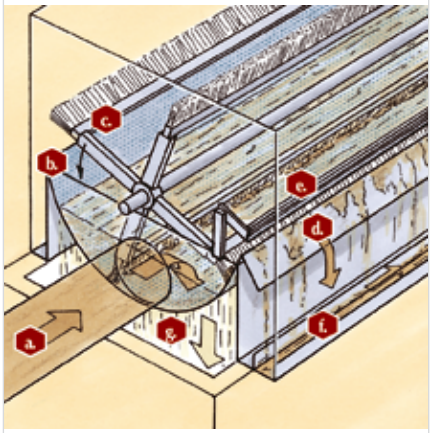
Construction began in mid-2003, with the plant completed at the end of 2004. The old plant was maintained alongside the MBR for several months, in order to lessen the risk. As with a conventional treatment plant, using sand filtration, the membranes treat the urban wastewater with bacteria for the decomposition process. The difference is that the membranes, a type of plastic reed impregnated with miniscule holes, allow the treated water to be drawn through, while the bacteria remain behind in the treatment plant. According to Schyns, this process produces "extremely clean water" containing no solid particles and very little phosphate and nitrogen.

Following tests, the MBR went into operation at the beginning of 2005. The plant was officially opened on 3 May 2005 by Crown Prince Willem Alexander of the Netherlands. This high-profile dissemination event, organised by the beneficiary and partners, attracted considerable media attention, receiving coverage in Dutch local and national TV, local, regional and international press and 24-hour worldwide news channel CNN.

Drawing: Hans ter burg.nl



Detail 9' MICROSIEVE TYPE I



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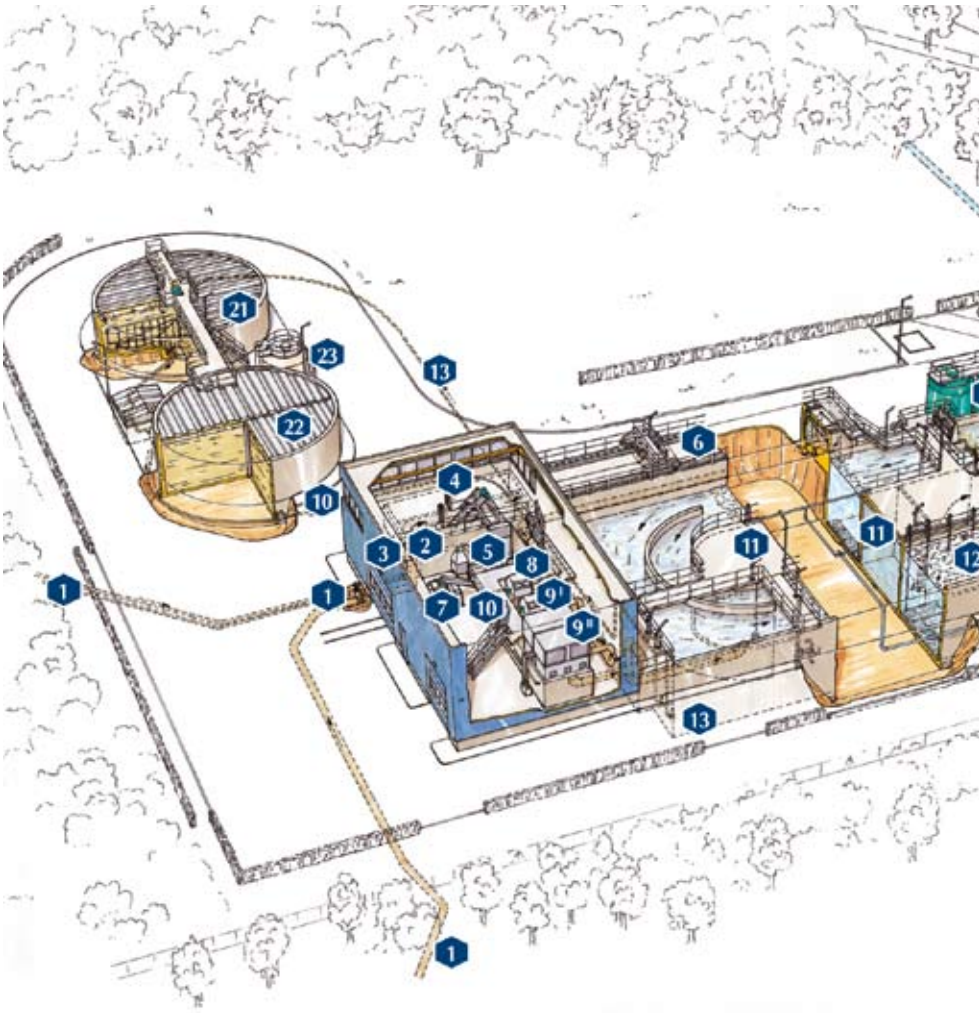


Project results

The project closed in June 2006. The first 16 months' operational results and experience showed the new technology is suitable for the treatment of municipal wastewater. Although membranes normally function best under constant water supply, the Varsseveld experiment – using a number of membrane compartments of modular construction with an advanced control system – showed it was feasible to apply the technology to process fluctuating water supplies. Using the membranes, the plant processes some 4,500 m^3/day on average – producing over 755 m^3/hour of clean water. Target values for permeate quality (5 mg[2] Ntotal/l and 0.15 mg Ptotal/l) have been achieved.

Biological purification: bacteria feed off the waste in aeration tanks

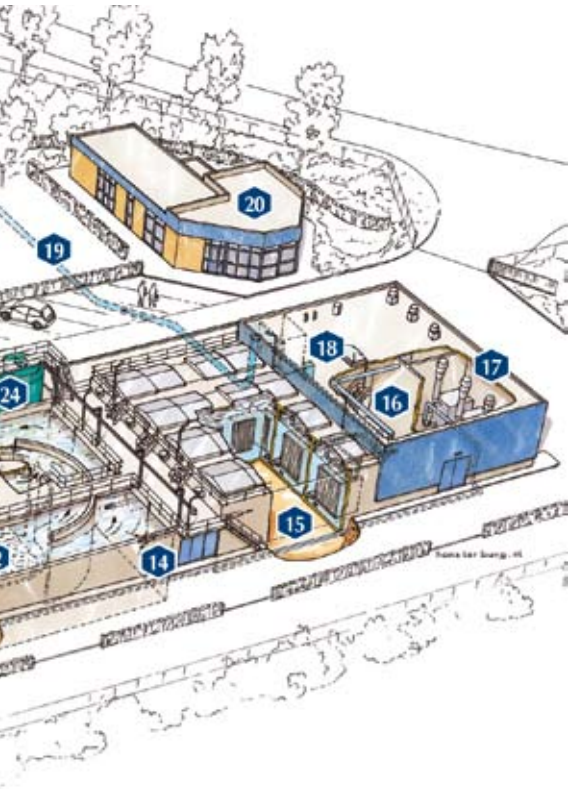
The following aspects are particularly innovative:

- Stringent pre-treatment using 0.8 mm microsieves (this is becoming the accepted standard for new MBRs in Europe)
- Application of (four) separate membrane tanks
- High automation of the plant and membrane cleaning processes
- High variation in influent quantity that is specific to the Netherlands, and the high loads that are put through the membranes that can peak at 50 l/m2h (this is the highest of all European MBR installations)
- High reduction percentages realised (97% COD, 93% total nitrogen and 99% total phosphorus)

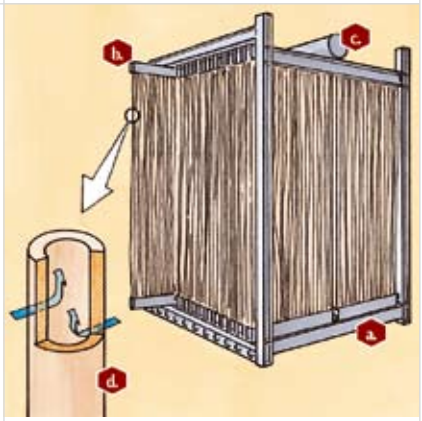
'Keeping the membranes clean'

Key to the project's success is "keeping the membranes clean" – a task whi ch, although fully-automated, has not been without problems. Each of the four membrane tanks is cleaned weekly on a rotating basis, which places stress on the system, especially in periods of exceptionally heavy rainfall as, for

2 Even rates of 2.2 mg/l Ntotal/l have been shown



Drawing of the Varsseveld WWTP with membrane bioreactor



Detail 15 MEMBRANES

1. Sewage water supply (high-pressure pipes)
2. Sewage water collection
3. Sewage water sampling
4. Extraction of large pieces of refuse
5. Removal of large pieces of refuse
6. Sand and oil trap
7. Sand cleaner and sand removal
8. Water volume monitoring point
9[I]. Microsieve type I
9[II]. Microsieve type II
10. Removal of sieved particles
11. Oxygen-poor section
12. Purification by bacteria with oxygen
13. Removal of excess sludge
14. Membrane supply pump
15. Membrane tanks
16. Pump room
17. Blower room for aeration
18. Purified water inspection point
19. Removal of purified water
20. Plant management building
21. Sludge thickener
22. Sludge storage
23. Iron salt storage tank (for removal of phosphate)
24. Air treatment

DETAIL 9 [I] - MICROSIEVE TYPE I
a. sewage supply
b. rotating microsieve
c. sprayers for cleaning sieve
d. collection/removal of sieved particles
e. collection/removal of sieved water

DETAIL 9 [II] - MICROSIEVE TYPE II
a. sewage supply
b. stationary sieve
c. rotating sieve cleaning brushes
d. sieved particles overflow
e. brush cleaning scraper
f. collection/removal of sieved particles
g. collection/removal of sieved water

DETAIL 15 - MEMBRANES
a. frame with membrane modules
b. subframe with discharge channel for purified water
c. collection pipe
d. detail of membrane fiber

example, the record rainfall during the months of June and early July 2007.

Overall the MBR is functioning well, says Schyns, adding that of course there were some minor "teething" problems, but these were quickly overcome. There was however, one more serious problem, which emerged only one month after start-up, threatening to undermine the planned, high-profile inauguration of the plant on 3 May 2005. Inexplicably, the membranes had become blocked and appeared to be coated with a sticky substance. The problem appeared to be related to discharges of polymers of a cheese factory, and, following "intensive and delicate negotiations", the cheese factory agreed to collect the wastewater with the polymers separately and to transport it by lorry to another wastewater treatment facility. Plant manager, Jacques van Someren, recalls "sleepless nights" before the problem was located and resolved. The membranes were thoroughly cleaned in mid-April – only days ahead of the planned royal visit. Thankfully, the problem has not reoccurred.

Cost-effectiveness

The MBR costs are comparable to those of a conventional wastewater treatment plant requiring high quality purified water, (that is, WWTPs requiring supplementary technologies such as sand filtration and/or a decontamination system), and the cost differential is minimal with respect to energy consumption. Future developments (lower energy consumption and notably, lower membrane prices) are expected to lead to further cost reductions – making it increasingly cost-effective. According to Schyns, there is also growing international interest in the technology notably from China and the rest of Asia. Closer to home, and partly as a result of the Varsseveld project, other WWTP managers have also opted for the implementation of MBR plants (the Hilversum, Heenvliet, and Ootmarsum WWTPs in the Netherlands and Tervuren WWTP in Belgium). The knowledge and experience gained can be used to great effect in the design of new MBR plants. The extensive research programme has provided various possibilities for optimisation that are already proving useful in future designs.

Project Number:
LIFE02 ENV/NL/000117

Title: Membrane Bioreactor WWTP Varsseveld, first full scale demonstration of a MBR based municipal waste water treatment plant

Beneficiary: Waterschap Rijn en IJssel, (Rhine and IJssel Water Board), Netherlands

Total Budget: €8,055,000

LIFE Contribution: €1,585,000

Period: Oct 2002 to Jun 2006

Website: www.mbrvarsseveld.nl/

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The MBR Varsseveld purification steps

1. Mechanical purification
To prevent blockages, a grid removes the larger pieces of refuse, such as sanitary towels, paper and plastic. Then sand and oil are removed in the sand/oil trap. In addition, hair is filtered out using micro-sieves.

2. Biological purification
During the biological purification process, bacteria feed off the waste in aeration tanks, breaking the waste down into harmless residues. They also convert nitrogen into nitrogen gas and absorb the phosphates.

3. Sludge/water separation
In the membrane tanks, water is separated from the bacteria-rich sludge by sucking it through membranes. The water passes through the holes, and the sludge remains.
To prevent the membranes from becoming blocked, the pumps are occasionally reversed and clean water is forced back through the membranes. Furthermore, at the bottom of the membrane modules, an aerating function is fitted. This produces bubbles which causes turbulence in the water, preventing the bacteria-rich sludge from becoming attached to the membranes. The clean water is then discharged into the Boven Slinge. Most of the bacteria-rich sludge is then reused in the purification process, and the rest is removed for sludge processing.

4. Sludge processing
The sludge is partly condensed and then stored at the plant. It is then transported periodically in tankers to a larger WWTP, where most of the water is removed using a decanter. The sludge is then furthered dried in a composting plant, after which it is incinerated.

Chemical & biological water quality: standard treatment process vs Varsseveld MBR

Parameter in mg/l	Standard WWTP	Varsseveld MBR
Total nitrogen	10	3.7
Total phosphate	2	0.19
Undissolved substances	5	0
Bacteria and viruses	Present	Absent

Viru-Peipsi camp: River management in Estonia

Industrial activity and inadequate management have created serious environmental damage in Viru-Peipsi region of Estonia. A LIFE project helped implement the EU Water Framework Directive (WFD) as a means of improving water quality.

The WFD dictates that water management plans must be introduced for all river basins in the European Union to ensure the sustainable management of water resources. While Estonia aims to introduce a National Environmental Action Plan, a specific plan for the Viru-Peipsi catchment area was also needed. Water quality had suffered as a result of oil-shale mining, industrial activities, mining, agricultural activities, the mismanagement of oil and fuel stocks, and inadequate waste management. The negative consequences have been the development of depression cones, an accelerated movement of pollutants from one aquifer to another, and the eutrophication of the shallow Lake Peipsi.

The LIFE project aimed to develop a management plan for the Viru-Peipsi catchment area, in order to enhance the protection of the water resources of the Narva river and Lake Peipsi basins. Its long-term goal was the cessation of discharges, emissions and release of hazardous substances listed in the EU Priority List, the EU Lists I and II of Dangerous Substances, and the list of hazardous substances in Estonia.

Water protection and clean-up measures

Water quality in the Viru-Peipsi catchment area had long suffered from the effects of industrial activities

The main achievement of the project was the drawing up of a River Basin Management Plan (RBMP) through the consultation of experts and the involvement of the public. The beneficiary, the Ministry of the Environment, will use the draft plan as the basis for the final RBMP, which will be completed according to the schedule set in the WFD. The project also helped revise legislation on the delineation of river basin districts and groundwater bodies.

To develop the draft RBMP, the project carried out inventory and data gathering activities in co-operation with the relevant national institutions. The project also produced a cost assessment for reducing the municipal, agricultural and industrial pollution load, and proposed water protection and clean-up measures.

Another key aspect of the project was the provision of valuable experience and expertise for the development of the final RBMP. Capacity building activities included the training of technical staff in monitoring and sampling, as well as the upgrading of technical equipment (for example, PCs, and GIS and MIS applications).

The project was also instrumental in improving stakeholder dialogue and participation. The project carried out wide-ranging dissemination activities, including broadcasts on Estonian national television. It also built up a dialogue with Russia, which borders Lake Peipsi.

Project Number:
LIFE00 ENV/EE/000925

Title: Viru and Peipsi Catchment Area Management Plan

Beneficiary: Ministry of the Environment, Republic of Estonia

Total Budget: €1,668,000

LIFE Contribution: €500,000

Period: Dec 2001 to Sep 2005

Website: www.envir.ee/viru.peipsi

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URC: Demonstrating Ultrasonic Resonance Cleaning in Germany

Ultrasonic Resonance Cleaning (URC) offers several advantages over traditional methods for treating wastewater. The 'Ultraschallreinigung' LIFE project aimed to develop three prototypes of URC to demonstrate the efficiency and feasibility of the technology.

Ultrasonic Resonance Cleaning is inexpensive both to acquire and to maintain

A LIFE project, which was undertaken by Ultra Sonic Systems, designed URC prototypes for use in different EU countries and in three typical fields of application: the standard wastewater cleaning requirements of the food and beverage industries; municipal or special waste dumping sites; and drinking-water purification plants. The aim of the project was to demonstrate that the technology is reliable and superior to the treatment technologies currently in use. The contaminant load of the wastewater would be reduced to below the threshold at which wastewater may be drained into a water body or used as process water. The know-how generated during the project would be used to optimise the system and to prepare for a broad market entry.

In each of the three areas, URC was successfully applied leading to:

- A reduction of COD/TOC (the ratio of chemical oxygen to total organic carbon, an indication of organic pollution) in the leakage water of a waste dump of 50%;
- Lower energy requirements due to the controlled input of power sources and oxygen providers in a limited amount of space;
- A reduction of ammonia of 50% during wastewater pre-treatment with 50-70% less strip air consumption;
- Disinfection of the run-off of communal wastewater plant, achieving a 10^3-fold decrease in bacteria;
- Faster treatment of pollutant chargers, since substances are brought more quickly into a liquid phase: a ten-minute treatment instead of six weeks with a traditional biological purification plant;
- A considerable reduction of cost per treated cubic metre of wastewater, in the range of 20-50% and even higher, e.g., 60% in the case of ammonia reduction.

To achieve the desired reduction in ammonia for the standard waste-water facility, the beneficiary completely redeveloped the original design. For the other pilot plant designed for disinfection, a long period of testing was necessary, as every new field of implementation requires optimisation of a whole range of process parameters. The results of the project are continuously updated on the project website

During the project, the beneficiary focussed on finding partners in other countries to work with in order to spread the use of the technology.

The pilot plants were installed in standard containers and are easily transportable to other locations of interest for test application. For example, the University of Wales was expected to attempt to use the technology in a project involving Welsh Water.

The beneficiary also attempted to find new fields of application. Most of the project's communications were targeted to reach these goals. The beneficiary also planned a media campaign on the market launch of the new technology.

URC is an inexpensive device, both in terms of initial outlay and operating costs. The beneficiary estimates that cost savings of 50% can be made in the field of ammonia reduction and treatment of contaminated waste water. Furthermore, the process is transferable to a wide range of water treatment processes. Three companies have already declared their interest in applying or distributing the technology.

Project Number:
LIFE02 ENV/D/000404

Title: Waste Water Cleaning through Ultrasonic Resonance

Beneficiary: Ultra Sonic Systems GmbH

Total Budget: €2,015,000

LIFE Contribution: €583,000

Period: Sept 2002 to May 2005

Website: www.ultra-sonic-systems.de/

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EcoRiver: Demonstrating the benefits of an eco-toxicological approach

Wastewater composition is complex, with a range of different components that interact with each other. The Portuguese EcoRiver project sought to demonstrate how in the River Trancão area, an eco-toxicological evaluation of the toxicity of effluents is superior to just a chemical-specific approach.

The River Trancão and its adjacent basin, just north of Lisbon, may not be a very big area, but it is quite heavily industrialised and densely populated. The Trancão flows into the Tagus estuary, one of the largest rivers in Portugal. All of these attributes made the basin suitable for a LIFE demonstration project that could compare several methods of evaluating eco-toxicity from multiple effluent types.

The composition of wastewater is complex and the range of different components are not easily identifiable. Moreover, toxicity depends on the interaction between these different components and so an eco-toxicological evaluation will be more relevant to the protection of ecological systems than a chemical-specific evaluation. A chemical approach alone is not sufficient to evaluate the toxicity of effluents. Furthermore, eco-toxicology is a field that is growing in importance within environmental policy.

In many European countries, one effective strategy in minimising eco-toxicological pressure in the environment caused by wastewater is a 'Direct Toxicity Assessment' (DTA), an eco-toxicological measuring tool that has a good cost-to-benefit ratio. However, in Portugal, before the EcoRiver LIFE project, co-ordinated by the Instituto do Ambiente, there was no relevant legal framework for this, so there was a real need to fill in gaps in national legislation and at the same time develop the necessary related scientific framework.

The EcoRiver project's main objective was to demonstrate the importance of eco-toxicology for wastewater management and at the same time establish planning and control techniques for industrial and municipal wastewater networks in Portugal.

The project integrated both an eco-toxicological and a complementary physico-chemical study of wastewaters from industries from different sectors in the local area, the Frielas and São João da Talha wastewater treatment plants and the receiving waters.

EcoRiver demonstrated that methodologies for a direct toxicity assessment approach were indeed available for use and should be used in the evaluation and control of complex wastewater toxicity. The project also found that the tests should also be performed under a quality control system, and that eco-toxicological evaluation of effluents discharging into sanitary systems can provide important information to support wastewater treatment plant management. The eco-toxicological approach is clearly of added value in the hazard and risk assessment of discharges into receiving waters and can contribute to a more correct establishment of discharge conditions.

Modelling was demonstrated to be a useful tool in the evaluation of the impact of effluents on the receiving waters. Specifically, the project's models evaluated suggested management actions, identified risk areas and seasonal critical periods.

The project organisers thus recommend the use of modelling in receiving-waters monitoring programmes and in the definition of toxicity limits for discharges based on discharged flow and dilution capacity.

Additionally, the project found that the ecological characterisation of receiving systems would benefit from sediment studies with chemical, eco-toxicological and biological components.

A chemical approach alone is often not sufficient for evaluating the toxicity of effluents

Project Number:
LIFE02 ENV/P/000416

Title: EcoRiver - Ecotoxicological evaluation of municipal and industrial waste waters

Beneficiary: Instituto do Ambiente

Total Budget: €1,151,000

LIFE Contribution: €518,000

Period: Oct 2002 to Sept 2005

Website: www.iambiente.pt/ecoriver/pt/novidades.html

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Email: tereza.vinhas@iambiente.pt

TANWATER: Tannery achieves over 80% cut in nitrogen discharge

The Tanwater project from Sweden successfully demonstrated that it is possible to reduce the nitrogen discharge from the leather industry by more than 80% in a cost-effective way. Current technologies achieve a reduction of about 30%, so the project's results have significant transfer potential for other European tanneries.

The Elmo tannery is one of the oldest and largest tanneries in western Sweden

Leather tanning (the process of converting raw hides into leather) is a raw-materials and labour-intensive industry. It is also a potentially pollution-intensive industry. Europe's 3,000-plus tanneries release wastewater originating from wet processing (in the beamhouse and the tanyard) and the post-tanning operations. This wastewater usually contains a high concentration of nitrogen, which is difficult to remove due to its high solubility. Nitrogen is a major environmental problem in many countries, as high nitrate levels can cause eutrophication[1] of watercourses and the pollution of groundwater, a source for drinking water.

1 Eutrophication refers to the accumulation of nutrients (nitrates and phosphates) in a body of water. This process can occur naturally, but recently has been accelerated by nutrients' runoff from activities (farms and sewage) input. Algal blooms result and their decay removes dissolved oxygen, eliminating aerobic organisms such as fish.

The project developed and tested in full-scale at the Elmo tannery, the largest tannery in Scandinavia, located in Svenljunga in western Sweden, a new technology for treating wastewater that applies nitrification and de-nitrification processes. The technology had previously not been considered feasible in tannery wastewater treatment plants due to the complex composition of tannery wastewater.

The project was implemented by the Elmo Leather AB tannery in Sweden, the beneficiary and subsidiary of the Elmo Leather Group, the world's largest manufacturer of high-end leather furniture and a major supplier of leather to the automotive industry.

The construction of the new plant started in March 2004, with the plant operational by April 2005. The wastewater treatment process has been monitored since the launch of the plant, and tests have shown that the process is also stable under different weather conditions. The project's results have been impressive: It achieved a reduction in nitrogen of 86% – higher than the expected 80%. The nitrogen load from the plant is 21 tonnes a year, a marked decrease on the previous 104 tonnes a year using conventional biological treatment. Monitoring of the environmental impact of the tannery also showed a reduction in biochemical oxygen demand (BOD) of 98%, chemical oxygen demand (COD) of 92% and chromium of 87% (performance from September 2005 to December 2006).

The cost of treating wastewater from the leather industry using the Tanwater concept is around the same as the conventional treatment, even though it is more efficient. The treatment cost is approximately €1.5 - €1.6 m^3, including the original investment cost.

Finally, the new wastewater treatment technology also gives better results than the current best available techniques (BATs) for the tannery sector and, as a result, the beneficiary has participated in meetings with the European IPPC Bureau[2] in Seville (part of JRC/IPTS) to discuss the revision of the so-called "BREF" reference document for tanneries.

The current BREF for the tanning industry was adopted in February 2003 and is available at: http://eippcb.jrc.es/pages/FActivities.htm. The revised BREF is expected to be finalised in 2009.

2 The European IPPC Bureau of the European Commission (DG Joint Research Centre) organises an exchange of technical information on BATs under the IPPC Directive (96/61/EC), and prepares the reference documents (BREFs).

Project Number:
LIFE03 ENV/S/000595

Title: Reduction of the nitrogen discharge from the leather industry

Beneficiary: Elmo Leather AB

Total Budget: €5,119,000

LIFE Contribution: €914,000

Period: Dec 2002 to May 2006

Website: www.tanwater.net

Contact: Leif Svensson

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Recyclaqua: Worms put to work processing wastewater

Traditional wastewater treatment normally takes up large amounts of space and produces un-decomposed sludge that is often burnt in incinerators. The French Recyclaqua LIFE project, however, showed that employing worms instead uses far less land, produces no sludge and can be implemented on an industrial scale.

The earthworm *(Eisenia Andrei)*, the wiggly unacknowledged janitor of the world, has worked day-in, day-out, looking after the planet's soils for hundreds of millions of years. Following the work of one successful and pioneering wastewater processing LIFE demonstration project in the south of France, these hard-working, hermaphroditic little caretakers are now getting their day in the sun - or rather, their day covered in organic substrate and organically polluted wastewater – as international media from Chile, Spain, Germany and further afield visit the 'Recyclaqua' venture to see how the technology could be exported to their own wastewater systems.

Wastewater is normally treated by decomposing the organic matter it contains under aerobic ('with air') or anaerobic ('without air') conditions. This generally takes place in a liquid medium (activated sludge, bacteria beds, lagooning, etc.), which requires extremely large surface areas or volumes (extensive lagooning requires around 10 m^2 per inhabitant) or the construction of costly plants that accelerate decomposition and produce an un-decomposed 'mass', or sewage sludge, which is finally digested in fields or burnt in incinerators.

However, the LIFE Recyclaqua project, located in the rural community of Combaillaux and employing technology developed by Soil Zooecology Lab at the National Institute for Agronomic Research and the University of Montpellier 2 - Water Sciences Unit, has demonstrated that a new process, lumbri-filtration, which uses earthworms to treat organically polluted water (OPW) instead, is feasible both technologically and economically.

The lumbri-filter consists of a 20- to 30-cm-thick active organic substrate layer (a mixture of wood chips and bark) in which the earthworms live, placed over a 70-cm substrate that itself lies atop a gravel bed.

The wastewater is sieved on its arrival at the plant to remove any large particles and then sprinkled over the surface of the substrate through which it filters, leaving behind any organic particles in suspension, which the earthworms then transform into mineral matter by digestion. Earthworms are inoculated into the upper layer together with a layer of vermi-compost (a mixture of blonde peat and pine bark vermi-composted for at least six months) after the lumbri-filter has been 'watered' for the first time.

Sieved wastewater is regularly sprayed over the circular lumbri-filter by a revolving sprinkler arm, ensuring that wastewater is spread evenly before percolating.

The main advantage of this process is in the minimal amount of sludge it produces, which almost entirely consists of the matter removed during pre-treatment, and which is transformed on site into vermi-compost. Lumbri-filtration is not therefore merely a filtration process; it also dispenses with the problem of sludge. The virtually odourless and noiseless system also had the advantage of requiring little surface area (0.25 to 0.5 m^2 per inhabitant) and using a minimal amount of energy.

By the end of the project, the lumbri-filtration system was operational, met all quality requirements for processed wastewater under French law, and was being used by the local town.

Municipalities across the world have expressed interest in the system, and elected representatives from all over France have visited the plant and shown interest in exporting the system to their own wastewater treatment plants.

The lumbi-filtration sewage treatment process

Project Number:
LIFE03 ENV/F/000257

Title: A new sewage treatment process: the vermifiltration. Demonstration-dissemination technically and environmentally integrated

Beneficiary: Mairie de Combaillaux

Total Budget: €1,178,000

LIFE Contribution: €381,000

Period: Dec 2002 to Nov 2005

Website:
www.recyclaqua.agropolis.fr

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Minimising the environmental impact of economic activities

European Union policy on the environmental impact of economic activities is implemented through a wide range of instruments. The most important legislation includes the 1996 Directive on Integrated Pollution Prevention and Control (IPPC), which aims to minimise emissions into water, air and soil from industrial point sources throughout Europe. The directive 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.

Directive (96/61/EC) http://ec.europa.eu/environment/ippc/index.htm

REF: Producing coated material in a faster, quieter, cleaner and more economical way

The production of coated material for Europe's infrastructure, roads, car parks and pathways results in wasted energy and fuel and significant fine particle emissions. Using LIFE funding, UK SME Mixlance has developed a series of innovations to create a modern production plant that reduces electricity use by up to 75% and gas and oil consumption by up to 30%. The process cuts operation costs and times, uses less space, reduces gas ($C0_2$) and particle emissions and is totally waste free.

The modular unit developed by REF is shorter and takes up less space on the ground than traditional plants producing coated material

The majority of the coated material needed in Europe is produced by conventional asphalt plants. These mix a prescribed 'recipe' of base material such as stone and dust - known as aggregate - with bitumen to form coated material. Asphalt plants produce large quantities of material in a relatively efficient way. However, many customers do not require large volumes of the same type of coated material.

Customers working to repair a road that has been damaged or dug up, re-lay a driveway or create a new path will require relatively small amounts of a particular variety of coated material. Whenever a customer arrives requesting a different recipe, the asphalt plant has to empty out the remaining 'in-flight' product as waste. An asphalt plant jettisons up to 60 tonnes of material per day in this way, wasting the aggregate itself and all the energy and fuel used to mix and heat it.

Batch heaters were developed specifically to produce small volumes - batches - of coated material according to the requirements of each customer. The batch heaters were more efficient at switching between recipes, but still showed major inefficiencies in operation.

Mixlance, a UK SME, sought to develop, test and demonstrate a series of innovations to reduce the economic and environmental costs of the batch heater. Jed Smyth - managing director of Mixlance - firmly believes that if they had not received LIFE funding to develop the innovations, no one else would do it. "The quarrying industry is a bit of a dinosaur," he explained. "The REF project had to take the batch heater plant kicking and screaming into the 21st Century."

BEST OF THE BEST 2006-2007

A new modular concept

The core concept of the new batch heater was modular design. Mixlance divided the plant into four modules and redesigned each to fit into a standard ISO shipping container. This part of the process was like doing a puzzle, modifying the different components so that they would fit into the available space without compromising the functioning of the fully constructed plant.

The whole plant can now be shipped anywhere in the world in just four easily transported containers. Furthermore, because each module can be part-constructed before shipping and then erected using a 'plug-and-go' system, the actual construction time on site is reduced from 16 to just six weeks, saving vital resources.

The modular design reduced the area of land taken up by the plant from

nearly 120m² to just 20m² and the total height of the structure is down from 25m to only 12m. This means reduced visual pollution and the need to use less energy to move material around the plant.

The greatest benefit, however, is that the smaller size makes it much easier to erect the plant in an urban environment, where space is at a premium and planning permission constraints can preclude larger structures. A plant can thus be erected close to urban construction projects needing coated material, which reduces the distance lorries need to travel and consequently their fuel consumption.

Hibernation mode

Perhaps the major source of inefficiency and wastage in the conventional process was during short periods of inactivity. Although the burner could be switched to pilot flame, it was not possible to stop the turning of the barrel as this would have melted the rubber/polymer tyres it rests on.

Mixlance solved this problem by developing a lifting cradle that allows the support rollers to stop turning and the barrel to be lifted into the air where it can rest safely. The 37kW motor used to turn the wheels and the 90kW fan can therefore be switched off, providing savings of EUR 0.15 per kW hour during periods of inactivity.

The introduction of lagging to the barrel shell increased its retention of heat, reducing the cycle time and therefore fuel consumption even further. These innovations have enabled significant cost reductions and energy savings on days when there are gaps in demand.

Variable rotation speeds

During the production process, the aggregate is cascaded in a barrel. The lifting and falling of the batch within the barrel creates a 'curtain' of material which is heated by a conical flame burner. The efficiency of drying and then heating the aggregate to the required temperature for coating with bitumen depends on the quality and evenness of the material curtain.

Conventional batch heaters rotate their barrels at a constant speed of 13rpm. However, at any given speed, different weights of material lift and fall in different ways. This has meant that for some batches, the 'curtain' is far from even. Parts of the flame are hitting empty space rather than the aggregate and thus wasting fuel.

The innovative lifting cradle enables the barrel to stop spinning without melting the wheels

The even distribution of aggregate in the barrel means the powerful flame heats it more efficiently

During field trials with the lead partner CEMEX - a producer of coated material - Mixlance found that varying the rotation speed for different batch sizes could improve the results. As Jed Smyth recalled, "We used inverters to rotate batch sizes from 0.5 to 3 tonnes at different speeds and monitored the material curtain. We even blew up motors seeing how far we could go." The result of these tests was the identification of specific rotation speeds to produce the optimum material curtain for each weight of material.

The efficiency gains were impressive. It takes a plant approximately 90 seconds to heat three tonnes of material to the required temperature at 13rpm. At the optimum rotation speed, it takes just 75 seconds. This does not just represent 15 seconds of saved time, but 15 seconds shorter burning time and a 15-20% reduction in fuel consumption.

Innovative 'pulse jet' filter

A further innovation was the introduction of a new compressed-air 'pulse jet' cleaning system. This takes dust-laden air from the process through specially adapted filter sleeves. The cleaning pulse forces cleaned hot air back down the sleeves to remove the particles. The steady state conditions within the pulse jet filter assist in achieving consistent volume flows under all plant operating conditions.

Lorries wait less time than ever before to collect the final coated material

The main advantage of the filter is that it achieves a more consistent dust removal pattern. New UK regulations stipulate that the emitted air cannot contain more than 50mg of fine particles per m³. However, the pulse jet filter gives results consistently under 10mg, and a plant in the Midlands using the new sleeve design recently confirmed emissions of under 3mg per m³. This is unheard of in the field and suggests the possibility of more stringent environmental legislation on fine-particle emissions.

Project Number:
LIFE03 ENV/UK/000615

Title: REF - Demonstration of a Recycling, Energy Efficient and Environmentally Friendly Modular Batch Heater Plant

Beneficiary: Mixlance (Technical Services) Ltd

Total Budget: €4,876,000

LIFE Contribution: €1,004,000

Period: Oct 2003 to Apr 2006

Website: www.mixlance.com/LIFE/

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The cleaning pulse also removes the vast majority of cold cleaning air entering into the filter, thereby minimising dew point problems and short-term bag damage. The excellent inlet air distribution system minimises local bag wear and the filter's performance is not impaired by production problems associated with high moisture sand. These benefits provide lower operation and wear-and-tear costs and since no motors or generators are needed, noise pollution is reduced.

Computer-operated process

One of the project partners, Batching and Blending Systems Ltd., wrote a protocol for the batch heater process, which Steve Smith - one of the operatives at the CEMEX plant in Leeds - describes as being "simplicity itself." The system allows the operator to select the exact mix of ingredients to produce the right quantity of the specific aggregate requested by each client.

This ensures that there is no waste, since everything that goes into the barrel comes out as final product. The system also prevents waste by enabling the operator to abort a batch if the adequate temperature or weight is not reached before the bitumen is added. At this stage, an aborted batch can be easily recycled back into the process.

Greater amounts of recycled material - up to 50% - can also now be incorporated into the ingredient recipe as the process is better able to control and manage the mix of the different materials in the right quantities and at the appropriate moment. A specially designed hopper - with a narrower opening for a better flow of material - allows for recovered cold road planings to be successfully added to the process via the existing feed system.

Impact and transferability

Dave Hunt, commercial manager for CEMEX at the operational plant in Leeds, points out that one of the most notable achievements of the project is that "everyone wins: the new plant benefits the environment through zero waste and reduced pollution; the operator enjoys reduced running costs; and the customers on the ground get the same quality of product, only more quickly."

Indeed, what is exceptional about this modular batch heater is that there are quite literally no disadvantages of using this technology. There are no compromises. As the project material states, the modernised process simply makes the future of coated material "smaller, shorter, cheaper, faster, quieter [and] cleaner."

Its transferability is extremely high, as coated material is produced across Europe, but no one else is currently producing it so efficiently. CEMEX has already commissioned a new €2.25-million plant in Bristol using the project technology. The project team is convinced that this is a technology that will be used widely in the future because the economic advantages are so clear. When this happens, the environmental benefits from lower fuel use and reduced emissions will be substantial.

PVTrain: Applying photovoltaic cells to railways

Innovative in the railway sector, this Italian LIFE project successfully assessed the possibility of using photovoltaic cells on railway carriages and locomotives to reduce greenhouse gas emissions, minimise the generation of dangerous waste, and save energy.

PVTrain on track – photovoltaic cells have been applied to locomotives, coaches and wagons.

It rarely happens that one manages to see a diesel railcar Aln 668 that has been in service for more than 50 years just standing in the blazing Italian sun. But recently, it's not only trainspotters that have been interested in giving it a closer look.

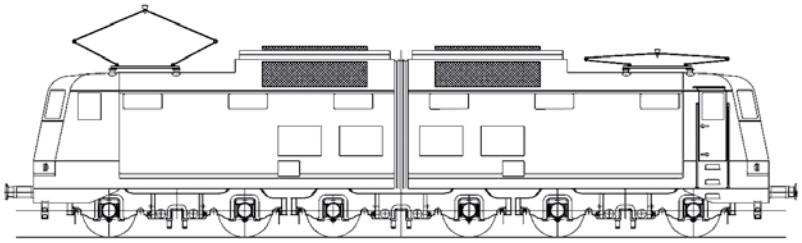
Along with nine other vehicles, the vintage locomotive was the subject of Italian LIFE project PVTrain, which aimed to verify the feasibility of the use of solar power to keep on-board accumulators charged during breaks in power supply. Specifically, the project aimed to decrease the railway sector's consumption of energy from conventional sources, cut its CO_2 emissions, and reduce the problematic disposal of waste from onboard accumulators by extending their lifespan.

The main question to address was that currently, Trenitalia's electric back-up systems are powered by a 3kV direct current contact line, energy that is collected from the overhead lines via the electric locomotive's pantograph and then distributed to the rest of the train. Any interruption of power supply affects the accumulators, leading to them to undergo numerous irregular charging/discharging cycles. This results in high levels of wear and tear in the accumulators, as well as of energy use and CO_2 emissions. Alternative sources of power, such as solar energy, could help bridge these interruptions in the power supply.

However, at the start of the project, photovoltaic (PV) technology had hardly ever been applied to rolling stock, despite the significant potential environmental and economic benefits. The main challenges to the innovative technology included the tough physical conditions that PV cells need to withstand, such as the high speed of the trains, or special requirements with regard to the cells' thickness and their shape.

Nevertheless, the project beneficiary, Trenitalia, the transport company of Italy's state railway group, Gruppo Ferrovie dello Stato, believed in the potential advantages of PV technology and decided to implement a LIFE project to experiment on its fleet of trains.

Installation of US 116 modules on locomotive E 636



"What I am really proud of is that we have been the first rail transport company applying PV technology to trains and testing it on such a broad range of vehicles. I am glad that we had the courage to do so," says Alessandro Basili, the project's manager. "LIFE can really be seen as the accelerator of the initiative. The co-funding definitely helped us start experimenting on the use of PV technology on trains back in 2002."

Possible uses of solar energy on trains

The project, which ran from November 2002 to October 2005, used for the experiment the amorphous silicon 'Photovoltaic Tile' and US 116 modules (made of triple-junction amorphous silicon, encapsulated in a polymer, with an anodised aluminium frame, and applied to a steel plate). Due to their structural characteristics, both models perform well in conditions of poor solar radiation. The two models are also particularly suitable for curved surfaces such as those of train roofs. The photovoltaic tiles were installed on five passenger coaches and the US 116 photovoltaic panels on two locomotives and three freight coaches.

Depending on where the photovoltaic panels are installed, the energy produced can be put to different uses. They can be applied to passenger coaches and locomotives to recharge the accumulators as an alternative to the main power supply, but also to support the engine starters of diesel locomotives (which are equipped with an autonomous power supply and therefore not connected to the high-voltage 3kV line).

As shown by PVTrain, a potential large-scale application could see their installation on freight carriages, which are generally not connected to any power supply. Here, photovoltaic panels can recharge accumulators in order to ensure the power supply for electric door locks intended to protect goods being transported.

16 trays, curved with the same radius as the roof, carefully positioned

Electric application

In order to use the energy produced by the chosen PV system as efficiently as possible, the project team designed and created special converters that transform the solar energy into electric power with a voltage and current suitable for recharging the rolling stock's batteries. This converter is able to adapt to the extremely variable conditions caused by the movement of the vehicle it is on, for instance when rapidly entering or leaving a tunnel. It also ensures galvanic isolation from the power supply line in case of accidental contacts. Its main tasks are to recharge the accumulators and to power the low voltage appliances installed on board the vehicles.

PV systems can be equipped with accumulators that save electrical energy during the day - especially during sunlight hours - for use at night or on overcast days. The energy is conserved in batteries (normally lead-acid), and a regulator prevents the charge voltage from exceeding a set value to ensure perfect performance of the accumulator. These systems are usually used for appliances that are not connected to the electrical mains.

Initially, the converter presented problems linked to incorrect calibration of the control software. A process of streamlining the capturing mechanism to the maximum power of the converter, carried out as soon as the necessary solar conditions prevailed (in May 2004) and based on research into the maximum power generation under different radiation conditions, was successful.

Research results

Since the photovoltaic panels were been installed, the ten PV vehicles have been almost constantly en route across Europe. Basili says that 95% of the overall targets were achieved, and Fernando Gherardini, the project's technical director, adds: "A major success factor was that all members of the project team did their best."

The project's success is validated by tests and measurements that were continuously carried out on the whole system to assess its performance. In this regard, a real-time measurement system (used in

Alessandro Basili, project manager, and Fernando Gherardini, the project's technical director, catch some rays in front of one of the two PVTrain locomotives.

addition to a field-point system, which recorded data continuously for more than twenty days consecutively) proved to be extremely helpful. On the basis of GPS technology that was connected with the rolling stock in real-time, this system ensured the transmission and visualisation of the data generated by the experiment. Already in place to detect the position of about 2,000 of Trenitalia's goods wagons, the technology was now combined with the ability to transmit data from the panels and the battery charger. The system enables the daily monitoring of the energy status of each railcar on which it is installed, in real-time and easily accessible via the internet.

As shown by the trials and measurements, the photovoltaic technologies provide energy cost savings and offer two significant environmental advantages over non-renewable energy sources:

- Less greenhouse gas production: Since the photovoltaic modules keep the trains' accumulators and auxiliary apparatus charged during stops, there is no need to resort to primary energy sources. For each kWxh of energy produced by traditional power plants, a CO_2 reduction of 750g is achieved with the photovoltaic modules.

  For the whole observation period, from July 2003 to October 2005, the energy used by the prototype coach was 1,378.42 kWh, resulting in a reduction in CO_2 emissions of 1,033.82 kg. Between August 2004 and October 2005, the energy used by the prototype locomotives was 159.3 KWh (sufficient to keep the on-board accumulators going), with a CO_2 emissions reduction of 119.95 kg. The energy used by the prototype freight wagons was 540 KWh (sufficient for the electric locks), resulting in a reduction in CO_2 emissions of 405.51 kg.

- Longer lifespan of the accumulators: As a result of the photovoltaic cells being kept constantly charged, the accumulators are subjected to less wear and tear. The project team estimates that constant maintenance of the accumulator charge via the photovoltaic cells extends their life by an estimated 10-20%, equalling an increase in the average turnover period from 48 months to 56 months. Longer lifespans mean less hazardous waste.

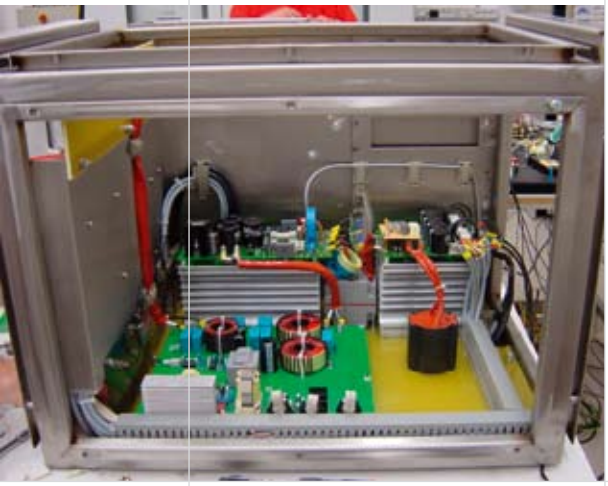
From a railway management point of view, there are further advantages. Goods wagons, for historical reasons and as a result of their use, do not use any power derived from the 3kV line. Consequently, the possibility of exploiting energy sources that are both alternative and low maintenance is particularly interesting. PV panels could, for example, be used to maintain ideal temperatures and humidity in refrigerated wagons used for transporting foodstuffs (as tested by Cargo of Trenitalia in a subsequent project). Furthermore, the use of PV technology for electric locks for goods wagons (an important

project success) could increase the transport safety of high-value goods, such as tobacco (every year, tobacco products worth several million euros are stolen from goods wagons in Italy). Electric door locks powered by solar energy, in combination with an alarm system and the GPS control system that are able to localise any coach in real-time throughout Italy, could significantly decrease the risk of goods theft.

Theoretically, PV technology could also support better use of the railway system itself. In recent years, the delivery times of railway transport on some international routes have doubled or even trebled, due mainly to long stopping times en route to give way to other priority trains, such as passenger services. According to the project team, a PV system could support anti-skid breaking systems so that trains delivering goods could possibly travel 40km/h faster than at present. Consequently, freight and passenger trains could travel at the same speed, enabling a much better use of the whole railway system.

Secondary results should further reassure rail companies interested in PV technology. Although noise increased for the passenger coaches, the panels' special design kept increases in noise emissions

The converter's electronic control compartment



below the set 3% target. And the frequently discussed problem of the adverse effect of dirt (such as grease and oily substances from the sliding elements of the pantograph, bird droppings, dust and scrap of wiring) on the current generated by the solar cells, seems to be negligible. Experiments with two identical panels observed over two years showed that although one model was cleaned once a week and the other was left untouched, the difference in power generation was marginal. Fernando Gherardini points out that this "self-cleaning capacity" of the panels through rainwater was another reassuring result.

PVTrain – a great potential

According to Basili, the large-scale implementation of PV technology, i.e., panels and converters suitable for the use on trains, could be very attractive, both environmentally and economically. However, he sees two conditions that would need to be met first.

On the one hand, political and economic incentives are needed to encourage the development and implementation of PV on moving appliances, which have so far been excluded from the respective legislation. This has left PV still too expensive (around € 300-400/m^2,according to Basili) to apply on a large scale. On the other hand, industry will need to be pro-active in promoting the application of PV on rolling stock. Basili is sure that then, train companies such as the Gruppo Ferrovie dello Stato would also be able to apply this environmentally very successful and technically very efficient technology on a wide scale.

Such broad application would generate impressive results. The measurement of greenhouse gases emitted into the atmosphere during the two-year trial period enabled the LIFE project team to estimate the

The US 116 module was chosen for its flexibility and ability to work well in diffused light and high temperatures.

potential reduction in emissions in the case of large-scale application, based on a life expectancy of the PV equipment of about 20 years:

- Application on around 8,600 coaches: 77,500 tons of CO_2 not emitted,
- Application on around 700 locomotives: 3,000 tons of CO_2 not emitted,
- Application on around 200 freight wagons: 207 tons of CO_2 not emitted.

Though these are still visionary scenarios, PVTrain has shown the potential of PV for putting railways on the track to more sustainable energy use.

Project Number:
LIFE02 ENV/IT/000064

Title: The application of innovative photovoltaic technology to railway trains

Beneficiary: Trenitalia

Total Budget: €1,253,000

LIFE Contribution: €616,000

Period: Nov 2002 to Oct 2005

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Vapo: Warming up to energy efficiency for oil heating systems

Anticipating an explosion in demand for more efficient oil combustion systems, the German Vapo project developed a burner system for households that delivers energy savings of five per cent on the best available oil-burning systems. The system also reduced carbon monoxide and carbon dioxide emissions by a third from their current level, lowered nitrogen oxide emissions, reduced noise and eradicated soot waste.

Low-temperature exhaust systems for household oil are still in their infancy

The heating of houses and apartments is an important environmental issue for all EU countries. Domestic heating systems make a large contribution to carbon dioxide (CO_2), nitrogen oxide (NO_x) and carbon monoxide (CO) emissions, especially in mid-European and northern European countries. While low-temperature exhaust systems (*Brennwerttechnik*) for household gas heating have proved to be very efficient, oil heating systems using this technology are still in their infancy and have only just been introduced to the European market.

The porous medium combustion technology for oil heating systems is the only technology that will be able to fulfil future requirements of extremely low combustion emissions and low energy consumption. The specific application of this technology in the combustion area results in a very clean and homogeneous combustion of the oil vapour and air mixtures. The porous medium vaporiser significantly reduces the amount of residue in the vaporiser and allows for the use of a special self-cleaning process.

Key targets

The project aimed to develop a burner system that modulates between 2 and 20 kW and offers energy savings of at least 5% over the current best available oil-burning technology. The burner would reduce CO emissions to a third of current levels, eliminate soot emissions and significantly reduce noise and NOx emissions.

Such extremely low emissions and high efficiency through its homogeneous combustion field and the high modulation range mean the system is set to become a new standard in oil-combustion. The project anticipates a widespread push towards modernisation to meet general environmental goals. Such a move could create a market for 500,000 oil-condensing boilers in the EU. Since the market responds intensely to state subsidy initiatives, leading manufacturers are seeking cleaner and more efficient oil combustion systems. Looking forward to such prospects, Danish household heating company Danfoss has a financial stake in the project.

A prototype was produced that is able to run across a power range of 4-20kW. CO emissions are lower than 5mg/kWh, and NOx emissions are lower than 120mg/kWh. With such a high modulation rate, the number of burner starts can be reduced and so emissions are decreasing as efficiency increases. Further developments to the oil-supply system are necessary to achieve a lower output than 4kW. The prototype is designed to be attachable to all standard oil boilers, and therefore it allows the system to be updated with a new modulating oil burner.

Although the vaporiser is designed for operation with standard light fuel oil and diesel, it can also be run on vegetable oils and fuel mixtures. Its application extends beyond domestic heating. It can be used in the automobile industry as well as for particle filter regeneration burners and fuel treatment of liquid fuels in combined heat and power units (CHP) and their subsequent combustion in gas engines.

A key objective of the project was to achieve direct integration with the major manufacturers and suppliers of oil heating systems Europe-wide. Promeos, received a national German award for start-up companies, and the technological achievements of the project have received TV, newspaper and magazine coverage.

Project Number:
LIFE03 ENV/D/000031

Title: Oil-Porous-Burner system with integrated vaporizer unit

Beneficiary: Promeos GmbH

Total Budget: €1,452,000

LIFE Contribution: €433,000

Period: May 2003 to Mar 2006

Website: www.promeos.com

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SoNatura: Natural, low-energy solution reduce VOC emissions from cork and leather industries

The SoNatura project in Portugal helped bring a cork-stopper manufacturer and a leather tannery in line with EU legislation on the emission of volatile organic compounds (VOCs), employing a new technology that's clean, has low energy consumption, produces no additional waste and costs less than traditional VOC emissions control.

The emission of volatile organic compounds, or VOCs, into the air is a major contributor to the formation of ozone in the boundary layer of the troposphere, which in turn causes damage to natural resources. Worse still, high concentrations of ozone, a potent greenhouse gas, in ground-level air can endanger the more vulnerable members of society, such as children and the elderly, who experience symptoms such as sore eyes, sore throats and even serious respiratory problems.

What are VOCs? They are any carbon compound that participates in atmospheric photochemical reactions, and they mainly come from vehicle exhaust fumes, or organic solvents from chemical plants, paint and varnish producers or industries involved in surface coating and printing.

Unfortunately, the traditionally available physical-chemical techniques for VOC emissions control, particularly incineration and activated carbon adsorption, have high-energy costs, involve the use of chemicals, and generate waste products.

Vapour phase bioreactors (VPBs), however, offer a natural solution, through the biodegradation of VOCs into water and carbon dioxide. VPBs also have low energy consumption, low operation and maintenance requirements and require lower capital investment. They offer a natural treatment system almost without waste generation, and thus are well accepted by the public.

The SoNatura project, co-ordinated by the Escola Superior de Biotecnologia da Universidade Católica Portuguesa (UCAPOR), demonstrated the use of a prototype VPB in agro-non-food industries, specifically in the cork and leather sectors. Granotec, a cork-stopper producer, and Marsipel, a leather tannery, were the private-sector partners.

These partners were approached as the EU legislation imposes on the leather industry new emissions limits, particularly with regard to activities involved in the finishing process. Most gaseous emissions are produced at this stage, which entails the use of spray-painting machines to apply solvent-based products such as pigments, dyes and lacquers to the final leather product. Meanwhile, in the cork industrial sector, it is the use of solvent-based resins for cork agglomeration that is the target of the Directives.

UCAPOR first established a characterisation of the environmental concerns at each site and then produced an enrichment of microbial cultures that were able to biodegrade the identified pollutants. Characterisation of the treatment process mimicking the industrial gaseous emissions from Granotec and from Marsipel was first carried out at laboratorial scale and then following the development of treatment processes - again in the laboratory, the project designed VPBs and piloted them via a mathematical model. Granotec and Marsipel then co-ordinated the operation of actual pilot-scale units at the industrial sites.

VPBs biodegrade VOCs into water and carbon dioxide

Ultimately, the project contributed to the development of novel technologies for the reduction of VOCs in the leather and cork industries, and mainly for emissions coming from leather painting cabins and the mixing of granulated cork. The outlet emission values were well below the established legal limits.

Project Number:
LIFE03 ENV/P/000521

Title: Vapour Phase Bioreactors for Agro-non-Food Industries

Beneficiary: Escola Superior de Biotecnologia - Universidade Católica Portuguesa

Total Budget: €465,000

LIFE Contribution: €202,000

Period: Sep 2003 to Nov 2005

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EMAS-EDIN: Cleaning up the University of Macedonia

This project successfully introduced the European Union's EMAS environmental management certification at the University of Macedonia (UoM) in Thessaloniki.

Prior to 2002 (when the project was launched) public institutions in Greece had been slow to take up the EU's Eco-Management and Audit Scheme (EMAS)[1]. The University of Macedonia (UoM) implemented this project with the Municipality of Thessaloniki in order to demonstrate the potential for environmental co-operation between educational institutions and local authorities.

The managing partnership (comprising the UoM research committee, the company for the development and management of UoM property, an environmental consulting engineering company and the Municipality of Thessaloniki) introduced a range of actions aimed at integrating environmental principles into the everyday operations of the university.

The overall objective was to reduce the environmental impact of the university's operations. Other objectives were to improve health and safety conditions, raise environmental awareness, stimulate closer co-operation with other educational institutions and disseminate information on the lessons learned.

The project involved staff, students and the local community. It helped raise awareness of environmental issues and introduced more environmental courses to the university curriculum. A computer system was set up to help the implementation of EMAS within the UoM's operations, and a cost-benefit analysis on the project's impact was carried out.

1 http://ec.europa.eu/environment/emas/index_en.htm

The project also achieved some reductions in the impacts the UoM's activities have on the environment, for example:

- Heating: an estimated reduction in total annual fuel consumption of 8%
- Cooling: an estimated reduction in power consumption of 5%
- Lighting: a 25% reduction in power consumption.

In the final year of implementation of the project (2004-2005), when all the planned measures had been implemented, the following environmental benefits were recorded in comparison to the previous year:

- A 20% decrease in energy (thermal and electric) consumption
- Significant reductions in CO_2, CO, NOx, HC
- Reduced consumption of paper – around 15% less than 2001-2003 levels
- A 20% reuse of printer cartridges and toners during the first two years of implementation.

The project achieved its objectives. It was innovative because it was implemented in a sector whose participation in EMAS has been very low – educational institutions. Another major innovation was the partnership that was established: between an educational institution (its staff and students) and the municipality hosting it. Most UoM employees, students and other interested parties live in the Municipality of Thessaloniki, and so their increased environmental awareness and training will not only benefit the UoM but also the local community. Furthermore, as part of the project, an 'Environmental Education Kiosk' was constructed at the Nea Elvetia municipal park, in collaboration with the Municipality of Thessaloniki, for the provision of environmental education to primary school children, by the members of the Student Voluntary Environmental Support Groups. The necessary educational material was developed, and now around 800 to 1,000 children between the ages of six and nine years old now visit the Kiosk every academic year.

Hundreds of school children visit the Environmental Education Kiosk every year

Project Number:
LIFE02 ENV/GR/000363

Title: Development and implementation of eco-management and audit scheme (EMAS) in educational institutions

Beneficiary: University of Macedonia - Research Committee

Total Budget: €1,089,000

LIFE Contribution: €487,000

Period: Jul 2001 to Jun 2004

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LIFE00 ENV/D/000318

Waste management

The Commission's Thematic Strategy on the Prevention and Recycling of Waste is one of the seven thematic strategies set by the Sixth Environmental Action Programme (6th EAP). The approach to waste management is to contribute to reducing the environmental impacts of using material resources by avoiding waste generation (prevention) and increasing the amount of recycling and recovery of materials and energy from the waste we produce. This long-term policy is having significant results. Over the past ten years, the EU has doubled the amount of municipal waste recycled to more than 80 million tons per year, and several EU countries have managed to achieve recycling rates for packaging waste of over 60%.

6th EAP http://ec.europa.eu/environment/waste/strategy.htm

DOL-EL: 100 percent recycling of used oil lubricants

The EU uses 4.7 million tonnes of oil lubricants a year, but, as the Mineraloel-Raffinerie Dollbergen GmbH (MRD) stresses, 'used' does not have to mean 'waste'. This German firm recycles used oil lubricants into high-grade base oils and solvents in a way that leaves no waste.

The old clay treating process produced 4,900 tonnes of used clay annually. The new process is waste-free

With nearly 50 years experience in the field, MRD recognised that the potential to develop waste oil recycling was considerable. It only takes 1.3 tonnes of used oil - compared to ten tonnes of crude oil - to produce one tonne of high-grade base oil for the lubricant market. Furthermore, even the leftover fraction of the recycling process can be recovered for use in industrial heating. Yet, at the time of the project, recycling was extremely limited in Europe.

However, the savings of nearly nine tons of crude oil per ton of high-grade base oil plainly shows that from a life-cycle perspective, waste oil recycling is far superior to combustion. Nonetheless, there are also opposing market forces: for example, the cement industry would rather keep their large share of the waste oil market, to profit from waste oil as a tax-free fuel, with disposal revenues on top of that.

The company, located near Hannover, had already developed an innovative solvent extraction process for used oils, but the development of new quality criteria for state-of-the-art motor oil lubricants - accounting for 50% of the recycled oil market - were requiring the greater use of non-conventional oils such as synthetic oils with increasing amounts of elaborate polyalphaolefins (PAO). As these expensive and fragile components were destroyed in conventional recycling processes, the beneficiary researched technologies to recover them from the waste-oils.

Similarly, the recovery processes have needed to ensure the improved elimination of toxic polycyclic aromatic hydrocarbons (PAH), amounts of which have been increasing in used oils. Existing processes were not able to both eliminate the PAHs and recover the valuable synthetic base oil fractions. MRD therefore developed a new process based on a liquid-liquid extraction technology.

It developed the use of N-methyl pyrrolidone (NMP), a highly selective solvent to remove aromatics and heteroatomic compounds. The solvent is non-toxic, soluble in water and biologically harmless and can accordingly be endlessly and completely recovered and reused in the process.

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

The average base oil process yield within the 'Enhanced Selective-Refining' process is about 91%. The produced base oils have superior properties: a high viscosity index, low evaporation loss during use and high oxidation stability, providing excellent lubrication at different temperatures and over time.

It achieved the elimination of PAHs to less than 1 mg per kg (=1 ppm) with the simultaneous retention of high-quality semi-synthetic and fully synthetic base oil fractions such PAOs and their associated positive properties.

Both national and international patents have now been granted for the process, which promises high levels of flexibility in the face of evolving compositions of used oils and increasing quality requirements for base oils.

Project Number:
LIFE00 ENV/D/000318

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

Beneficiary: Mineraloel–Raffinerie Dollbergen GmbH

Total Budget: €9,620,000

LIFE Contribution: €1,550,000

Period: Sept 2001 to May 2005

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Humification of Sludge: Converting sewage waste into valuable soil

Significant progress in Greece in the treatment of sewage had not been matched by similar advances in the disposal of the resulting sludge. This LIFE project demonstrated the use of the latest technologies to turn 100 percent of sewage sludge 'waste' into valuable and environmentally friendly soil.

Sludge produced by sewage treatment plants constitutes a significant proportion of solid waste in urban areas. During the 1990s, a considerable number of wastewater treatment plants were constructed in Greece to handle the major environmental problem of sewage treatment. Although most achieve this prime objective, from the nearly one million tonnes of sewage sludge annually produced in Greece, less than two percent is reused.

Plants were not concerned with final sludge management and disposal. Rather, almost all sewage sludge ended up in uncontrolled disposal areas, burdening the environment, the soil and groundwater. It greatly increased the production of heavily polluted leachate and the generation of greenhouse gases, especially methane, by introducing biodegradable organic products to sanitary landfills.

The project therefore aimed to demonstrate an environmentally friendly sludge management process by adopting state-of-the-art technologies to convert sludge into soil. This process is known as the 'humification' of sludge and achieves 100% reuse of sludge in an environmentally friendly manner. Furthermore, the soil produced is itself a highly valuable product.

The project applied humification at a 6,000 m² site in Thessaloniki transforming dewatered sewage sludge into soil. The sludge was prepared in a mixture with inert materials and green wastes, such as wood and green cuttings, depending on a simulation of the desired final product composition.

The mixture was layered and constantly aerated and mixed with a special turning machine (a windrow turner). Mixing guaranteed the homogeneity of the mixtures and the enrichment with oxygen to accelerate thermal rotting, which is an aerobic, exothermic, microbiological and biochemical transformation through which the decontamination of the mixture is ensured. The process destroyed all pathogenic bacteria and spores. At the same time, the growth of thermophilic fungi enriched the final product.

The unit treated approximately 600 tonnes of dewatered sludge, together with 1,000 tonnes of inert material and 400 tonnes of green waste, to produce 2,000 tonnes of earth material. Throughout the process, chemical analysis of nearly 100 parameters was used to determine the quality of the raw materials, the sludge and the final product.

At the end of the humification process - which can last up to eight weeks - earth material equivalent to natural soil, free of sludge contaminants, was produced. Final laboratory analysis confirmed that it complied with all existing EU and Greek regulations regarding chemical composition, including heavy metals. Although the soil product was intended only for landfill cover, it was found to be of sufficient quality for parks and recreation areas as well.

The process fully used the waste products from sewage treatment leaving no residues. The process consists of a lasting and final solution to the problem of waste treatment, requiring no after-care.

The transferability of the project seems to be high with the collection of disposal fees for incoming sludge and sales of the soil providing revenue. Whilst the financial viability of a humification plant will be enhanced as market confidence in the final product develops, supplementary regulatory acts could also support its proliferation.

Turning dangerous sewage sludge into valuable soil for parks and gardening

Project Number:
LIFE02 ENV/GR/000371

Title: Demonstration plant for sludge management of sewage treatment plants with humification

Beneficiary: Helector S.A.

Total Budget: €1,800,000

LIFE Contribution: €743,000

Period: Feb 2003 to Jan 2005

Website: www.life02env371.gr

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Integrated Product Policy

The Commission's strategy on Integrated Product Policy (IPP) aims to reduce the environmental impact of goods and services at the most relevant stages of a product's life-cycle. The approach covers all issues related to a product, from its design and development, to the consumption of natural resources as raw materials, its manufacture, assembly and transport, its marketing and sale, its subsequent use and, finally, its recycling or disposal. An integrated approach for products implies involving many different actors and stakeholders along the product chain, aiming to improve the environmental performance of the product. As part of this process, IPP seeks to promote the co-ordination and exchange of information/knowledge between the relevant groups.

IPP strategy http://ec.europa.eu/environment/ipp/

Empereur: Beating the metal-plating competition with a more eco-friendly product

By extending the lifetime of the blue and black passivating baths, emulsion pertraction technology shows itself to reduce toxic metal sludge waste and produce a better product at a much lower cost. So impressive is this technology that the Dutch partner even won back a customer that had switched to a Chinese competitor.

Extending the lifetime of passivating baths significantly reduces costs for the European metal plating industry

The EU metal plating industry discards about 420 million litres of contaminated passivating bath liquid every year, resulting in the production of 40,000 tonnes of toxic metal sludge waste. Passivation is the final treatment of the surface of iron and steel objects. It protects the zinc coating which has been deposited on the surface first. Across Europe, the metal plating industry consists of some 10,000 companies, mainly SMEs. With their current technology, the estimated cost of chemical replacement is €168 million and the treatment and disposal costs are €76 million a year.

Extending the lifetime of the passivating baths, however, would minimise the negative environmental effects and reduce these substantial economic losses.

Tramp ions FE3+ and Zn2+ are responsible for the degeneration of the passivating baths at the metal plating industry. These ions are dragged in the passivating bath through normal operation. Zinc and iron ions are formed in the acid baths of the galvanic line, simply by dissolving the steel object and or zinc coated object a little bit. When the concentration of the ions reaches a critical level, the passivating bath needs to be replaced.

The solution to this problem, emulsion pertraction (EP), is a new process evolved from a combination of permeation through membranes and solvent extraction. In the emulsion pertraction process, the water phase is kept apart from the emulsion phase by a hydrophobic microporous membrane. At the contact surface (the pores in the membrane) between the water (passivating bath) and organic phase (containing the extractant, selective for the tramp ions), the tramp ions are bound by the extractant. The passivating bath liquid is redirected to the bath in the factory and the extractant is regenerated.

This process extends the lifetime of the *blue* passivating bath from six weeks (without emulsion pertraction technology) to at least 60 weeks, and the lifetime of the *black* passivating bath from one year to three years.

Research had confirmed the technology in principle, but the LIFE Empereur project was its first full-scale demonstration. Specifically, Galvano Techniek Veenendaal B.V., one of the the project partners and a Dutch metal plating firm, achieved a lifespan of the baths that was increased substantially: the *blue* passivating bath at one of the participating metal platers had an extended lifespan of two years instead of six weeks. At Loko Gramsbergen BV, the project beneficiary, the *black* passivating bath were treated with emulsion pertraction. The lifespan was extended from one to three years. The considerable savings in chemicals, energy and water resulted in the installation paying for itself in just over a year.

BEST OF THE BEST 2006-2007

There are additional financial benefits to the technology. Furthermore, the quality that can be obtained with blue Chromium3+ (Cr3+) passivating in combination with emulsion pertraction is better than traditional yellow Chromium6+ (Cr6+) passivating. Without EP technology, concentrations of the tramp ions in the passivating bath become very high at the

end of the bath's lifetime. This results in off-spec products, which, in order to not have dissatisfied customers, have to be reworked, which adds an additional expense.

During the long-term testing of the EP technology by the LIFE project, however, the product quality remained unchanged, independent of the lifetime of the passivating bath. When the EP unit was started, the *blue* passivating bath was already at the end of its normal lifetime, meaning that it produces darker-coloured products. But within two hours of the operation of the EP unit, the coated objects became high-quality products.

The thousands of small-business metal platers in Europe are under fierce competition from low-wage countries, most especially China, and so a technical innovation that reduces their costs and provides consistent product quality to their customers would be a life-saver. This can be accomplished with the introduction of the EP technology in Europe. The proof that consistent product quality provided by the application of the EP technology leads to the return of customers actually happened with this project. The product quality of the coated objects with the use of the EP unit was so impressive that one customer, who had switched to a Chinese competitor, switched back Galvano Techniek Veenedaal B.V.

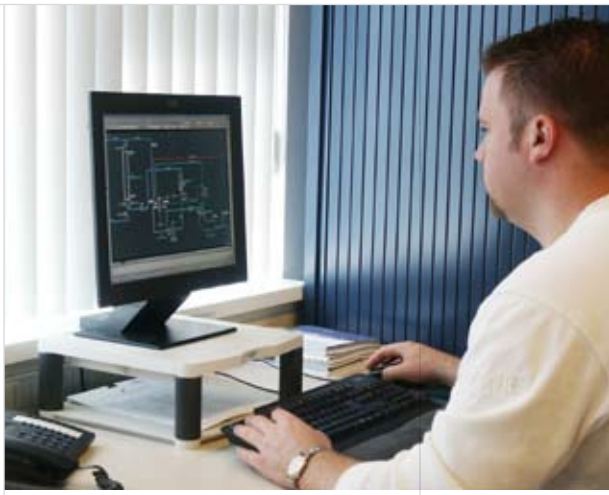
It takes less than a year for the EP units to pay for themselves

A number of directives (including end-of-life vehicle, the restriction of the use of hazardous substances in electrical and electronic equipment, and waste electrical and electronic equipment directives) limit or ban the use of Cr6+ passivating operations for the automotive industry and consumer electronics. For these applications, the Cr6+-based, *yellow, green* and *black* passivating operations must therefore be abandoned very soon.

For blue passivating, without the use of EP technology, the cost estimate for the normal operation over the course of a year is €47,920. With the application of the EP technology the cost is reduced to €2182. The commercial cost of the EP unit is about €42,000. The time it takes for the EP units to pay for themselves is less than one year, which is in line with the expected result.

For black passivating, without the use of EP technology, the cost estimate for the normal operation in three year time is €145,223. With the application of the EP technology the cost are reduced to €57,757. The commercial cost of the EP unit is about €30,000. In this calculation, the recent rise in the price of the black passivating liquid by a factor of two is not included.

There are countries where the introduction of the very expensive and newly developed yellow Cr3+-based chemicals is proceeding more rapidly than others. However, most of the metal plating community is very hesitant to switch over to the new passivating chemicals, because their customers are not willing to pay for the raised cost of their products. The application of emulsion pertraction technology for these newly developed chemicals should be investigated, as many customers will require yellow passivating coatings.



EP technology could be a life-saver for thousands of SME metal platers in Europe, who are under fierce competition from low-wage countries

Corrosion resistance tests showed that while operating the EP unit, the *blue* passivating coating had higher resistance to corrosion than the yellow Cr6+-based passivating layer. Furthermore, by applying EP technology to these new and expensive passivating baths, the operational cost can be drastically reduced.

Thus with superior, cheaper products that meet European regulation, there is no longer any rationale for using the Cr6+-based *yellow* and *black* passivating liquids. This means that the suspected carcinogen, Cr6+, can be eliminated from the metal plating environment entirely, making the project relevant for a range of other EU policies.

Project Number:
LIFE03 ENV/NL/000476

Title: Empereur - Emulsion Pertraction for Europe

Beneficiary: Loko Gramsbergen BV

Total Budget: €1,070,000

LIFE Contribution: €321,000

Period: Nov 2003 to Jun 2006

Website: www.galvaniseren.com/s/onzevisie/life

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Microfinishing: A new process for ceramic finishing that's clean, dry and sludgeless

Ceramic finishing has historically been a process that uses substantial quantities of water, a great amount of electricity and produces thousands of tonnes of unrecyclable sludge every year. 'Microfinishing', however, is a new, dry finishing process, designed by the LIFE beneficiary Ceramica Fondovalle, an Italian ceramics firm, that cuts energy consumption in half, eliminates the need for water and reduces to zero the resultant pollution.

The ceramics industry is rarely thought of as being a polluting sector, but in fact, when it comes to the finishing of ceramic surfaces, this aspect of the business causes significant environmental damage. The polishing of products such as ceramic tiles involves grinding wheels and the application of highly polluting enamels and soluble compounds. Worse still, the whole process uses a great amount of both energy and water, and also produces a substantial amount of ceramic mud, which is itself a dangerous waste product.

In order to overcome these problems, Ceramica Fondovalle, an Italian ceramics firm founded fifty years ago in the village of Torre Maina in the region of Emilia-Romagna, wanted to experiment with a new *dry* process – 'microfinishing' – for finishing tile surfaces that eliminated the need for water and reduced to zero the resultant pollution.

Traditional abrasive substances are replaced with the very same material used to make ceramic tiles

Unrecyclable sludge

Until the development of the new technology, the grinding and polishing stages had been carried out with special wet-running silicon carbide abrasive wheels, which produce sludge totalling 1.95kg per square metre of end product, of which 0.45 kg is the abrasive element.

This sludge is composed of porcelain stoneware dust, abraded residues from the action of the abrasive wheels, washing water and additives from the flocculation and clarification process. It is stored temporarily in open-topped systems or passed on to third parties for disposal at the relevant sites. It is not even recyclable, due to the physical, chemical, mineralogical and thermal incompatibility of its main components. The heterogeneity and the physical chemical and mineralogical nature of the sludge make it unserviceable in any case, even after filter-pressing or drying.

Dry finishing

The new idea was to replace the traditional abrasive substances with the very same material used to make the tiles in the first place. This would allow for a much greater recycling of the material used – either as abrasive or in finished tiles – and significant reductions in the waste produced. The technology the company had in mind would eliminate the use of both water and grinding wheels from the process, thus reducing the water and power needs and the subsequent impact on the environment.

With the support of LIFE, Ceramica Fondovalle designed, produced and tested a pilot plant that uses this new dry finishing process for grés ceram-

Ceramica Fondovalle ceramics showroom

The abrasive material conveyance system is part mechanical, part gravity-powered and part pneumatic

ics. The process enables the company to eliminate the grinding and polishing stages from ceramic tile production, which, across the industry in 2001 alone, produced over 110,000 tonnes of sludge in Italy.

These two stages are replaced by a method wherein the surfaces that require treatment are bombarded with homogeneous particles similar to the material treated. The particles, with selective, varying grain sizes, are obtained through a raw porcelain stoneware grinding process and then blasted against the surfaces with a pneumo-mechanical method. Via this process, stress is applied to the surface to be treated in order to mould it as required and create the desired features, such as a matt or glossy finish or a translucent effect.

This material, which is blasted against the tile's surfaces, performs the same role as abrasive sand, taking on the specific functions via preset pressure, incidence angle and composition modes. With this methodology, the company can treat any type of flat, planar or indented surface, such as those typical of marble, breccias and split stones.

The waste ensuing from the microfinishing process is reusable (in the same state) in the porcelain stoneware production process, as all its elements are identical to the raw material employed in the process.

The conveying of the abrasive material now makes use of a system which is part mechanical, part gravity-powered and part pneumatic. In this system, the compressed air only comes into use during the spraying stage inside the nozzle, where the abrasive material falls, by the effects of gravity, while all the other abrasive handling actions are performed by the power of gravity or through mechanical actions, by means of a bucket elevator. This has allowed the company to: a) eradicate the abrasive action on the conveying system parts; b) substantially reduce the use of compressed air (and therefore electric power) by 80% in relation to the prototype; and c) maintain the performance of the abrasive used.

Water use reduced to zero

All the finishing waste is now recovered and re–entered into the process either as abrasive material once more or – if its grain has become too thin – as raw material for the production of the tiles. The plant is on target to reach industrial performance levels once the automation of the loading process has been completed.

The dry process has reduced the use of water and grinding wheels to zero. This has consequently eliminated the production of dangerous polishing mud and solid waste from the abrasive materials and eradicated the accumulation of exhausted grinding wheels. For the beneficiary alone, this has meant savings of 20,000 litres of water per day, 20,000 grinding wheels per year and 4,300 tons per year of polishing mud. Energy consumption has been halved in the plant and the use of special pollutant enamels reduced by 10%.

The success of the fully optimised plant allowed the beneficiary to obtain more resistant surfaces in the finishing process, thus increasing the quality of the final product. The greater precision has also reduced the production of waste products. Better still, overall production costs have been significantly reduced helping the competitiveness of the products on the world market.

Ultimately, Ceramica Fondovalle intends to shift all its products onto the new finishing process and has already installed the pilot plant in another factory where the loading process has been automated giving it close to industrial performance levels and greatly improved environmental performance.

Project Number:
LIFE02 ENV/IT/000052

Title: Microfinishing

Beneficiary: Ceramica Fondovalle

Total Budget: €2,670,475

LIFE Contribution: €733,704

Period: Oct 2002 to Dec 2005

Beneficiary's website:
www.fondovalle.it

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S-House: Buildings of the future

While waste from construction and demolition accounts for over a third of all waste generated in Europe, the Austrian 'S-House' combines sustainable building methods throughout the entirety of a building's construction, using minimal amounts of energy and employing mostly renewable and recyclable materials.

To reduce environmental impacts, the life-cycle approach takes into account all phases of a product's life, from its design through to its re-use, recycling or disposal. The S-House project adopted this approach, seeking to combine all relevant aspects of sustainable building methods and thereby construct a building that not only met the high energy standard required for 'Passive House' certification[1], but also comprised only recycled or renewable raw materials, and was constructed in an energy-efficient manner.

The building sector is characterised by an extremely high use of material and energy. Moreover, waste from construction and demolition accounts for around 34% of all waste generated in Europe, having a significantly adverse impact on the environment and necessitating substantial disposal costs.

The Centre for Appropriate Technology (Gruppe Angepasste Technologie, or GrAT), at the Vienna University of Technology, planned and constructed the S-House based on results obtained from research conducted in the framework of the 'Building of Tomorrow' programme, administered by the Austrian Federal Ministry of Transport, Innovation and Technology.

Wrapped in straw

With an energy consumption of only 6 kWh/m^2, the resulting office building not only meets the highest passive house standards, but also demonstrates the effective employment of building materials derived from renewable and recyclable natural resources. Located in Böheimkirchen, 50 kilometres from Vienna, local materials were used for the building wherever possible, thereby reducing transport distances and energy use. Furthermore, numerous construction solutions were developed that enable materials to be easily reused at the end of the building's lifespan.

All the building's structural components and outer panelling are made of wood, and the entire building is 'wrapped' in straw due to its excellent insulating properties. The construction of conventional concrete walls was found to consume ten times the amount of natural resources and substantially more energy than that of their wood and straw equivalents.

No metal or synthetic materials were used in the entire building. For example, a specially designed 'straw screw' was developed to afford maximum strength when applied to fasten wooden planks on the straw bales used for the outer walls' insulation. The screw, which is a good example of the project's approach, is made of Treeplast, a biosynthetic material that combines the advantages of renewable raw materials with those of modern synthetic material processing such as injection moulding.

The project, along with its integrated approach that combines a diverse range of sustainable construction techniques and materials, has received recognition at home and abroad, winning the Austrian 'Energy Globe' award in 2005, the 'Global 100 Eco-Tech Award' at the EXPO 2005 in Japan, as well as the Austrian State Award for Architecture and Sustainability[2].

The S-House uses straw for its insulating properties

1 To achieve certification by the accreditation agency Passivhaus Dienstleistung GmbH (Darmstadt, Germany), a building must consume less than 15 kWh/m^2 per annum for heating.

2 Österreichischer Staatspreis für Architektur und Nachhaltigkeit

Project Number:
LIFE00 ENV/A/000243

Title: Innovative use of renewable resources demonstrated by means of an office and exhibition building

Beneficiary: GrAT (Gruppe Angepasste Technologie), TU Wien, Austria

Total Budget: €1,507,000

LIFE Contribution: €752,000

Period: Jun 2001 to May 2005

Website: www.s-house.at

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Taneftreat: Boosting tannery wastewater treatment with 'better than best' technology

A new, compact integrated plant for the treatment of tannery effluent significantly improved on the existing best available technology, reducing chemical oxygen demand, removing sulphur and nitrogen – and costing 35% less.

Wastewater treatment is not normally a core activity for a tannery

Hulshof Royal Dutch Tanneries, which dresses raw bovine hides into finished leather, is the only entirely Dutch tannery that comprises all the main leather tanning processes, and in recent years, has put much effort into reducing its impact on the environment.

A significant number of operations within a tannery are 'wet' operations, those that consume large amounts of water, chemicals and energy, and also produce large quantities of polluted water. The Taneftreat LIFE project at Hulshof, demonstrated a new, compact, integrated plant for the treatment of tannery effluent. The project co-ordinators aimed to transform Hulshof into an operating tannery that employed 'better than best available technology (BAT)' by improving upon current BATs in tannery wastewater treatment.

Since wastewater treatment was not one of Hulshof's core activities, they looked for an operating partner that could help in the design and operation of a new treatment facility. For this, Waterstromen B.V., the LIFE beneficiary, was approached. Waterstromen is an affiliate of Waterschap Rijn en IJssel, the regional water quality manager, and operates three wastewater treatment plants on behalf of industrial companies. In the context of the Taneftreat project, Waterstromen is the operator of the plant and charges Hulshof for the amount of water processed.

The new plant includes a combination of 'process-integrated' and 'end-of-pipe' measures. 'Process-integrated' measures consist of the separation of different waste streams generated in the tannery. The 'end-of-pipe' process consists of an anaerobic pre-treatment (chemical oxygen demand - COD - breakdown and sulphate reduction), followed by a sulphur bioreactor (sulphide and sulphate is transferred into elementary sulphur) and two reactors for nitrogen removal (partial nitrification and Anammox technology). Sludge is fermented in order to reduce its volume. Biogas is produced in both the anaerobic pre-treatment and the sludge fermentation.

COD removal was better than expected and indeed better than BAT - the project achieved a 95% removal rate, whereas the BAT had a COD removal rate of under 90%. Sulphur removal showed considerable improvement. Here, the project achieved a 70% removal rate, compared with a BAT removal rate of 40%. Chemical use was better than expected. The project achieved an 80% reduction on the amount of chemicals used with the BAT.

However, energy use (electrical and thermal) was comparable to the BAT. Nonetheless, more sulphur is removed with the same amount of energy, and net external energy input is 30% less than BAT because biogas from the installation is used to produce its energy. Better still, the cost-benefit ratio was significantly improved: the cost of installation, although higher than foreseen, was 35% lower than the BAT.

The process has good replication possibilities for the tannery sector and for other industries with comparable wastewater characteristics such as the food industry, and the beneficiary is initiating talks with the European IPPC Bureau and the tannery working group in order to ensure that it will qualify as a BAT itself once the original BREF[1] document for the tannery industry is reviewed.

Project Number:
LIFE02 ENV/NL/000114

Title: Taneftreat - Demonstration of effective and efficient TANnery EFfluent TREATment using an innnovative integrated and compact biological and physical treatment plant

Beneficiary: Waterstromen B.V.

Total Budget: €5,097,000

LIFE Contribution: €725,000

Period: Dec 2001 to Jul 2006

Website: www.waterstromen.nl

Contact: Eef Leeuw

Email: e.leeuw@waterstromen.nl

1 Published by the Commission, the BAT reference documents (BREFs) determine BATs at the EU level for a particular sector.

Selected LIFE publications

LIFE-Focus brochures

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

LIFE and Europe's rivers – Protecting and improving our water resources (2007 – 52pp. ISBN 978-92-79-05543-0 - ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/rivers.pdf

LIFE and Energy – Innovative solutions for sustainable and efficient energy in Europe (2007 – 64pp. ISBN 978 92-79-04969-9 - ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/energy_lr.pdf

LIFE and the marine environment (2006 – 54pp. ISBN 92-79-03447-2- ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/marine_lr.pdf

LIFE and European forests (2006 - 68pp. ISBN 92-79-02255-5 - ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/forest_lr.pdf

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

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

LIFE, Natura 2000 and the military (2005 - 86 pp. – ISBN 92-894-9213-9 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/military_en.pdf

LIFE for birds - 25 years of the Birds Directive: the contribution of LIFE-Nature projects (2004 - 48 pp. – ISBN 92-894-7452-1 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/birds_en.pdf

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

LIFE-Nature: communicating with stakeholders and the general public - Best practice examples for Natura 2000 (2004 - 72 pp. – ISBN 92-894-7898-5 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/natcommunicat_lr.pdf

A cleaner, greener Europe - LIFE and the European Union waste policy (2004 - 28 pp. – ISBN 92-894-6018-0 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/waste_en.pdf

Industrial pollution, European solutions: clean technologies - LIFE and the Directive on integrated pollution prevention and control (IPPC Directive) (2003 - 32 pp. – ISBN 92-894-6020-2 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/cleantech_en.pdf

LIFE and agri-environment supporting Natura 2000 - Experience from the LIFE programme (2003 - 72 pp. – ISBN 92-894-6023-7 – ISSN N° 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/agrienvironment_en.pdf

LIFE for Natura 2000 - 10 years implementing the regulation (2003 - 108 pp. – ISBN 92-894-4337-5)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/lifefornatura_en.pdf

A sustainable approach for the environment - LIFE and the Community Eco-Management and Audit Scheme (EMAS) (2003 - 32 pp. – ISBN 92-894-0543-0)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/emas_en.pdf

Other publications

LIFE-Third Countries 1992-2006 (2007, 64 pp. – ISBN 978-92-79-05694-9 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/TCY_lr.pdf

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

Best LIFE-Environment Projects 2004-2005 (2005, 44 pp. – ISBN 92-79-00889-7) *http://ec.europa.eu/environment/life/publications/lifepublications/bestprojects/documents/bestenv05_lr.pdf*

LIFE-Environment 1992 – 2004 "Demonstrating excellence in environmental innovation" (2005, 124 pp. – ISBN 92-894-7699-3 – ISSN 1725-5619)
http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/lifeenv92_04.pdf

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

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

LIFE-Third Countries Projects 2006 compilation (2006, 20 pp. – ISBN 92-79-02787-5)
http://ec.europa.eu/environment/life/publications/lifepublications/compilations/documents/tcycompilation06.pdf

A number of printed copies of certain LIFE publications are available and can be ordered free-of-charge at: *http://ec.europa.eu/environment/env-informa/*

The programme

Name LIFE ("L'Instrument Financier pour l'Environnement" / The financial instrument for the environment)

Type of intervention co-financing of actions in favour of the environment in the twenty-seven Member States of the European Union, in the candidate countries who are associated to LIFE and in certain third countries bordering the Mediterranean and the Baltic Sea.

LIFE is made up of three thematic components: "LIFE-Nature", "LIFE-Environment" and "LIFE-Third Countries".

Objectives

> with a view to sustainable development in the European Union, contribute to the drawing up, implementation and updating of Community policy and legislation in the area of the environment;
> explore new solutions to environmental problems on a Community scale.

Beneficiaries any natural or legal person, provided that the projects financed meet the following general criteria:

> they are of Community interest and make a significant contribution to the general objectives;
> they are carried out by technically and financially sound participants;
> they are feasible in terms of technical proposals, timetable, budget and value for money.

Types of project

> Eligible for LIFE-Environment are innovative pilot and demonstration projects which bring environment-related and sustainable development considerations together in land management, which promote sustainable water and waste management or which minimise the environmental impact of economic activities, products and services. LIFE-Environment also finances preparatory projects aiming at the development or updating of Community environmental actions, instruments, legislation or policies.
> Eligible for LIFE-Nature are nature conservation projects which contribute to maintaining or restoring natural habitats and/or populations of species in a favourable state of conservation within the meaning of the "Birds" (79/409/EEC) and "Habitats" (92/43/EEC) Community Directives and which contribute to the establishment of the European network of protected areas – NATURA 2000. LIFE-Nature also finances "co-op" projects aiming to develop the exchange of experiences between projects.
> Eligible for LIFE-Third countries are projects which contribute to the establishment of capacities and administrative structures needed in the environmental sector and in the development of environmental policy and action programmes in some countries bordering the Mediterranean and the Baltic Sea.

Implementation

Every year, the Commission publishes a call for proposals of projects to be co-financed.The Commission evaluates these proposals and selects those that will be co-financed. It closely monitors these projects and supports the dissemination of their results.

Period covered (LIFE III) 2000-2006.

Funds from the Community approximately EUR 638 million for 2000-2004 and EUR 317 million for 2005-2006.

Contact

European Commission D6 Environment E4 (LIFE Unit) B-1049 Brussels
Internet: http://ec.europa.eu/life

Life Focus / Best Life-Environment projects 2006-2007

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