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Best LIFE Environment projects 2012



LIFE Environment

Environment



EUROPEAN COMMISSION ENVIRONMENT DIRECTORATE-GENERAL

LIFE (*"The Financial Instrument for the Environment"*) is a programme launched by the European Commission and coordinated by the Environment Directorate-General (LIFE Units - E.3. and E.4.).

The contents of the publication "Best LIFE Environment Projects 2012" do not necessarily reflect the opinions of the institutions of the European Union.

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Luxembourg: Publications Office of the European Union, 2013

ISBN 978-92-79-32960-9

ISSN 2314-9329

doi:10.2779/33943

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Printed in Belgium

Printed on recycled paper that has been awarded the EU Ecolabel (<http://ec.europa.eu/ecolabel/>)



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Foreword

The LIFE Environment Awards have now taken place for nine consecutive years and they continue to build on past successes by rewarding the most outstanding LIFE projects. This year they acknowledge those projects that were completed by the end of 2012. The aim of the awards is to shine a light on the most notable of the many worthwhile projects co-funded by the LIFE programme: those that provide a model for others of what well-designed, well-executed, innovative and inclusive projects should look like.

I would like to express my sincere gratitude to the National Focal Points from the other Member States for the excellent support and expertise that they provided during the selection of the prize winners, which followed the by now well-established selection procedure (see page 5). The selection team consisted of 20 evaluators from 12 Member States.

A total of 13 LIFE Environment projects received the merit of being a "Best" LIFE Environment project and an additional four outstanding projects were considered worthy of the "Best of the Best" LIFE Environment project accolade.

All 17 winners are featured in this LIFE publication and you will see from the four articles featuring this year's Best of the Best projects that they each had a common element flowing through them: namely water. Water is often referred to as the essence of life and this year it has certainly been the essence of the Best of the Best LIFE Environment Award winners.

Results from the four Best of the Best projects represent major achievements in water management. Covering beneficiaries from four different countries, all of the project results hold strong potential for replication throughout Europe. Germany's IWPM project for example demonstrated a cost-effective and innovative method for increasing the capacity of overloaded wastewater treatment plants; Greece's EcoPest developed transferable techniques for protecting surface waters from farm-based pesticide pollution; Spain's OXTAN showed how European tanneries can reduce heavy metal content in their effluents, thereby significantly improving the industry's environmental footprint; whilst Italy's TRUST pioneered new methodologies for managing and reducing stresses on groundwater aquifers.

Water-related topics were also featured amongst in the 13 Best project winners, as well as outcomes offering environmental innovations in fields as diverse as energy, waste, ecosystem services, aquaculture, climate action and sustainable tourism.

Together, the 17 prize winners from this year's LIFE Environment Awards highlight the huge opportunity that LIFE co-finance offers for helping Member States to implement EU and domestic policy priorities at local, regional, national, and international levels. This year's winners fill me with great confidence about the ongoing opportunities provided by LIFE and I look forward to seeing what new innovations and important environmental lessons emerge from next year's awards.



BEST LIFE ENVIRONMENT PROJECTS

TABLE OF CONTENTS

Foreword..... 1

The LIFE Best Awards..... 4

BEST OF THE BEST PROJECTS..... 5

Germany: An innovative solution to wastewater purification..... 6

Italy: Safeguarding stressed groundwater supplies..... 9

Greece: Pioneering strategies for sustainable use of pesticides..... 12

Spain: A greener way of tanning leather..... 15

BEST PROJECTS..... 18

Germany: Unlocking the environmental potential of SLUDGE2ENERGY.... 19

France: Tackling pollution through artificial wetlands..... 21

Germany: Greener solutions for marine aquaculture..... 23

Denmark: Recycling roofing bitumen to surface roads..... 25

Spain: Creating sustainable biofuels from waste..... 27

Spain: Foreseeing the future and planning for change..... 29

Spain: Powering water treatment with biogas..... 31

Spain: Breakthrough web-based platform helps reduce e-waste..... 33

Finland: Assessing climate change impacts on ecosystem services..... 35

Greece: Implementing ‘pay-as-you-throw’..... 37

Italy: Top marks for local carbon trading scheme..... 39

Latvia: Demonstrating good governance for eco-tourism growth..... 41

Sweden: Improving environmental sustainability across industrial sectors.... 43

Available LIFE Nature publications..... 45



LIFE07 ENV/E/000820

INTEGRAL-B

Demonstration of a multi-feedstock sustainable biodiesel production scheme integrating an on-site by-products energy valorisation system

LIFE07 ENV/E/000842

WEEE-NET

Project to demonstrate an innovative ICT platform as support tool to implement Community Policy for the sustainable management of e-waste

LIFE08 ENV/E/000140

OXATAN

Environmentally friendly oxazolidine-tanned leather



BEST AWARD WINNERS 2012



BEST OF THE BEST PROJECTS



BEST PROJECTS



LIFE07 ENV/FIN/000141

VACCIA

Vulnerability assessment of ecosystem services for climate change impacts and adaptation



LIFE07 ENV/S/000912

TOSCA

Towards sustainable value chains through a common approach for company strategic work and daily operations



LIFE07 ENV/D/000229

ECOSMA

Ecological Certification of Products from Sustainable Marine Aquaculture



LIFE07 ENV/DK/000102

From Roof to Road

Innovative recycling of bitumen felt roofing material



LIFE07 ENV/LV/000981

POLPROP-NATURA

Proposals for environmental policy and governance based on demonstration of environmental, social and economic benefits from tourism in the Slitere national park - A NATURA2000 territory



LIFE06 ENV/D/000478

IWPM

Integrated Wastewater Purification Management



LIFE06 ENV/F/000133

ArtWET

Mitigation of agricultural non-point-source pesticide pollution and phytoremediation in artificial wetland ecosystems



LIFE06 ENV/D/000460

SLUDGE2ENERGY

Waste prevention through sewage sludge reuse for efficient energy generation at wastewater treatment sites



LIFE07 ENV/IT/000475

TRUST

Tool for regional scale assessment of groundwater storage improvement in adaptation to climate change



LIFE07 ENV/E/000845

WATER CHANGE

Medium and long term water resources modelling as a tool for planning and global change adaptation. Application to the Llobregat basin



LIFE07 ENV/IT/000388

CARBOMARK

Improvement of policies toward local voluntary carbon markets for climate change mitigation



LIFE07 ENV/E/000847

BIOCELL

Energy self-sustaining and environmental footprint reduction on wastewater treatment plants via fuel cells



LIFE07 ENV/GR/000266

EcoPest

'Strategic plan for the adaptation and application of the principles for the sustainable use of pesticides in a vulnerable ecosystem' change



LIFE07 ENV/GR/000271

HEC PAYT

The Development of Pay as You Throw Systems in Hellas, Estonia and Cyprus

The LIFE Best Awards

The LIFE Best Environment Awards 2012 illustrate the demonstration value of the LIFE programme and the importance of replicable project results.

The objective of the LIFE Environment Awards programme is to help improve the transmission of project results by using a set of criteria to identify those projects with the highest potential for long-term environmental improvement. Thus, for the last nine years, EU Member States represented on the LIFE Committee and the European Commission's LIFE Unit have acknowledged those projects that are just a little bit more outstanding than the rest by awarding them "Best of the Best" and "Best" project status (see box "How the winners were chosen" for an explanation of the selection procedure). The latest round of awards - for projects completed by the end of 2012 - saw 17 projects singled out for special attention.

This year, there were four "Best of the Best" projects (see pages 5-16): IWPM from Germany, TRUST from Italy, EcoPest from Greece and Oxatan from Spain. Highlighting the breadth of environmental issues addressed by the LIFE programme, these covered innovations in wastewater treatment and groundwater management, reduced water and pesticide use in agriculture and a more environmentally-friendly leather tanning process.

The 13 "Best" projects (see pages 18-43) included further representation from Spain, Italy, Greece and Germany, as well as best practice examples from Denmark, Sweden, Finland, France and Latvia.

Winners of the LIFE Environment Awards 2012



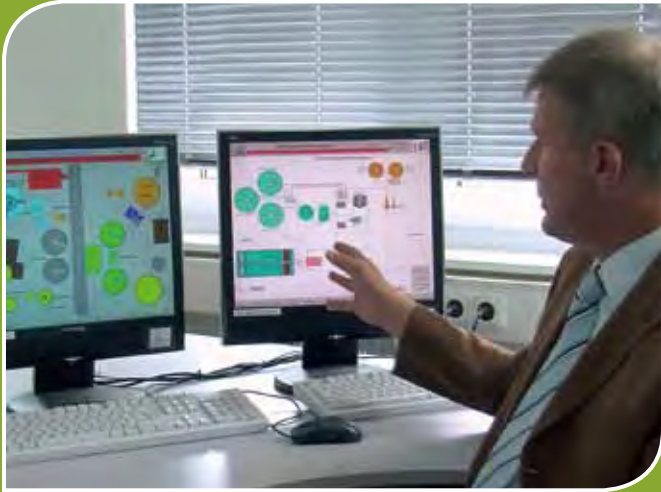
Photo: 2013 EU - Patrick Mascart

An award ceremony for the successful projects was held in Brussels on 5 June 2013, alongside the annual Green Week event. The awards were presented by the German MEP, Jutta Haug, who is also the European Parliament's rapporteur for the new LIFE Regulation. Ms Haug said she was glad to see in the award ceremony such "excellent and encouraging examples of an exceptionally successful EU programme... Every year in the annual budgetary procedure I am in charge of following the environment and health-related expenditure; every year, I am able to reassure my colleagues in the Environment Committee that the performance of LIFE is very satisfactory from the budgetary perspective; the rate of execution has been consistently above average."

How the winners were chosen

Scoring of completed LIFE Environment projects was launched in the summer of 2004, judging them against a set of 'best practice' criteria developed by the Commission in cooperation with the Member States. These included: projects' contribution to immediate and long-term environmental, economic and social improvements; their degree of innovation and transferability; their relevance to policy; and their cost-effectiveness. In view of the importance of these criteria to the success of a 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 forms an integral part of the evaluation process.

The selection of this year's winners followed the established procedure, whereby projects were initially technically assessed by the LIFE Unit's external monitoring team, provided by the Astrale consortium. The monitors ranked all the projects that ended by December 2012 to produce a first list. Using the agreed criteria, the final selection was undertaken by the Member States under the coordination of Andrzej Muter (from the Nature Protection Department of the Polish National Fund for Environmental Protection and Water Management).



BEST LIFE ENVIRONMENT PROJECTS

BEST OF THE BEST PROJECTS

Germany: An innovative solution to wastewater purification

Communication and collaboration are noted as key success factors by the team behind one of this year's "Best of the Best" LIFE project prize winners, which introduced a new cost effective solution for managing wastewater in Germany.

Expanding urban populations in many parts of Europe, as well as pressure from business developments can adversely affect the ability of existing wastewater treatment plants (WWTPs) to provide effective environmental protection services. Furthermore, new and stronger legislation aimed at preventing pollution and conserving air or water quality may place additional strains on the way that Europe's wastewater needs to be treated.

These pressures can combine to create considerable difficulties in areas where WWTPs are already operating at full capacity. Such was the case in Germany's Bad Essen community, where a LIFE project titled Integrated Wastewater Purification Management (IWPM) identified an innovative and highly successful way of reducing strains on water treatment plants caused by overloading.

Uwe Bühning, Managing Director of the Wasserverband Wittlage (WvW) water authority in Bad Essen, which coordinated the project, says that in addition to the problems caused by population growth and more stringent environ-

mental protection rules, "we are located in the catchment of the Dümmer See (Lake Dümmer) which is a Natura 2000 site that needs to be protected from eutrophication threats and effluent standards are very high here."

WvW faced two options: either build a new plant at another location, or find a way to overcome the issues at the existing location. Realising that a nearby WWTP at Ostercappeln was under-loaded, the water authority commissioned a study to see if it was feasible to connect the two facilities.

Cost-effective solution

The study showed that it could be more cost effective to try to find a way of using the spare capacity in Ostercappeln to reduce the peak loads of wastewater and sludge at Bad Essen than to build a new plant.

LIFE co-finance was secured to enable WvW to demonstrate how the proposed more cost-effective concept could be converted into a practical and tangible outcome. The main as-

The IWPM project improved the effectiveness of existing WWTPs



Photo: Tim Hudson

pects of the project involved testing an automated system for directing wastewater and sludge from one plant to the other via a series of new pipelines.

“The LIFE project has allowed us to link up the WWTPs and increase the capacity at Bad Essen from 15 000 population equivalents to nearly 50 000, which is significant,” notes Mr Bühning. One important element of this was the introduction of a much more sophisticated level of electronic control of automated operations, he explains.

The water authority already had access to data that enabled it to forecast when peaks and surges would occur during different times of the day or year at Bad Essen. These data could therefore be used to help automatically trigger the pumping of wastewater sludge from the over-loaded site to the under-loaded facility in order to gain a harmonised and manageable overall balance of wastewater treatment.

Project components

LIFE funding was used for the physical works involved in connecting the WWTPs through a number of pipelines of different sizes, including an intermediary pump station. It also went into modernisation of the automation at the treatment plants so they could function as ‘intelligent WWTPs’ and react in a timely way to forecast surge pressures.

A third and particularly novel component of the IWPM project, a biologically-activated sludge pipe, was tested and validated in real-life conditions. “The pipe is not just used as a mechanical device for transportation of wastewater sludge, but we add microorganisms in the form of activated sludge to make them react along the pipe,” explains Professor Karl-Ulrich Rudolph from the Institute of Environmental Engineering and Management at the University of Witten/Herdecke. “The pipe has a total volume of 980 m³ and it can be used as a so-called ‘phosphorous hydrolyser’ stage. This means that the sewerage treatment plant is receiving water which is biologically already treated,” he adds.

A fourth and equally important component of the project was the time spent by the stakeholders working together.

LIFE funds enabled the project team to undertake a larger amount of testing, monitoring and analysis than otherwise would have been possible. This extra critical mass of knowledge led to a much more informed and efficient set of operational parameters for the resultant IWPM technology.

“LIFE support provided the incentive for the partners to find effective ways of bridging gaps between scientific theory and real-life practice; gaps between the need for new WWTP capacity and the cost of such investments; and gaps between



Photo: Tim Hudson

IWPM results have allowed new socio-economic developments for local communities

the positions of academic experts and political decision-makers,” explains Professor Rudolph, who believes that, “No matter how good your project concept is from a technical perspective, it won’t ever get off the drawing board if you don’t first invest in the right amount of time in communicating and explaining the idea to the right decision-makers in ways that they will relate to and so support.”

Multiplier effects

“The LIFE project pipeline that has connected Bad Essen, Ostercappeln, and Bohmte is much more than just a pipe” says Bad Essen’s Mayor, Günter Harmeyer. “[It] not only connects the WWTPs but it symbolises a real connection between the municipalities and it has concluded a long running set of political discussions between us all.”

He adds that the “positive experiences” of the LIFE project have led the municipalities to work more closely on a number of different activities, including a joint plan for a container harbour for commercial river traffic, whilst cooperation with the provincial government has also been strengthened.

Pipelines connecting the treatment plants included internal treatment services



Photo: Tim Hudson

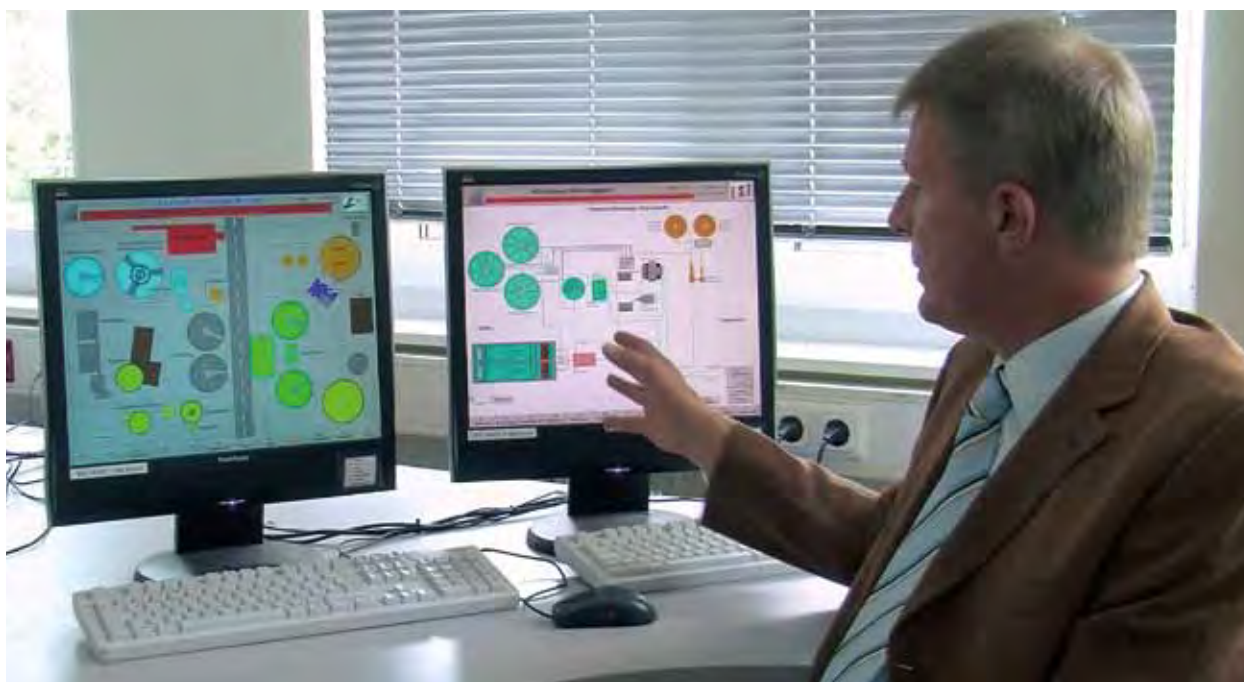


Photo: Tim Hudson

Uwe Bühning explains the IWPM project's connectivity system

Such multiplier effects from the EU funds confirm how LIFE can act as an important catalyst for helping political bodies work more collaboratively. "[IWPM] has made a big contribution to the development potential of this rural area," believes Mr Harmeyer, pointing to the extra water treatment capacity now available for new businesses and new housing.

Thus the project should have a positive long-term impact on social demographics and associated quality of life factors for this small community, since Bad Essen's WWTP now has sufficient flexibility to act as driver of sustainable socio-economic development in the surrounding area.

Results from this "Best of the Best" LIFE project hence show how WWTPs serving communities of relatively small size can be adapted to operate in the same way as a much larger treatment plant. This makes it more financially viable to share the costs of novel high performance treatment processes, such as the biologically activated sludge pipe.

In fact, the technology introduced by the project performed even better than forecast: 35% more sludge was treated than predicted, whilst power consumption was 20% less than anticipated.

Knowledge transfer

"We believe that our IWPM LIFE project is a good example of a "Best of the Best" prize winner because it involved a real-life demonstration of a successful, cost-effective technique. It was not a laboratory-scale test, it works in practice and it works very well indeed," concludes Mr Bühning.

Proactive dissemination of the results by the project partners has led to significant interest from a number of parties. For example, IWPM partners have already helped a Spanish local authority to carry out a detailed engineering study into implementing the technology there, whilst a municipality in Saxony is exploring options for adopting a similar water treatment system.

The value of replicating the system used by IWPM depends on a proper cost-benefit analysis: "Close investigation would be required if the distance between the treatment plants is too far, such as more than 15 km. If there is no benefit in terms of equalising load peaks between the two plants then the costs may also be more than the savings," notes Professor Rudolph.

"The best situation is when one plant is over-loaded and another is under-loaded," he explains, adding that IWPM makes sense anywhere in Europe where "you have to take account of the costs of having to consider constructing a new plant, or a huge extension of an existing plant, including all the associated infrastructure and difficulties involved in such a requirement."

Project number: LIFE06 ENV/D/000478

Title: IWPM - Integrated Wastewater Purification Management

Beneficiary: Wasserverband Wittlage

Contact: Mr Uwe Bühning

Email: buehning@uhv70.de

Website: <http://www.eu-life-iwpm.de/>

Period: 01-Oct-2006 to 31-Oct-2011

Total budget: €12 268 000

LIFE contribution: €1 899 000



Italy: Safeguarding stressed groundwater supplies

The TRUST project has succeeded in building the capacity for river-basin governance of stressed groundwater supplies. It has improved understanding of the likely impacts of future climate change and land-use on groundwater resources and investigated the most cost-effective measures for improving aquifer recharge.



Fast growing trees in the MAR test site of Brenta favoured water infiltration whilst extracting excess nitrates from the water

Healthy groundwater supplies are essential for maintaining the quality of surface water ecosystems and are the main source of drinking water for three out of four EU citizens. However, certain EU localities already experience situations of water stress when extraction of groundwater resources outstrips natural replenishment. Many Mediterranean cities and tourist destinations face particular risks, which will only increase with climate change.

The EU's Water Framework Directive requires Member States to design River Basin Management Plans to improve management of essential water resources. These should include monitoring, assessment and protection of groundwater supplies with the aim to achieve a "good status" by 2015. The main challenge is to achieve a balance between water abstraction and recharge of the aquifers.

This challenge led the Italian Authority of the Northern Adriatic river basins to develop the LIFE project TRUST for the river basins of the Veneto and Friuli high plain – Isonzo, Taglia-

mento, Livenza, Piave and Brenta-Bacchiglione. The authority knew it needed to act because as project officer Matteo Bisaglia explains: "We had monitoring data of the area going back 30-40 years, which showed a slow but significant and ongoing decline of the water table."

The project sought to bring stakeholders together to improve understanding of the current causes of water imbalance and the best means to overcome them. More ambitiously, as Andrea Scarinci, an engineer at project partner SGI Studio Galli, highlights: "We wanted to investigate the likely future effects of climate change and land-use on the availability of groundwater to include these aspects in successful water management planning."

Gathering the data

One of the first challenges for improving understanding of the current and future dynamics of aquifer levels in the river basins was to gather all the required data. "It was a big chal-



lenge because it is such a complex area,” points out Mr Scarcini. “We need hydrological data for an area of nearly 4 000 km², which contained six watersheds that are very different from each other. We also needed to combine this with accurate climate data.”

The project established a Technical Board that included all the key stakeholders concerned with groundwater management and exploitation. Agreements were signed for the provision of climate data, surface and groundwater data, and soil and geomorphological maps. The project also acquired satellite images covering an area of 3 600 km².

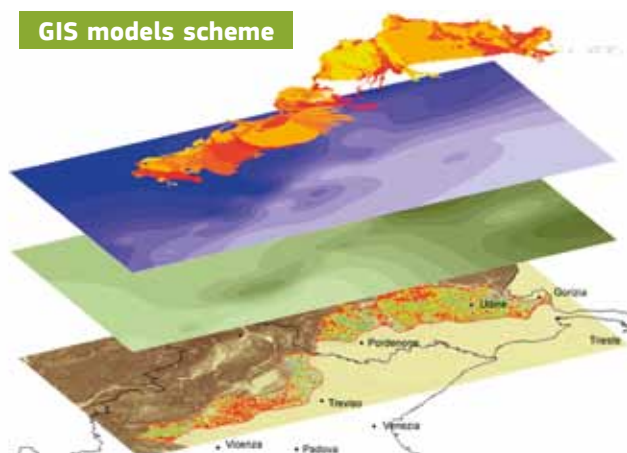
“The amount of data that we received was much higher thanks to working together through the project than if we had simply asked stakeholders as part of our daily institutional functions,” believes Mr Bisaglia. Data were checked, combined according to subject, geo-referenced and, where necessary, formatted into a common structure. More than 12 Gigabytes of data were collected and reorganised to create a Web GIS database.

The project also used GIS remote sensing to conduct a thorough multi-year, land-use mapping of the project area. This was able to determine how much was agricultural land and, more specifically, which crops were being cultivated over a number of years. This analysis enabled the project team to calculate the real water needs of agriculture in the river basins.

Modelling future hydrology

The Euro-Mediterranean Centre for Climate Change (CMCC) used its models to predict climate change scenarios for the project area covering the 21st Century. It used historical precipitation and temperature data and then extrapolated trends for the climatic conditions of the future. It estimated that, by the end of this century, the land temperature could have

GIS models help to assess future water needs based on the land uses of a certain area



Artificial irrigation channels on agricultural land were filled with water enabling it to seep into the ground and recharge the aquifer

increased by up to 5°C and rainfall reduced by up to 0.5 mm/day. Crucially, it also suggested that seasonal changes could be even greater.

The project used meteorological data, digital terrain maps and land-use maps to develop a new model of river flows. This was able to forecast future variations in river flows induced by climate change scenarios. It suggested that flows will increase in winter whilst decreasing in summer, spring and autumn.

Finally, but most importantly, the project developed a hydrological balance model. The river and groundwater dynamics were modelled with software from the Danish Hydraulic Institute. The model was then calibrated using water table measurements from 200 stations for the period 2000-2008, along with specific field measurements of flow in different sections of the rivers.

“These measurements helped us to calculate the water that infiltrates into the groundwater and thus to create a model that could provide an estimate of future groundwater levels and trends over time,” explains Mr Scarcini. The model incorporated the assessed impacts on precipitation rates and river flows from the first two models together with the results of the land-use analysis and water extraction estimations.

The model estimated the water balance over time for each of the 30 aquifers in the project area, as well as for the whole area. “The modelling showed that 8% of the groundwater volume will decrease in the next 30 years due to climate change alone. By the end of the twenty-first century the annual aquifer recharge could be reduced by 7% in Veneto and 11% in Friuli,” points out Mr Bisaglia.

“What was important for our aims was to compare the past with the future trends to understand the specific variations,” continues Mr Scarcini. For example, a Regional Risk Assessment identified many agricultural areas at particular risk of water scarcity and nitrate pollution of groundwater. Similarly, he adds that the project team “saw that changes in temperature and rainfall will be more important at different times of the year. This increases the risks of water stress in the spring and summer and more flood events in the winter.”

Assessing aquifer recharge techniques

Beyond predicting water stress, the project wanted to look at the best means for preventing it. It tested the effectiveness of Managed Aquifer Recharge (MAR) techniques at three demonstration sites with different characteristics, including different soil type and aquifer depth.

In the wooded Brenta area, the project dug trenches and planted short-cycle trees. This was found to favour infiltration of water to the aquifer, whilst also extracting excess nitrates from the water. Testing sites in Piave and Ledra focused on filling artificial irrigation channels on agricultural land. This prevented water flowing away, enabling it to seep into the ground and down into the aquifer.

The tests concluded that MAR over 100 ha could recharge an aquifer with approximately 50 million m³ of water. Mr Scarcini highlights the encouraging nature of these results combined with potential regulation of domestic-well abstraction from the artesian aquifer: “The hydrological model evaluated that MAR techniques could restore groundwater by 25% and 70% of the groundwater deficit induced by climate changes in Veneto and Friuli regions respectively.” The latter means that MAR could replenish over two-thirds of the groundwater reserve in these regions, even taking into account the future negative impacts of climate change.

Additionally, the cultivation of fast-growing, short-cycle trees provided interesting cost recovery options as a source of biomass for renewable energy. This raises the possibility for the agricultural sector to consider payment for such ecosystem services within its production cycles, creating a more sustainable activity for protecting groundwater reserves.

New synergies, new enthusiasm

TRUST has established a solid basis for enhancing the management of groundwater resources in the river basins of the Veneto and Friuli plains, as Matteo Bisaglia is keen to stress: “We are entering a new planning period and the results of the TRUST project will translate themselves perfectly in the



The test field and the progressive water distribution during the initial phases of water provision at the Busta site

programming tools.” The online GIS database and modelling tools are already being used by planners and managers of water resources. Furthermore, “concrete measures to improve the water balance identified by the project will be included in revised river basin management plans from 2015,” notes Mr Bisaglia.

Another of the main strengths of the project was in successfully engaging stakeholders. “Getting planners, managers and users to participate together proved fundamental for guaranteeing the consistency of the project activities and achieving the project goals and long-term sustainability of the project results,” says Mr Scarcini. Both he and Mr Bisaglia agree that the project has created new synergies and enthusiasm for improved water management in the area.

Project number: LIFE07 ENV/IT/000475

Title: TRUST - Tool for regional scale assessment of groundwater storage improvement in adaptation to climate change

Beneficiary: Authority of the Isonzo, Tagliamento, Livenza, Piave and Brenta-Bacchiglione River Basins

Contact: Francesco Baruffi

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Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €1 838 000

LIFE contribution: €898 000



Greece: Pioneering strategies for sustainable use of pesticides

The EcoPest project developed best strategies for implementing the 'Sustainable use of pesticides Directive' (2009/128/EC) through pilot activities carried out in a vulnerable ecosystem north of Athens.

The Kopais plain in the Kopaida region 70 km north of Athens is an intensively cultivated area. Unusually for Greece, the water table is high, and there is much surface water in the area, which makes the use of pesticides (insecticides, fungicides and herbicides) and fertilisers even more problematic. Since excess concentrations of such substances have a negative impact on food safety and water quality in the region, Benaki Phytopathological Institute carried out a LIFE project to minimise the input of agrochemicals into the agro-ecosystem and to reduce human and environmental exposure to such chemicals.

Intensive agriculture is important to the economy of the region. However, it has to comply with European safety stand-

ards for human health and the environment. The demonstration of this value was the core idea of the EcoPest project. "The challenge was to protect the aquatic ecosystems and soils from the impacts of high concentrations of potentially toxic substances due to excessive use of pesticides and fertilisers," explains project manager Dr Kiki Machera.

To meet this challenge and achieve the end result of strategies for sustainable use of pesticides, the project developed a 'Low Input Crop Management' (LCM) system and agro-environmental safety principles for human health and the environment. This system and principles were applied on a pilot scale on 900 ha of agricultural land (cotton, maize and plum tomatoes) at Viotikos Kiffissos river basin, adjacent to

Farmers were trained to apply Low Input Crop Management systems on cotton, maize and plum tomatoes





Compiled soil map of the study area

Lake Yliki. This productive basin supplies drinking water for the region, as well as being a reservoir for water abstraction for the city of Athens.

Monitoring and sampling

Before such pilot measures could be carried out, the project needed to first identify the baseline for carrying out monitoring activities and defining risk indicators and indicators for sustainability implementation (a requirement of the 'Sustainable Use of Pesticides' Directive – 2009/128/EC). The project team gathered historical data of the area and gave farmers questionnaires on the amount and type of pesticides that they commonly apply to their crops, their agricultural techniques and use of water, pesticide waste management methods, and personal and environmental protection measures.

"We also developed soil and hydrogeological maps of the Viotikos Kifissos basin, and determined where to locate the sampling and monitoring sites on the pilot area," says Dr Macher. Sampling of water was carried out in 14 wells and in different points of the river, whilst surveys of the weeds, pests and diseases present in the area were also conducted.

The project thus was able to determine the levels of pollutants and priority substances for drinking water quality standards as well as assess the hazardous potential of toxic substances through their impact on indicator organisms, such as bacteria, phyto- and zoo-planktonic organisms, and earthworms.

The farmers involved in the project then implemented suitable site-specific crop protection systems, which included a range of innovative agricultural technologies to minimise pollution from agriculture. Participating farmers kept detailed records of the cultivation practices and pesticides and fertilisers they were using, submitting different types of infor-

mation on a weekly or monthly basis to the project team throughout 2010 and 2011. Results were then compared with baseline data from 2009. By conducting a comparative assessment of all available pesticides, the project team was thus able in some instances to propose the use of alternatives that are less harmful in terms of human health and the environment

Steps towards sustainability

Amongst the innovative technologies trialled by EcoPest was the LCM system. This aimed to rationalise the use of pesticides and fertilisers, replacing them, where possible, with non-chemical and alternative methods of controlling weeds, pests and diseases. Primary criteria were the protection of both surface and groundwater, taking into account EU Directives and local needs.

It was found that by only applying chemicals in the corridors between rows of plants (band application) herbicide use was reduced by 60%. Further reductions were possible using the 'weed seeker', a sensor placed on the tractor that locates weeds and allows the targeted use of herbicides.

One of the other ways in which the project addressed the issue of pesticide management included establishing a process for disposing of empty pesticide containers. Ten specially-labelled waste bins were installed across the pilot area for farmers to leave the empty containers. Training was also organised to encourage farmers to rinse the pesticide containers three times before disposal in order to effectively eliminate any residues they might still have contained.

In addition, the project team set up a liquid pesticide collection system called 'Heliosec' in two locations, thus offering a possible solution for the management of the liquid waste that derives from the remnants of the spraying solution and

Band application of chemicals reduced herbicide use by 60%





Pheromone traps were used to monitor the presence of pests

the washing of the spraying equipment. Helioseca allows for the water to evaporate, leaving a concentrated waste in semi-solid form that can be easily handled.

Finally, the EcoPest team also dealt with the problem of 'spray drift', the unplanned exposure of people and the environment to drifting pesticides. A strategy to minimise this problem was developed, involving the use of low drift nozzles (two types were trialled), as well as the calibration and maintenance of spraying equipment. The project demonstrated that drift can be reduced from 1.62% of the application rate to 0-0.18% at a distance of more than 2 m. With conventional nozzles, spray drift tends to diminish completely at a distance of 11 m from the target area, while this distance is reduced to 2-3 m when low drift nozzles are used.

Positive impact

Results showed that the project innovations helped achieve a 30% reduction in the amount of pesticide needed to produce the crops cultivated in the pilot area, exceeding the beneficiary's expectations. Moreover, the frequency index treatment (how often the pesticides are applied) was reduced by 67%, which translated to a 70% reduction of pesticide concentration in well water and a reduction in the toxicity of the environmental samples on the indicator organisms. The area under unacceptable risk was also reduced, and the most hazardous pesticides were replaced with safer alternatives.

An important aspect of the project was the training of farmers and agronomists. Around 220 farmers (63% of those present on the pilot site) were trained to apply LCM systems on cotton, maize and plum tomatoes. They also received training in spraying techniques, safe use of pesticides and fertilisers, personal protection (e.g. wearing gloves and overalls), the disposal of empty pesticide containers and the safe storage of pesticides and fertilisers. A further 50 agronomists received specialist training to help them better advise farmers on the types of pests in the region, when to spray and when to wait, and what pesticides to use.

At first the farmers involved in the project "did not always believe that what we scientists were explaining to them was true," says Emilia Markellou, a researcher at the institute. "They could not believe that by reducing pesticides on the crops, these would survive. They were really scared that they would lose their crops and income. The EcoPest scientists started to gain farmers' trust when they introduced the pesticide sustainability use principle – 'as little as possible, as much as necessary' – by explaining in parallel the possible impacts of their use on human health and the environment," she reveals.

Two kick-off workshops including one organised by the local mayor, helped foster interest in the project and building this relationship with the farmers was fundamental to EcoPest's success. Reduction in the use of pesticides and herbicides represents a significant financial saving for farmers. For example, for weed control costs for the use of herbicides fell from 320 to 90 euros per hectare.

Overall, the project made a considerable contribution to the strengthening of Greek environmental legislation. A national certification scheme for spraying equipment and the professional use of pesticides, distributors and advisors is now close to becoming a reality. It also led to the calibration of spraying equipment in the project area in line with the requirements of the Sustainable Use Directive. In addition, four experts who led project actions are now part of a team tasked with producing a national action plan for implementing this directive.

Project number: LIFE07 ENV/GR/000266

Title: EcoPest - 'Strategic plan for the adaptation and application of the principles for the sustainable use of pesticides in a vulnerable ecosystem'

Beneficiary: Benaki Phytopathological Institute

Contact: Kiki Macherá

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Website: <http://www.ecopest.gr/>

Period: 01-Jan-2009 to 31-Mar-2012

Total budget: €1 645 000

LIFE contribution: €823 000



Spain: A greener way of tanning leather

The **OXATAN** project demonstrated the feasibility and financial viability of leather tanning with oxazolidine, which avoids the environmental impacts associated with chrome tanning.



Oxazolidine tanning enables the production of leather with a similar appearance, quality, properties and applications to conventional processes, but with a smaller environmental impact

More than 90% of leathers tanned worldwide use trivalent chromium. Under specific conditions, however, this substance can oxidise to hexavalent chromium, which is harmful to the environment, polluting water resources and leading to soil infertility. In Europe, one tonne of leather typically produces around 50 m³ of wastewater and 700 kg of different solid waste. The potential environmental impact is therefore not insignificant.

To overcome this problem, INESCOP – a large Spanish research institute with laboratories in many leather footwear-producing regions of the country – has been testing chrome-free alternative chemicals for tanning leather. At its central

laboratories in Elda in the Valencia region, it can conduct around 600 tests for shoe manufacturers. In studies carried out before the project, the institute demonstrated that using an oxazolidine tanning agent combined with other vegetable or synthetic agents can be used to produce leathers of sufficient quality for footwear and upholstery industries.

Joaquin Ferrer Palacios, a senior engineer at INESCOP and the project leader, says that the institute had tried more than 10 alternatives, but “the best one was the oxazolidine”. The leathers it produces are biodegradable and avoid the typical ‘wet blue’ tinge when tanning with chromium. Oxazolidine is therefore better for producing clearer leathers.





Photo: Jon Eldridge

The in lab process was scaled up to an industrial level to produce leather goods in Italy and Spain

Some challenges, however, needed to be met. Using oxazolidine produces formaldehyde, which is also a harmful substance, and the researchers needed to find a chemical to remove it. The current European threshold for formaldehyde is 150ppm, but the institute's process was able to reduce the concentration to below 20ppm, which meets even the strict limits in place in Japan for baby shoes.

Moreover, Oxazolidine-tanned leather does not become damaged at the temperatures reached during the production of footwear. But in order to improve the performance of the oxazolidine tanning, a re-tanning process is carried out using vegetable or synthetic agents. The technology thus completely avoids the use of chromium.

Scaling up

The aim of the LIFE OXATAN project was thus to optimise this process in the lab before demonstrating that it can be scaled up to an industrial scale and represent a feasible alternative to traditional chrome tanning. "We also carried out a test in tanneries in big drums, and we then asked some companies to produce some shoes to show that the leather is good enough," explains Mr Ferrer.

Tanneries that contributed in the project for the industrial tests included Tenerias Omega and Cuator, whilst the footwear factories that produced the shoe samples were División de Anatómicos, Dechics, Calzados Canos Garcia, Calzados Moseipe and Todo Para sus Pies. As well as foot-

wear, the oxazolidine leather was also tested in some Italian factories for the production of different leather goods and upholstery items. Partner companies were sought in Spain and Italy, which are home to nearly 90% of the total number of EU tanneries.

First, however, preindustrial tests were carried out on cattle hides and sheepskins using INESCOP's own tanning drums and different ratios of oxazolidine (3% and 5% by weight) combined with 15% synthetic or vegetable tanning agents – previously determined in the lab tests. The obtained leathers were shown to have the required smooth texture, strength and flexibility, and no significant differences with chromium-tanned leather were detected.

Moreover, tests showed the oxazolidine-tanned leather is more biodegradable than chromium-tanned leather. The beneficiary designed a test to compare the biodegradation of the differently tanned leathers with a pure collagen standard. After 700 hours, the test standard showed a degradation rate of 85%, while chromium-tanned leather was just 12% – but oxazolidine-tanned leather was 55%. It can be concluded the oxazolidine-tanned leather is five times more biodegradable than its chromium counterpart.

The test process also confirmed that the selection of synthetic or vegetable tanning agent will depend on the desired end product: synthetics are more suitable for lighter colours, while vegetable agents are better for darker colours.

The next step was to actually carry out the tanning process in the selected tanneries. The results were very promising and according to Mr Ferrer, several tanneries including one in Spain and one in Italy are very interested in continuing with the oxazolidine process, "but they have yet to make a decision to go ahead."

Mr Ferrer suggests that many companies in recessionary times are reluctant to make fresh investments, but INESCOP is making the argument to its partners that it is vital to invest in new technologies and innovate in order to stay competitive. It has widely distributed the positive outcomes of the project amongst tanneries throughout the EU.

The institute has even given tanneries instructions on a USB stick on how to implement the oxazolidine technology. It wants to ensure that the key step of removing the formaldehyde is carried out. It has also applied for a patent for the process and expects one to be finalised by the end of 2013.

One major environmental benefit of the technology is that it avoids the presence of heavy metals (e.g. chromium) in tanning wastewater and wastewater treatment sludge, as well as improving the biodegradability of wastewater.



The oxazolidine tanning technique helps companies fulfil compulsory and voluntary environmental requirements applicable to footwear and upholstery regarding chrome-free substances

The results of the project were presented at the annual conference of International Union of Leather Technologists and Chemists Societies (IULTCS) – “the most important conference worldwide for leather”, according to Mr Ferrer – in Valencia during the project. The project also generated a significant amount of media interest and coverage.

Implementing regulation

The main advantage of oxazolidine tanning is that it allows more environmentally-friendly leather to be obtained, which in turn has a similar appearance, quality, properties and applications to those achieved using conventional tanning processes. This way, it is possible to considerably reduce the environmental impact generated during the tanning process of leather and also at the end of the material's lifecycle. The process helps companies fulfil compulsory and voluntary environmental requirements applicable to footwear and upholstery regarding chrome-free substances. The project therefore made a great contribution to achieving the objectives of the EU's Green Paper on 'Integrated Product Policy', which focuses on the environmental effect of products during their lifecycle. European tanneries that tan using oxazolidine will provide leathers free from heavy metals. These leathers could be used by footwear and upholstery industries for the manufacture of products, thus improving the environmental impact at the end of their useful life.

Oxazolidine technology will also have a positive effect on the environmental design of products (i.e. eco-design). By using oxazolidine-tanned leathers, manufacturers are opting for a more environmentally friendly raw material. Furthermore, oxazolidine-tanned leather meets the hazardous substances limits based on the criteria of the European Eco-label for footwear, which was established by the European Commission Decision 2009/563/EC.

The project's technological innovation also contributes towards the implementation of the Integrated Pollution Prevention Control (IPPC) Directive, which promotes measures that reduce pollution at the point of origin. Chrome-free tanning, such as the oxazolidine tanning technique, is moreover a Best Available Technique. Finally, the project supports the implementation of the Environmental Technologies Action Plan (ETAP), which promotes environmental technologies.

Project number: LIFE08 ENV/E/000140

Title: OXATAN - Environmentally friendly oxazolidine-tanned leather

Beneficiary: INESCOP

Contact: Joaquín Ferrer Palacios

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Website: www.oxatan.eu

Period: 01-Jan-2010 to 30-Jun-2012

Total budget: €690 000

LIFE contribution: €345 000





BEST PROJECTS

Germany: Unlocking the environmental potential of SLUDGE2ENERGY

LIFE funds have helped develop a new technology for treating wastewater sludge that is capable of minimising waste, mitigating pollution and reducing hazards.

Many of Europe's environmental challenges need to be tackled at very localised levels, and LIFE remains at the forefront of helping Member States to put into practice the concept of 'thinking globally while acting locally'.

Innovation is a highly productive tool for helping Member States to find localised solutions that can be used to tackle environmental challenges, and winners of the LIFE Best awards regularly include good practice approaches to demonstrating how innovative technologies can both be applied and replicated at very local levels.

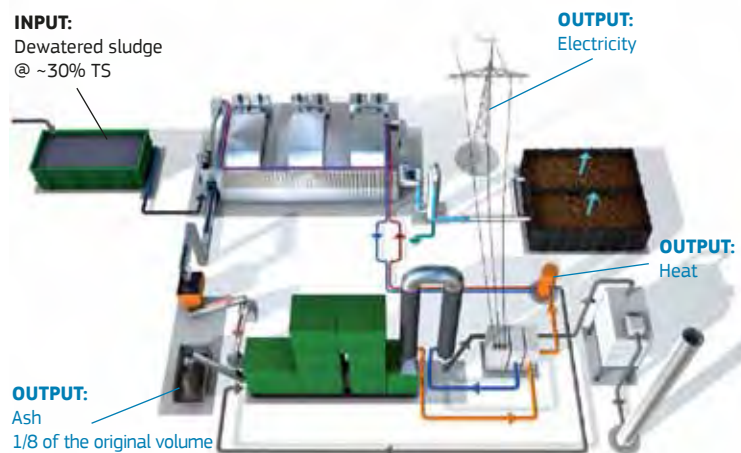
A good example of this is the SLUDGE2ENERGY project (**LIFE06 ENV/D/000460**) from Germany, which is among this year's winners of the Best LIFE Environment prizes.

Partners from the project set out to find an economically feasible and environmentally appropriate solution to on-site treatment of sludge from wastewater treatment plants (WWTPs).

Viable on-site treatment options for this sludge are becoming increasingly important for environmental authorities around Europe as conventional disposal methods (such as drilling sludge into agricultural land) become less acceptable in light of the pollution threats to soil and water. Thermal treatment processes represent lower risk options but these tend to require large furnace facilities, such as cement kilns, coal-fired power plants or other incinerators – all of which can have environmental drawbacks.

Hence, the main aim of the SLUDGE2ENERGY project was to highlight the overall effectiveness of an innovative, self-sufficient, on-site, sludge treatment process for WWTPs. In addition, the project also intended to reduce the need for transporting waste from treatment plants to centralised treatment centres.

Work on the five-year project started in 2006 and its results suggest that there is significant potential for up-



SLUDGE2ENERGY process diagram

take in the 170 WWTPs in Germany. The beneficiary points out that outcomes from the project are not only limited to Germany: the SLUDGE2ENERGY technology should be suitable for most wastewater treatment plants in Europe with a capacity of 150 000 PE (population equivalent) or greater.

How it works

LIFE co-finance was used to test and validate a new combination of technologies that first dry and then burn the sludge in-situ to produce heat that is converted to renewable energy through a gas turbine (see diagram).

A dedicated treatment building was constructed and equipped to carry out the LIFE project tests. This housed the drying machine, thermal plant and energy generator within a prototype of the 'closed-loop' system.

Power created from burning the first batch of dried sludge could then be used for drying the next batch of sludge, and so the treatment system was shown to be self-sufficient and able to fuel itself.



Photo: Huber & WTE

Power created from drying an initial batch of sludge can be used to dry subsequent batches in a closed-loop system

Sludge is first filtered to remove an initial extraction of water before it is channelled into the drier. An air streaming technology is harnessed to complete the drying process and all of the exhaust air is properly cleaned and cooled prior to being released. The process does not require high temperatures for drying, which thus enables more flexibility with the plant's design.

Spreading the benefits

The success of the LIFE project has demonstrated the viability of the technology and should help it to become more mainstream in the future as a beneficial form of localised sludge treatment.

This point is emphasised by Claudia Pfirrmann from Astrale, the LIFE Programme's independent external monitoring team, who notes that at the end of the intensive five-year implementation period, energy generation from the opera-

tional plant "was even better than expected. The beneficiary, an international well-known manufacturer of sludge treatment technology, will bring the technology onto the EU and worldwide markets. We are pleased that its success has been recognised by an award as a Best LIFE Environment project and we believe it is a very worthy recipient of the accolade."

Talking about opportunities to use the technology in other WWTPs, Dr Johann Grienberger from the SLUDGE2ENERGY team says, "There are no special requirements for its transfer to other sites. The amount of dewatered sludge should be more than 20 000 tonnes per annum and the sludge should have enough heat value - which is normally given at a dry solid content of above 28% and typical organic content of 50%."

Dr Grienberger adds that as a result of the level of interest in decentralised thermal utilisation of sludge, the beneficiary has set up a new company - sludge2energy GmbH.

Thus, the future for this award-winning LIFE project seems bright, as its potential continues to be recognised as an effective tool for providing positive localised environmental solutions that can successfully tackle strategic resource-efficiency challenges at European level.

The two managing directors of the new sludge2energy GmbH: Harald Plank (left) and Jörg Köring (right)



Project number: LIFE06 ENV/D/000460

Title: SLUDGE2ENERGY - Waste prevention through sewage sludge reuse for efficient energy generation at wastewater treatment sites

Beneficiary: Huber SE

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Website: www.sludge2energy.eu

Period: 01-Oct-2006 to 30-Sept-2011

Total budget: €3 812 000

LIFE contribution: €769 000



France: Tackling pollution through artificial wetlands

Pesticides are one of the main sources of water pollution in agricultural areas. The ArtWET project, however, demonstrated the feasibility of introducing sustainable artificial wetlands to treat such pesticide pollution.

Water and sediments in agricultural areas often contain dangerous levels of pesticides, which pose a great threat to the sustainability of Europe's water resources and aquatic biodiversity. This non-point source (NPS) pollution is difficult to treat on a wide scale and before the start of the LIFE project existing bioremediation approaches were not yet sufficiently advanced for this purpose.

The idea of the ArtWET project was therefore to improve bioremediation methods and show that they can be a cost-effective and efficient way of combatting the problem of NPS. Specifically, it aimed to prove the feasibility of bioremediation based on vegetation in artificial wetland ecosystems. These systems include vegetated ditches, detention ponds and forested wetlands that are able to mitigate the pesticides load at the outlet of agricultural systems.

This overall aim was achieved by developing experimental prototypes that support the natural attenuation processes that are commonly observed in engineered wetland systems. These were tested at selected sites in France, Germany and Italy on a controlled scale to optimise the pesticide bioremediation processes – i.e. the interactive hydro-biochemical functioning of the four components: water, sediment, soil and organisms.

Vegetated ditches were introduced in Landau, Germany, and microcosms in Antony, France, while a biomass bed was tested in Pusterla, Italy, and wetland microcosms in Colmar, France. These experimental sites enable the key factors affecting the removal of pesticides to be determined.

At the same time prototypes were also demonstrated on a wide scale. A detention pond was created in Eichstetten and in Landau, Germany, a storm basin in Rouffach, France, an artificial wetland and a forest plot in Loches, France, whilst a full-scale network of vegetated ditches was also established at Landau. These systems were designed to be fully integrated into the landscape at a low cost of construction and maintenance.

By employing a multidisciplinary approach that integrates hydrological, hydraulic, chemical, biochemical, ecotoxicological, microbiological, plant physiological and socio-economic aspects, the project team was able to then evaluate the systems with regards to:

- Mitigation of phytosanitary chemicals transfer;
- Persistence of aquatic diversity; and
- Acceptance by interested stakeholders.

ArtWet proved that bioremediation based on vegetation in artificial wetland ecosystems can treat pesticide pollution





The artificial wetland and the parallel arterial ditch stored and degraded most pesticide fluxes

The concentrations of 18 pesticides were monitored at the sites, and the results were extremely encouraging. The systems demonstrated by the project were able to mitigate 40-88% of the water – even at those sites that were still not fully vegetated. The beneficiary, ENGEES estimates that more mature systems would achieve a mean mitigation efficiency of 76 (\pm 19%) measured during two agricultural seasons. This equates to a 73-98% reduction in the total load estimates.

The project also verified that 90% of rainfall-runoff events can be treated. Seasonal load reductions ranged from 39% (simazine) to 100 % (cymoxanil, glyphosate, kresoxim methyl and terbuthylazine). It was also found that one hour was the maximal hydraulic retention time needed with a short vegetated ditch to reduce peak concentrations during runoff by a mean of 52% after storm events of 3-20 mm, whereas eight hours are needed to reduce peak concentrations during runoff by a mean of 87% after a very heavy storm event of 30 mm.

One valuable output of the project was its demonstration that bioremediation can totally remove some pesticides, such as glyphosate. Moreover, recirculating water – for example through biomass beds – was shown to be 99.8% efficient for mitigating pesticides even with strong concentrations of active ingredients widely used in vineyards, such as metalaxyl, penconazole and chlorpyrifos. The results were also high for several herbicides used in corn, wheat and tomato crops. The project also proposed methods to enhance the efficiency of the artificial wetlands.

The benefits of artificial wetlands

Another important aspect of the project was that it proposed methods for enhancing the efficiency of the artificial wetlands. The wetlands demonstrated by the project are low-cost solutions. Costs to be taken into consideration include those for preliminary studies, implementation – including land purchase and compensation to farmers for lost income – as well as for ongoing maintenance of the wetland. Many of these costs can be met using CAP payments and national and regional subsidies.

The artificial wetlands also complement the natural biodegradation potential and existing preventive actions on the farm or catchment area. Another benefit is that they reduce the cost of subsequent drinking water treatment, and help meet the requirements of the Drinking Water Directive.

In addition, the systems can be adapted hydraulically and biologically to fit different scales and areas, including a farm, plot, catchment area and an entire landscape. They can also address other challenges such as urban runoff water treatment, erosion control and downstream biodiversity protection, as well as other NPS pollution, such as nitrate or phosphorus pollution.

The results of the project can be easily reproduced elsewhere in Europe; a year after the end of the project, three new systems (two in France and one in Germany) had already been implemented. To encourage and ease further transfer across the EU, the project published a technical guide that offers advice on choosing, adapting and building the appropriate system. It also carried out a dissemination campaign that consisted of scientific presentations and the publication of a non-technical guide.

Finally, the project demonstrated a high potential for job creation, namely for managers, supervisors, technicians and operators. The project itself directly created 12 positions and a similar number of indirect jobs.

Project number: LIFE06 ENV/F/000133

Title: ArtWET – Mitigation of agricultural nonpoint-source pesticide pollution and phytoremediation in artificial wetland ecosystems

Beneficiary: ENGEES (Ecole Nationale de Genie de l'Eau et de l'Environnement de Strasbourg)

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Period: 01-Oct-2006 to 30-Sept-2010

Total budget: €3 879 000

LIFE contribution: €1 917 000



Germany: Greener solutions for marine aquaculture

The ECOSMA project developed criteria and a business model for sustainable marine aquaculture in the Baltic region that can be easily replicated in other coastal areas

Marine aquaculture or 'mariculture' provides a large proportion of the total landings of fish and seafood today. Some 29% of the total fish yield comes from aquaculture, with sales increasing by 10% annually. However, aquaculture can also cause serious ecological consequences in the marine ecosystem, as it contributes to over fishing of the oceans, over-fertilised waters and damage of valuable coastal habitats. Existing aquaculture is often not environmentally friendly and not integrated into specific local environmental requirements.

The North and Baltic Seas are potential fish-farm sites for German producers, but need to be managed appropriately. The LIFE ECOSMA project was carried out from 2009 to 2011 in the context of the boom in aquaculture and the risk of uncontrolled development of the sector. The project's launch also coincided with a new EU Regulation

(No. 834/2007) on organic production and labelling of organic products, which came into force on 1 January 2009, and which included, for the first time, aquaculture products.

The project was implemented by CRM (Coastal Research & Management) a small company from Kiel, Germany. Its main goals were to adapt the regulation to the specific conditions of the North German and Baltic Sea shorelines. Another important component was to raise awareness amongst the general public of the sustainable use of marine resources and the establishment of a discussion platform for the sector's many stakeholders.

Specific goals were to:

- Support the production and marketing of organic mariculture products - e.g. the marketing of seaweed and seaweed extract certified as 'Bio' products;

ECOSMA developed tools to calculate the CO₂ emissions from each process in the cultivation of seaweed and seaweed extract products

Photos: ECOSMA; Thomas Kujawski / ASA-Multimedia, oceanBASIS GmbH, CRM - Coastal Research & Management GBR



- Reduce the impact on the marine environment and improve water quality;
- Improve knowledge and awareness of sustainable aquaculture;
- Support a process for certification of sustainably-produced aquaculture products; and
- Provide training and transfer of knowledge.

The project enhanced communication and networking among the aquaculture actors and set up a Regional Committee, considered as a regional “think tank” on aquaculture. The committee supported the foundation of the national society of aquaculture (“Bundesverband Aquakultur”).

The beneficiary brought together numerous stakeholders, such as producers, retailers, scientists, supervisory authorities and consumers to initiate a discussion on the criteria for organic aquaculture. This participatory approach enabled the development of guidelines for sustainable marine aquaculture (*Leitfaden für die nachhaltige marine Aquakultur*) and defined criteria for organic aquaculture. Available from the project website (see project box) these provide, for example, a business model for sustainable marine aquaculture businesses, a ‘code of practice’, water quality guidelines for producers, and a database, or ‘Who’s who’ of German marine aquaculture.

CO₂-balancing

Tools were developed to calculate the CO₂ emissions from each process in the cultivation of seaweed and seaweed extract products. This was the first time such a CO₂-balancing methodology had been applied to aquaculture, thus serving as a ‘best practice’ example for other stakeholders.

Another important achievement was the establishment of a qualification and further training for those interested in marine aquaculture. To this end, a wide range of dissemination activities, training programmes and public events were successfully carried out. A notable success is the Kiel “TAK -Tag am Kai” (Day on the quayside), a sustainable aquaculture public event, which has become an annual family event with training sessions and exhibitions. During the first TAK event (held in 2009) an educational game exploring buying behaviour and consumption patterns in relation to fish and seafood was presented. At the same time a talk entitled “Fish on the table - but which?” was presented that highlighted the differences between conventional and sustainable aquaculture and explained the variety of different eco-labels on the market. In August 2009, CRM became the first company in Germany certified under the new EU Regulation on the production and labelling of organic products.



Photos: ECOSMA, Thomas Kujawski / ASA-Multimedia, oceanBASIS GmbH, CRM - Coastal Research & Management GbR

The project has increased consumers' awareness of sustainable purchasing and eating habits with regards to aquaculture products

Transferability

Finally, the project's results are easily transferable – whilst it was set up to address environmental issues concerning marine aquaculture, particularly in restricted sea areas such as the Baltic Sea, its guidelines have been compiled in such a manner that they can serve as a blueprint for other EU coastal regions.

The beneficiary is confident that, through its website, the Regional Committee and events such as the TAK, the project has increased consumers' awareness of sustainable purchasing and eating habits with regards to aquaculture products, as well as helping to market such products regionally. CRM hopes that ECOSMA, through its combination of competence and transparency, can serve as a model for other regions within the EU.

Project number: LIFE07 ENV/D/000229

Title: ECOSMA - Ecological Certification of Products from Sustainable Marine Aquaculture

Beneficiary: CRM (Coastal Research & Management)

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Website: www.ecosma.de

Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €828 000

LIFE contribution: €414 000



Denmark: Recycling roofing bitumen to surface roads

With LIFE's support, a firm in Denmark is developing a resource efficient business turning bitumen from old roofs into a product that can be used to surface roads.



Asphalt produced from the recycled material has been proven suitable for most road surfacing uses

The LIFE Environment project 'From Roof to Road' was led by a holding company established as a joint venture by Denmark's Enviso Group, a company that sorts and handles construction waste, together with road surfacing business NNC Roads and Affald+, a waste collection enterprise. "There is a lot of bitumen oil in old roof felt and this waste has gone to landfill for the last 100 years," explains Karsten Rasmussen, owner of Tarpaper Recycling AB, a company set up by the project partners to continue the work instigated with the support of LIFE. "We had the idea in 2006 to take old waste from roof felt and new waste from roof felt factories, and turn this into oil again," he adds.

In fact, Europe produces some 2 million tonnes/yr of bituminous felt roofing waste (bituminous membranes used for roof waterproofing), of which 25 000 tonnes/yr comes from Denmark. Felt roofing material has a bitumen content of 40-50%, compared with 5-7% in road asphalt. Thus recycled roofing bitumen could potentially replace 5-10% of the virgin bitumen in most asphalt recipes.

New LIFE for old roofs

LIFE funding was secured from 2009 to 2011 and enabled the partners to demonstrate the economic and environmental viability of recycling bituminous membranes rather than sending such waste to landfill and incineration, where it is a source of uncontrolled CO₂ emissions.

With the goal of recycling up to 70% of the felt roofing waste in Denmark within two years of the end of the project, the partners set up a system for collecting some 1 000 tonnes of roof felt waste, drawn from a network of 150 (roofing) waste collectors as well as 50 municipal recycling centres. This included instructions for handling the waste in a manner suitable for reprocessing.

The next stage was to develop procedures and equipment for grinding the roof felt waste into a commercially-viable secondary material. The project was able to extract approximately 60% of the waste as reusable bitumen aggregate,



mixed in small amounts with other materials (e.g. sand) to create different grades of 'bitumen mix' for different types of road surface. The pilot equipment used by the project – located on the site of an old power station in the town of Herning (Jutland) – has a processing capacity of some 10 tonnes of waste per hour, or approximately 10 000 tonnes/yr. This equates to some 25% of felt roof waste in Denmark.

Finally, to demonstrate its 'roadworthiness', the project team carefully analysed the characteristics of the end material both in the laboratory and at 10 onsite tests. "The asphalt with these waste ingredients has been found technically acceptable for most uses except airport runways," notes the independent project monitor, Pekka Hänninen.

"Now [roof felt material] is not waste, it is a product," says Mr Rasmussen.

Environmental benefits

There are several pluses for the environment that come from using recycled bituminous membranes as an ingredient in asphalt. These include a reduced demand for bitumen made from virgin mineral oil, less material going to landfill and lower CO₂ emissions from incinerators. The University of Applied Sciences (Hochschule Augsburg - University College) has conducted a preliminary analysis indicating that the project has produced environmental benefits – each kg of roofing waste used as an ingredient of asphalt, rather than going to incineration/landfilling, saves 1.677 kg of CO₂. However, it should be noted that centralised processing may slightly offset the CO₂ savings through increasing long-distance transportation of the waste and processed products.

Karsten Rasmussen, owner of Tarpaper Recycling AB, the company set up by the project partners to continue the work started off with LIFE



The project recycled felt roofing waste

Another positive aspect of 'From Roof to Road' is the potential for replicability, both because of the clear demonstration of the practical aspects of the project, including the drafting of a best practice handbook, and by showing that (in Denmark at least) already there is a market niche, without the need for further legislative incentives. In the project layman's report, the partners note that it was important to show that "it was not more expensive for companies to sort and recycle than to incinerate or landfill the waste material as previously." Another aim was to demonstrate that new jobs are created by recycling waste.

Demonstrating the socio-economic potential, the project partners have continued to develop their niche after LIFE, establishing the company Tarpaper Recycling AB, expanding operations into Sweden, Finland and Norway and making plans to replace the equipment at the facility in Herning with a large-scale installation. Up to 20 jobs could be created at Tarpaper Recycling Denmark and a further 20 supplying equipment "and improving the sorting of material. In the EU the concept provides a potential of up to 500 employees," notes the layman's report.



Project number: LIFE07 ENV/DK/000102

Title: From Roof to Road - Innovative recycling of bitumen felt roofing material

Beneficiary: Karsten Rasmussen Holding Thisted A/S

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<http://www.tarpaper.dk/Life%2b.6.aspx>

Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €2 068 000

LIFE contribution: €1 003 000



Spain: Creating sustainable biofuels from waste

The Integral-B project has demonstrated improved sustainability of biodiesel production using a joint biodiesel and biogas system that exploits local organic waste and the on-site valorisation of process by-products, notably glycerine.

Biofuels are an important element of the EU strategy for increasing energy sustainability and reducing greenhouse gas emissions. Biodiesel has been produced at industrial scale in the EU since 1992; however, its production remains relatively energy intensive with a poor CO₂ balance. Furthermore, biodiesel production in the EU alone produces 800 000 tonnes/yr of glycerine as by-product; whilst global demand for glycerine is estimated at only 500 000 tonnes/yr.

At the same time, production of organic household and food-industry waste continues to increase. Vegetable cooking oils can be recovered for use in biodiesel production, whilst separated food waste is typically composted for use as fertiliser. The LIFE Environment project Integral-B aimed to demonstrate the viability of a new, more sustainable, process of biodiesel production, based on improved energy valorisation of these local organic wastes.

Design of a new integrated process

The project started with preliminary tests to plan the development of an improved treatment process for organic wastes. It focused on heterogeneous food waste and used vegetable oil engine; 4. a biogas injection system for the co-generation engine; and 5. a glycerine evaporation system for purifying the glycerine by-product.

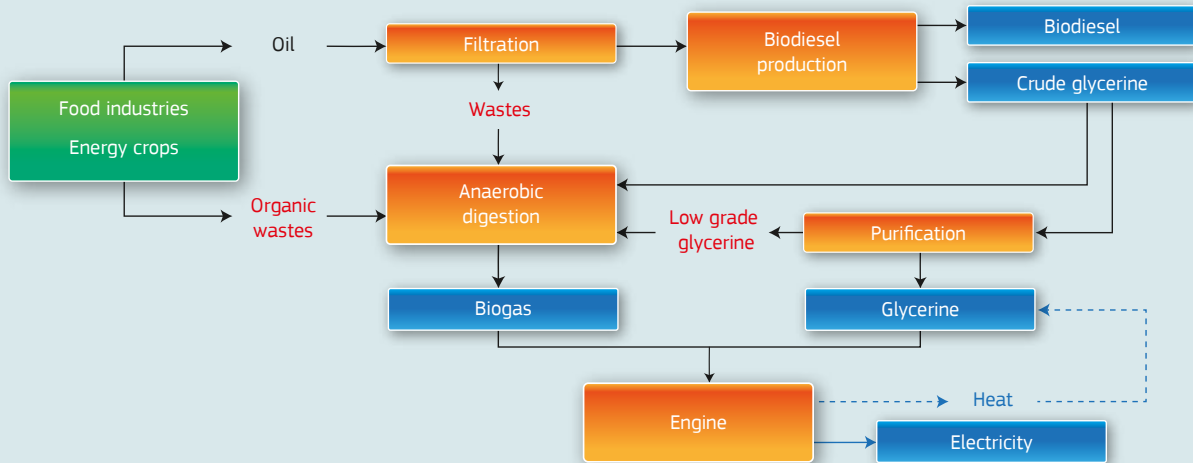
The internal combustion engine is specially adapted to burn a mixture of the biogas produced by the anaerobic digestion facility with small amounts of the by-product glycerine to produce heat and electricity. This heat is harnessed to purify the glycerine to improve its performance as a fuel, whilst the electricity is used to power the biodiesel production plant.

Integral-B produced biodiesel and biogas from locally-sourced vegetable oils

Photo: Mariana Salvatella



The anaerobic process allows the energetic valorisation of different materials and by-products



A key advantage of the project process is that it fully valorises the energy content of the different materials and by-products by feeding them back into the system in the most appropriate way. The team was able to revise and adapt these components during the course of the project to obtain the best results.

Benefits of full energy valorisation

The INTEGRAL-B joint biodiesel and biogas system demonstrated a high conversion rate of raw materials into energy in its different forms: biofuel; heat; and electricity. This represents an important improvement on the current under-utilisation of waste vegetable oils and other organic waste from the food and catering industries. Both the yield and methane content of the biogas obtained from the mix of wastes was high, whilst the levels of hydrogen sulphide (H_2S) were low enough to require no cleaning system.

The project demonstrated that the use of glycerine as a complementary fuel source is a feasible option. The glycerine con-

tent of the fuel mix should be less than 37% to maintain the quality of the fuel. It also showed at pilot scale that the glycerine can be purified within the existing system by using the heat from the combined heat and power (CHP) engine exhaust gas. Along with the potential sale of purified glycerine for use as fuel in other sectors, the project thus provides a potential valorisation of this excess by-product.

Furthermore, when compared with a standard biowaste management system - based on composting and landfilling - the new process was estimated, using a lifecycle analysis, to have a 100-times lower impact on global warming and a 23-times lower eutrophication potential. The financial costs were also calculated to be 35% lower.

Finally, and most importantly, the improved and integrated process increases the sustainability of biodiesel production by valorising its by-products. INTEGRAL-B therefore increases the potential for implementing EU guidelines of the use of energy from renewable sources and can have an important long-term impact on the fight against climate change.

Demonstrating a resource efficient reuse of organic waste



Project number: LIFE07 ENV/E/000820

Title: INTEGRAL-B - Demonstration of a multi-feedstock sustainable biodiesel production scheme integrating an on-site by-products energy valorisation system

Beneficiary: Asociación de Investigación de la Industria Agroalimentaria (AINIA)

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Website: www.integral-b.com

Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €1 487 000

LIFE contribution: €743 000



Spain: Foreseeing the future and planning for change

Water companies and environmental authorities will be among those that take an interest in a Spanish LIFE project that launched a tool that can help predict river basin management requirements.



The project developed a tool that will allow decision-makers to assess the impact of global change scenarios on the water cycle

Global changes, such as population growth and shifting climate patterns, introduce increasing levels of uncertainty for EU and Member State authorities that are tasked with responsibilities to plan for the future. LIFE funds can help these authorities to gain knowledge and develop models about environmental factors that can help improve our ability to safeguard long-term prospects for future generations.

An excellent illustration of this is the WATER CHANGE project in Spain, which ran from 2009 until 2012.

The project developed a methodology and tool for helping regional decision-makers to assess the impact of global change on a river basin. Its success led to a set of results that will be highly relevant for environmental stakeholders throughout Europe.

“The tool that has been developed by WATER CHANGE can be useful for river basin authorities and water companies in

their medium- and long-term planning activities and decision-making processes,” suggests Daniel Sempere, a director at the Centre of Applied Research in Hydrometeorology (CRAHI) at the Universitat Politècnica de Catalunya (UPC), one of the project partners. “It is specially oriented to support the environmental policies that will be related to the Water Framework Directive,” he explains.

Future knowledge

LIFE co-finance helped to test and validate the project’s methodologies and tools, which can be applied to help predict future water availability. The models also provide know-how about where, when, and how to invest in actions to protect a river basin’s water resources for decades in advance.

Much of the project testing took place in real-life scenarios focused on identifying future planning and management requirements for the Llobregat river basin. Stretching for

some 170 km in length from the port of Barcelona to the Pyrenees foothills, the Llobregat is a very important water source, influencing a river basin of some 5 000 km².

It was considered a good basin in which to test the project methodology because the Llobregat experiences many of the pressures faced by other Spanish and European river systems, including increased demand for irrigation and domestic water supplies during periods of reduced precipitation.

Food, commerce, and communities are all heavily dependent on the river basin and LIFE's WATER CHANGE project provided valuable information that can help regional authorities to better understand the scale of the future challenges they face.

Overcoming uncertainty

"The tool we have developed allows us to combine different models of the water cycle, [including] a hydrological model, a water management model, and a water quality model," explains WATER CHANGE project manager, Laurent Pouget. "This allows the simulation of different scenarios of global changes that will represent various possible changes in the basin in terms of climate, land cover and water use."

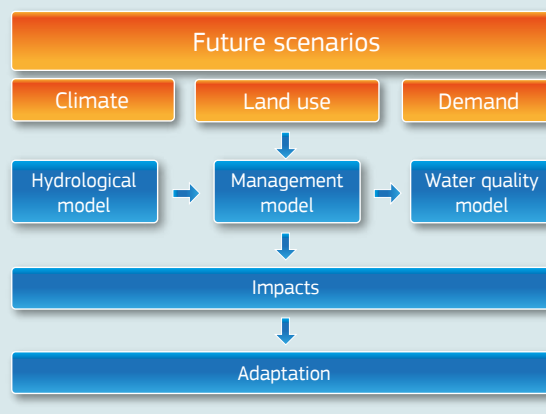
Factors such as demographic variations, climate change, precipitation dynamics, temperature patterns and land use trends can be integrated as a holistic data set. Such a system made it possible for the first time in Spain to accurately anticipate the consequences of these factors on a river basin's water resources.

Suzy McEnnis from the project team notes how, "We simulated a total of 65 scenarios of global change and our results indicate that it is likely that there will not be enough water to supply demands in agriculture, the environment and in urban areas. In our predictions the worst case could mean that by the year 2100 the water deficit could be as high as 30% of the demand in the Llobregat basin."

The LIFE project team was able to use such forecasts to go a step further by suggesting medium-to-long-term adaptation strategies suitable for off-setting future water problems, and knowing in advance their costs and benefits. This included testing scenarios that would include actions to increase water supplies (such as recharging groundwater or boosting desalination plant outputs) and also actions to reduce demand (such as raising public awareness or tackling leakages).

"We can define different combinations of adaptation measures to reduce water deficits in the coming years, and this

The Water Change approach and tool



model will help us to find the optimal strategy," explains WATER CHANGE researcher, Roger Guiu. Optimal approaches are presented by the cost-benefit analysis tool in the form of graphs that compare costs associated with water deficits against costs of adaptation measures and the consequent benefits that are generated.

Future commitments

Adapting in advance is therefore made easier using the WATER CHANGE toolkit and this is particularly useful for public sector budgeting, as adaptation costs can be high. In the Llobregat basin, for instance, the LIFE team estimated that carrying out the required adaptation measures up to 2040 would involve annual costs equivalent to around 0.1% of Catalonia's Gross Domestic Product (GDP) – yet costs of not adapting could be even higher and the model estimated these losses to be significantly higher than the cost of the adaptation action.

Such a tool can thus provide valuable support to environmental authorities working to put in place the commitments that are needed to plan properly for the future in an informed manner.

Project number: LIFE07 ENV/E/000845

Title: WATER CHANGE - Medium and long term water resources modelling as a tool for planning and global change adaptation. Application to the Llobregat basin

Beneficiary: CETaqua - Centro Tecnológico del Agua

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Period: 01-Jan-2009 to 31-Mar-2012

Total budget: €1 238 000

LIFE contribution: €616 000



Spain: Powering water treatment with biogas

The BIOCELL project demonstrated the feasibility and economical viability of implementing fuel cells at wastewater treatment plants so that they more efficiently use energy from biogas and thus have a lower impact on the environment.

Wastewater treatment plants (WWTPs) are responsible for the emission of high volumes of greenhouse gases and consume large amounts of energy. Emerging technologies, such as fuel cells, however, are less damaging to the environment and more efficient.

Wastewater sludge is commonly treated by anaerobic digestion at WWTPs, a process that produces a biogas rich in methane (CH₄) and carbon dioxide (CO₂). This renewable biogas could be used to replace fossil fuels; traditional combined heat and power (CHP) units have been widely employed to produce electricity from this biogas. However, the

efficiency of these units and their environmental impact is limited compared with fuel cells.

The BIOCELL project tested the viability of two types of fuel cells for producing electricity from the biogas produced at WWTPs: Solid Oxide Fuel Cells (SOFC), a high temperature technology that has been shown to be highly efficient without the need for expensive catalysts that are required for low temperature technologies; and Proton Exchange Membrane Fuel Cells (PEMFC), a cost-effective low temperature technology which requires that biogas is first converted to hydrogen. Both types of fuel cells require a thorough and

The project tested the viability of two types of fuel cells for producing electricity from the biogas produced at wastewater treatment plants





robust means of cleaning the system before biogas can be introduced, in order to reduce the concentration of raw biogas-damaging contaminants, namely sulphur and silicon compounds. To carry out these tests, two prototype plants were designed, constructed, operated and optimised at two different wastewater treatment facilities in Spain.

Alternative solutions

At the WWTP of Murcia, in southern Spain, a PEMFC prototype plant was designed to produce 3 kW of electric power using 10 Nm³/h of biogas. First, the biogas is cleaned with a caustic scrubber, before a process of adsorption on activated carbon and silica gel to dry the gas. Since the PEMFC needs hydrogen as an inlet gas, the methane from the biogas has to be converted into hydrogen – a highly sophisticated process called ‘reforming’.

At the second treatment plant, in Mataró, north-east Spain, the project constructed an SOFC prototype plant that operates at a high temperature (850°C) and simultaneously produces electricity and heat (sanitary hot water at 50°C) for a total of 2.8 kW power and 1 kW heat using 10 Nm³/h of biogas. The biogas is first cleaned with a ‘biotrickling’ filter to remove the H₂S. It is then further purified by adsorption on iron oxides, followed by drying and purification with activated carbon before entering into the fuel cell.

The operational performance of the plants was analysed for more than 12 months to obtain valuable knowledge for the future implementation of these two technologies and it was compared with conventional cogeneration technologies. The results of the tests carried out in both plants enabled the project team to produce a simple five-stage guide for WWTP managers on how to implement similar electricity generation systems at their plants. This guide also includes an economical study and an environmental impact assessment according to the lifecycle analysis (LCA) methodology for the construction and operational phases.

As a general conclusion, both plants showed that biogas treatment technologies are ready to achieve the stringent contamination limits of fuel cells and that those fuel cells are technically viable, environmentally friendly, and can provide up to 60-70% of the electrical needs of a wastewater treatment plant.

However, the plants were not sufficiently large to ascertain whether they would remain technologically and economically viable if they were up scaled. Additional investments must be made by all sides to further apply the results of the project. The project identified 10 major challenges for fuel cell deployment at WWTPs by 2020, as a spur to action to overcome



Photo: ACCUSOFT INC

The project constructed an SOFC prototype plant at the Mataró wastewater treatment plant (pictured)

current drawbacks. Development and innovation projects involving biogas producers, biogas treatment suppliers and fuel cell manufacturers will be needed to overcome the identified barriers.

Despite these challenges, it is clear that, at the pilot scale, the BIOCELL plants have demonstrated a range of economic benefits. The cost for sludge treatment was reduced by using electricity from biogas produced during the anaerobic digestion of the sludge in the WWTP. Moreover, the energy produced can be used to heat the digesters, thus dramatically lowering natural gas consumption. The electricity produced can also be used to meet the needs of the installation.

The project beneficiary has been spreading its results at a number of events. For instance, taking part in a workshop in Florence organised by the Italian LIFE project, SHOWW (LIFE10 INF/IT/000282), where the BIOCELL team highlighted the potential of PEMFC and SOFC fuel cells for the efficient energy recovery of biogas.

Project number: LIFE07 ENV/E/000847

Title: BIOCELL - Energy self-sustaining and environmental footprint reduction on wastewater treatment plants via fuel cells

Beneficiary: CETAQUA, Centro Tecnológico del Agua

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Period: 01-Jan-2009 to 30-Jun-2012

Total budget: €2 416 000

LIFE contribution: €1 207 000



Spain: Breakthrough web-based platform helps reduce e-waste

The LIFE WEEE-net project harnessed Internet-based and RFID technologies to demonstrate the sustainable management of e-waste in the Basque Country.



The project used an internet-based platform to centralise information and identify each piece of EEE throughout its lifecycle.

The manufacture and use of electrical and electronic equipment (EEE) is one of the fastest growing sectors of economic activity in Europe. However, this creates important challenges, since the waste from this sector is also growing three times faster – at 3-5% – than average EU waste production.

Estimates of the waste electrical and electronic equipment (WEEE) produced in the EU27 countries in 2005 were between 8.3 and 9.1 million tonnes, growing to 12.3 million tonnes of WEEE by 2020. Some 90% of this was still landfilled, incinerated or recovered without any pre-treatment, causing significant environmental problems. The most important threats to the environment and for human health are from air, water and soil contamination by heavy metals.

New WEEE Directive

The 2002 EU WEEE Directive (2002/96/EC) sets important targets for the collection, recycling and recovery for all types of electrical goods. However, achieving these targets at national and local levels is difficult given the relative lack of information available to e-waste managers and the financial restraints they are under. This contributed to delays in implementation of the directive – which subsequently underwent revision and has been recast as the new WEEE Directive (2012/19/EU), with an agreement to separately collect 85% of WEEE generated from 2019 onwards.

The LIFE Environment WEEE-net project addressed improvements in rates of valorisation, recycling and reuse of e-waste



RFID tags provided essential lifecycle information about the equipment

in the Spanish Basque Country, a region in which EEE manufacturing is an important part of the local economy. The project brought together six partners and was led by Inkoa, an engineering SME (small and medium-sized enterprise). The main aim was to develop new technologies for the sustainable management of electrical and electronic goods through the participation of all stakeholders involved in the EEE lifecycle, from manufacture to management at the end of their useful life.

As its WEEE-net acronym suggests, the project involves the use of an Internet-based platform, consisting of different modules, to centralise information and clearly identify each piece of EEE throughout its lifecycle. By providing a means of associating the equipment with its manufacturer at every stage of the process, WEEE-net offers a practical means of implementing the producers' responsibility principle.

The system is based on the use of adhesive radio frequency identification (RFID) tags. With a lifespan of 10-15 years, each tag carries essential information about the EEE: producer, model, WEEE category and subcategory, material composition, any hazardous substances present, and appropriate disassembly instructions to make reuse and recycling easier.

An important aspect of WEEE-net is stakeholder involvement: the platform facilitates the exchange of information and best practice amongst all those involved in the EEE lifecycle – from manufacture to end-of-life management; it also facilitates reporting.

An eco-design module integrated into the platform uses a lifecycle analysis (LCA) methodology to assess the environmental and economic impacts of a piece of EEE from cradle-to-grave. This module provides important feedback to producers looking to improve the eco-efficiency of products at the design stage through a range of submodules covering topics such as management of components and inventory management, as well as the ability to compare the impact of two pieces of EEE. As a result, the module (and platform as a whole) could be a useful tool for implementing the new WEEE Directive.

Real-world benefits

An example of the practical application of the WEEE-net platform was demonstrated by project partner, Fagor. An RFID tag containing the key information for e-waste managers was attached to 3 500 units of a new refrigerator model during production.

Tests showed that the addition of tags containing recycling and reuse information can improve rates of handling, sorting, recovery, recycling and disposal efficiency by around 30%. It can also speed up repair processes and enable improved recovery of parts and provide important efficiencies for logistics' operators. There are still barriers to market adoption, because of the cost of the tags – €0.15 each – but these are likely to reduce over time. Further issues still to be addressed include guaranteeing the privacy of business-sensitive information on the chips, and the end-of-life management of the tags themselves.

Finally, the project provided training to different stakeholder groups on how to use the platform to inform decision-making – particularly at the design, manufacture, collection, separation and recovery stages. Public authorities were trained on accessing the platform databases to oversee WEEE management. This could enable them to distinguish between producers not just by market share, but taking into account the sustainability of their products.

Project number: LIFE07 ENV/E/000842

Title: WEEE-NET - Project to demonstrate an innovative ICT platform as support tool to implement Community Policy for the sustainable management of e-waste

Beneficiary: Inkoa Sistemas SL

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Period: 02-Jan-2009 to 29-Jun-2012

Total budget: €1 2667 000

LIFE contribution: €627 000



Finland: Assessing climate change impacts on ecosystem services

The VACCIA project produced realistic climate change scenarios for specific sites, demonstrating that it is possible to tailor adaptation measures to local conditions.

Climate change presents a major challenge for the sustainable management of key ecosystem goods and services, including biodiversity, forests, water and agricultural production.

The Finnish LIFE Environment project VACCIA set out to model and assess how climate change predictions may alter the production of selected key ecosystem services or sectors and to identify critical change thresholds. It was intended that the models and scenarios developed would connect global/regional-scale climate change scenarios to the local/regional-scale where realistic adaptation measures are planned and conducted. In so doing it would give authorities and stakeholders at local and regional levels access to the information, thus enabling better informed decision-making with regard to understanding and planning the necessary adaptation measures.

Sector-specific adaptation measures are therefore needed. These adaptation measures have to be based on the understanding of (i) the likelihood and speed of change, (ii) the vulnerability of the specific sectors to the predicted change, (iii) information about trade-off relationships, and (iv) the local-scale possibilities for adaptation. Authorities and stakeholders need access to such information – provided in a format suitable for decision making – in order to understand and plan the necessary adaptation measures.

Drawing on a well-established system within Finland for the long-term monitoring of climate change indicators (the FinLTSE environmental network), this ambitious project calculated the potential impact of climate change on a total of six ecosystem resources (biodiversity, forest and agricultural production, carbon sequestration, water resources and quality, aquaculture and tourism).

The project methodology

Led by the Finnish Environment Institute (SYKE), with support from the Finnish Meteorological Institute, the universi-

ties of Helsinki, Jyväskylä and Oulu and the involvement of some 100 researchers and experts throughout Finland, the project used Global Monitoring for Environment and Security (GMES) satellite-data services for assessing climate change impacts and providing maps and databases for adaptation studies. Assessment and research work took place across nine geographical regions, following the footprint of the FinLTSE network.

The VACCIA team's analysis incorporated climate-change sensitive land cover information (such as snowfall and phenology). The project developed GIS-based platforms and computer programmes for effective modelling. By combining the contents of a site-specific information database, results from the modelling tools and the know-how of the FinLTSE environmental network, the VACCIA

Photo of the VACCIA emblem. Pollinators provide an important ecosystem service



Photo: Plug/Waark Einborg



Photo: Kari Laine

Vaccia identified the main adaptation challenges for forestry, such as the choice of wood species, timing of forest renewal and improvement cutting, and preparation for different kinds of damage and diseases

team was able to produce vulnerability and impact assessments for all the main ecosystem services threatened by climate change.

Key challenges and adaptation options

Sector-specific results were produced for each of the ecosystem services analysed, enabling the key challenges and adaptation options to be clearly presented to decision-makers. Key results were as follows:

For coastal ecosystems – the reduction of load from agriculture; countermeasures to increased runoff: buffer zones, fertiliser levels and the use of crop land. .

For agricultural production – the breeding of cultivars that can make use of the prolonged growing season and higher temperatures but are still adapted to long day conditions; more diversified crop rotation; development of water management systems that aim to enhance water protection and close nutrient cycles.

For forest production – species selection, stand regeneration, optimal stand densities and timing of intermediate cuttings; consideration of the impacts of drought, fungal diseases and insect outbreaks.

For fisheries production – the adaptation of commercial fishing to changes in fish stocks and the operation

environment: the ice-cover period will shorten so the trawling season will be longer but traditional winter fishing methods will be impossible.

For biodiversity in coastal ecosystems – land-use and conservation planning; selection of management and grazing practices.

For tourism-related communities – consideration of the predicted uncertainty of weather conditions because of climate change as a risk for those dependent on winter tourism; the development of year-round tourism and of tourism services that can cope with the changing climatic conditions.

For urban environments – the design of new types of infrastructure and technical solutions to optimise ecosystem services in the urban environment, and the artificial recharge of storm waters via use of more permeable surfaces.

Management and policy impact

The data collected in the VACCIA project was used for updating the Finnish national strategy for climate change adaptation, and will be used in the preparation of the Green Paper on Climate Change, helping to fulfil Finland's obligations at EU level. The work of the project is an important contribution to the development of international networks for climate/global change impacts assessment. VACCIA was presented at 10 national and international seminars and conferences during the course of the project. Building on this, the beneficiary has defined key national and international actors, especially within the EU, with whom the information will be exchanged and further cooperation sought after LIFE. A collaboration project with Chinese experts has also recently started.

Independent project monitor Pekka Hänninen highlights the innovative approach developed by the VACCIA team, "combining various existing datasets to achieve novel approaches to climate change adaptation."

Project number: LIFE07 ENV/FIN/000141

Title: VACCIA - Vulnerability assessment of ecosystem services for climate change impacts and adaptation

Beneficiary: The Finnish Environment Institute (SYKE)

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www.syke.fi

Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €3 122 000

LIFE contribution: €1 547 000



Greece: Implementing 'pay-as-you-throw'

The HEC-PAYT project implemented Greece's first ever 'pay-as-you-throw' municipal waste-management system and provided a roadmap for implementing further systems elsewhere in Greece, Cyprus and Estonia.



Photo: Cristina Marouli

Refuse collection lorry with weighing equipment

Effective management of municipal waste requires coordination of numerous steps within an integrated process – including sorting, collection, transportation, treatment and valorisation or disposal. This is an increasing management challenge for local authorities given the growing volume of waste generated and its increasing complexity and hazardous materials content.

Simply increasing the response of local authorities to ever greater municipal waste streams may not be a sustainable solution. The European Commission's thematic strategy on waste prevention and recycling has recognised that waste-management systems with user fees - based on the 'pay-as-you-throw' (PAYT) principle - could provide important incentives to create a more recycling-minded society.

PAYT systems work by measuring the waste produced by different households or businesses and charging them accordingly. There are different methods of applying this principle, taking into account local circumstances and capacity. Although several promising PAYT applications had already been implemented in Europe, this concept had not yet been introduced in Greece, Cyprus or Estonia.

Promoting PAYT in Greece, Estonia and Cyprus

The LIFE Environment HEC-PAYT project aimed to show how the PAYT concept could be implemented in these three countries, providing a fairer method of charging citizens and businesses for waste management services. By rewarding those

who produced less waste, it aimed to incentivise everyone to decrease their waste disposal, whether by reducing consumption or increasing recycling.

The team produced reports on the existing waste management situation in the three project countries, including the relevant legislative framework and current charging schemes. It also considered the prerequisites for a successful PAYT system; one of the most important is that an integrated and functional recycling infrastructure needs to be in place to facilitate behaviour change.

Through a series of forums, all stakeholders (citizens, businesses, local authorities etc) were invited to contribute to the development of a multi-faceted, integrated approach to PAYT, addressing such issues as the type of system to be used, how to transition from one charging scheme to another and methods of charging for waste management services. Also as a result of the forums, the project team identified the need for greater public awareness of the benefits of PAYT systems and what individuals can do in practice to reduce their waste and minimise their charges. People accept PAYT schemes more easily if the recycling and composting infrastructure is already in place and easy to use.

A key obstacle to implementing PAYT was identified in Greece. Landfill sites were charging fixed rates to local authorities, meaning there were no cost savings from decreased landfilling to be passed down the chain. A significant achievement of the project was that subsequent lobbying led to the introduction, in 2010, of an Article in Greek law (Article 9 of law 3854/2010) ensuring landfill sites charge municipalities according to the weight of disposed waste. This law change incentivises local authorities to initiate and promote waste prevention, reuse, recycling and composting as it directly links the cost of final disposal to the cost of waste produced within the municipality.

Another key policy issue that was addressed was the system for charging residential and business users. Currently billing is based on square metres of property used and not on the amount of waste produced. The project forums were a platform for discussing this challenge and, as a result, a series of options and proposals were developed and proposed to the relevant authorities within the framework of the project.

Implementation of a pilot system

The project introduced the first ever PAYT system in Greece as a pilot system in the beneficiary municipality of Elefsina - in West Attica. It built on previous waste management initiatives by the municipality, including separated collection of packaging waste and providing 250 households with composting bins. The PAYT system covered 1 500 households and 69 businesses.

To define the pilot, the team examined existing approaches in other countries to identify the most appropriate PAYT system for the local situation and characteristics of Elefsina. Different scenarios were developed and analysed and a sensitivity analysis of different pricing schemes was executed. The project also drafted practical guidelines and general rules for the implementation of PAYT schemes.



The pilot system registered and GIS-mapped 67 bins for packaging waste, 17 skips for bulky waste, 96 household composting bins and 99 residual waste bins. Weighing equipment was purchased and installed in waste collection trucks along with the associated software. The project launched a large public awareness campaign and introduced individual bin weighing in mid-September 2010. Individual bins are weighed once a week, with aggregate weights updated daily.

Through an analysis of waste collected before and after introduction of the PAYT system, the project was able to evaluate the impact of the pilot scheme. From the 1 500 households of the pilot area, the following results were achieved: the diversion of 25.8% (target 20%) of waste from landfill; the recycling of 56% (target 20%) of packaging waste and 4.6kg (target 4kg) of WEEE per person; and composting of 17.14% (target 20%) of the organic waste.

The project found Estonia lacked the public and infrastructural readiness to introduce PAYT. However, the results from Elefsina - where the municipality continues to implement the PAYT scheme - and the introduction of a similar system in Aglatzia in Cyprus demonstrate that such schemes are feasible there. Project outputs provide a roadmap for implementing PAYT schemes elsewhere in Greece, Cyprus and in other Member States, paving the way to increased waste diversion from the mixed waste stream and indirect support to the recycling industries.

Project number: LIFE07 ENV/GR/000271

Title: HEC PAYT - The Development of Pay as You Throw Systems in Hellas, Estonia and Cyprus

Beneficiary: Municipality Of Elefsina

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Website: www.elefsina.gr

Period: 05-Jan-2009 to 04-Jul-2011

Total budget: €1 358 000

LIFE contribution: €658 000



Italy: Top marks for local carbon trading scheme

LIFE CARBOMARK successfully promoted voluntary carbon markets to reduce GHGs in two Italian regions. This local initiative is designed to be easily replicated.

Recent data arising from the application of the Kyoto Protocol on climate change demonstrate that the strategies adopted until now have not sufficiently checked or reversed the increased concentrations of greenhouse gases (GHGs) in the atmosphere - in particular CO₂ - and their effects on climate change. Among the many tools to challenge climate change, there is recognition that forests can trap large amounts of atmospheric carbon and therefore act as a low-cost and natural mitigation strategy. Under the second Kyoto treaty application period (2013-2020), a forest can be called a carbon 'sink' and be allowed to generate credits for meeting country carbon reduction targets.

Local and replicable

The overall goal of the CARBOMARK project was to promote voluntary local-scale carbon markets. As well as being an instrument for strengthening EU policies related to the Kyoto agreement, the markets would also aid implementation of the 'EU Forest Action Plan' under the Sixth Environment Action Programme. These goals would be achieved by setting up a model for a local market for carbon credits that would help reduce and compensate for GHG emissions (the two participating regions were Veneto and Friuli-Venezia Giulia, both in north-east Italy). The model would be tested on a volun-

tary basis by parties not yet included under the EU Emission Trading Scheme (EU ETS), such as small and medium-sized enterprises (SMEs) and also forest owners. Although tailored to local circumstances, the model can be easily replicated by other regions.

The project was run by the Veneto regional government's Forests and Mountain Economy department (the beneficiary), in partnership with the Friuli-Venezia Giulia regional government and the universities of Padua and Udine. Work began in 2007, with two preliminary studies carried out - one to support local companies in adopting procedures and strategies (included joining local carbon markets) to improve their environmental performance; and the other comparing several credit certification standards for forest management and products, to highlight the strengths and weaknesses for each standard. Several models of contracts were also drawn up and considered by the partners' technical staff for the trading of carbon credits.

Defining the market

The research work led to the definition of three main principles of local carbon markets and helped establish activities that can be considered as sources of carbon credits:

1. **Permanence** refers to stable CO₂ sequestration achieved

CARBOMARK promoted voluntary local-scale carbon markets





One of the three contracts signed that will help to stock 250 tonnes of carbon

by project activities. Carbon stocking is a 'temporary' measure whose effects on climate change mitigation directly depends on its remaining in an unaltered condition in the wood mass for a significant time. This concept is important e.g. in the case of forest management, when considering possible losses caused by disturbances (such as fires, plant pathologies and falling trees) that can turn the ecosystem from an absorber into a carbon emitter;

2. **Additionality** means that projects are only eligible for carbon credits if the resulting emission reductions are 'additional' to any that would occur in the absence of the certified project activity. It is a mitigation activity that determines additional carbon sequestration compared with the 'baseline';
3. **Baseline** represents the scenario that would have been, if no initiative had been undertaken. In forest activities, for example, the baseline scenario is represented by the existing carbon stocks and sequestration before the project was implemented.

Market implementation

The results of the preliminary studies were adopted and integrated into the CARBOMARK Manual to aid the implementation of local carbon markets in the two regions targeted. It defines the method for calculating carbon shares, taking into account the three basic principles. The document considers three types of carbon stocking: forest management, wood products and urban forest. A fourth stocking opportunity, currently considered as 'experimental', is biochar (charcoal created by pyrolysis of biomass).

As well as establishing the procedures for local carbon markets, two "Observatories" were established by the project, which are local offices, set up by the regional governments to

provide advice and monitor the regularity of carbon market transactions. A project website was also created to regulate transactions of carbon credits between buyers and sellers. During the project three public auctions for selling carbon credits were held.

Both 'buyers' and 'sellers' of carbon credits are necessary to make the market work properly. Sellers include public sector bodies and municipalities (because of their public parks and gardens management), as well as a private enterprise constructing a building using Programme for the Endorsement of Forest Certification (PEFC)-certified materials (the inclusion of wood products in the voluntary market - based on the use of a higher quantity of structural wood in buildings than in a business as usual (BAU) scenario - was an innovative and experimental aspect of the project).

At the end of the project, 21 private companies - including small, medium-sized and large enterprises - and 27 public forest owners had joined the CARBOMARK initiative and three buying contracts had been signed. According to these, 250 tonnes of carbon will be stocked and the companies will reduce their emissions by adopting policies that will improve their environmental performance. The effectiveness of the strategy proposed was confirmed at the World Climate Summit held in Durban, South Africa on 3-4 December 2011.

At the time of writing (2013) a further three buying contracts have been signed for a value of 230 tonnes of carbon.

Finally, CARBOMARK's achievements are included in a Forest Trends ecosystem marketplace report (March 2012) "Bringing it home: Taking stock of government engagement with the voluntary carbon market"¹. It is highlighted as one of 13 government initiatives globally to establish voluntary carbon markets of which, only three are in Europe.

¹ http://www.ecosystemmarketplace.com/pages/dynamic/resources.library.page.php?page_id=8921§ion=library

Project number: LIFE07 ENV/IT/000388

Title: CARBOMARK - Improvement of policies toward local voluntary carbon markets for climate change mitigation

Beneficiary: Veneto Region department of forest planning & research

Contact: Maurizio Dissegna

Email: maurizio.dissegna@regione.veneto.it

Website: <http://www.carbomark.org>

Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €1 088 000

LIFE contribution: €544 000



Latvia: Demonstrating good governance for eco-tourism growth

The POLPROP-NATURA project successfully demonstrated a model of sustainable tourism management at a Natura 2000 site. Lessons from the project can be applied in other Member States, particularly in Eastern Europe.



Photo: www.celotajs.lv

The project implemented sustainability principles for tourism in a Natura 2000 network site

There are clear links between Europe's tourism sector and nature conservation areas, as a number of World Tourism Organisation reports have highlighted. However, tourists often lack awareness of how to behave in these sites in a way that serves to protect the natural environment. Thus, there is a critical need to monitor and coordinate tourism development and incorporate the results into relevant policy planning documents and action plans.

This is especially true for countries that have joined the EU in the last decade, such as the Baltic States. Addressing this issue, Lauku Ceļotājs, the Latvian Country Holiday Association, successfully applied for LIFE co-funding to develop and

demonstrate a sustainable tourism-management model for a Natura 2000 site – the Slītere National Park.

New principles

The goal of the POLPROP-NATURA project was to introduce and implement a range of sustainability principles geared towards achieving both tourism development and nature protection objectives. Specific aims included developing five sustainable tourism products for the National Park (cycling, walking, birdwatching, nature and cultural tourism products, with relevant routes through the site), as well as outdoor information stands and a plant-finder tool for visitors (featuring

common - but attractive - species, all of which were featured in a new guidebook; developing a methodology for assessing the environmental, social and economic impact of tourism within the National Park; drafting an environment and nature tourism policy proposal document for Latvia; and organising a communication and dissemination campaign targeted at all key stakeholders.

The project was a great success, achieving all its main objectives. In particular, project manager Asnāte Ziemele highlights the role it has played in changing public perceptions of the Natura 2000 network amongst the local community: "A lot of people when we [started] were angry with everyone: angry with themselves, with the national park, with the municipalities. And especially they were angry because they were living in the area with the status of national park." This anger was driven by the fact that economic activity in the area had been forbidden for so long: A core area of 1 100 ha of the National Park had had no economic activities for the last 80 years and was a closed military zone during Soviet times.

The project sought to overcome these issues through stakeholder engagement. "We put them around the table and we started to do some really practical things," explains Ms Ziemele: "How to make a trail; how to mark the trail; how to make a guide; and to involve each of them in some specific topics so they, in some way, start to speak to each other and cooperate with the municipality and the national park and each other."

A visible difference

The positive impact of the project within Slītere has been clearly identified thanks to the methodology instigated by the beneficiary. In environmental terms, the new tourism routes and guide services have helped ensure that appreciation of nature is taking place in an organised and controlled way, with visitor flow matched to the environmental capacity of the destination. Project monitor Inta Duce points out that, "According to observations of rural tourism providers and organisers of the public discussion events in the Slītere National Park, visitor behaviour has become increasingly responsible as a result of project promotional efforts, e.g., no infrastructure damage has been registered, no littering observed."

Visitor numbers have increased, contributing an estimated 1 million euros to the local economy in 2011. A further socio-economic benefit has been the increase in the number of tourism-related businesses within the park: from 23 at the start of the project to 48 by its conclusion.

Wider impact

As planned, the project team published a document outlining "Environmental policy and governance proposals for tourism



POLPROP-Natura has helped bring about a significant increase in visitor numbers to the project site

development in protected nature sites". A total of 21 governmental organisations within Latvia, including the Ministry of Environmental Protection and Regional Development and the Association of Local and Regional Governments, have accepted the proposals as a policy recommendation on tourism development in protected nature areas.

What's more, a further three national parks have begun implementing the approach set out in the document, as trialled at Slītere National Park.

The Sustainable Tourism Management model should also find an audience amongst policy-makers and tourism bodies outside Latvia thanks to extensive dissemination of the project results, including through a best practice handbook, a Baltic Nature tourism conference and inclusion in the Europarc Federation's "Starter guide to developing sustainable tourism in protected areas".

For Ms Ziemele, the great achievement of the project was in showing that: "it really is so simple to involve people in something so good for the nature and environment."

Project number: LIFE07 ENV/LV/000981

Title: POLPROP-NATURA - Proposals for environmental policy and governance based on demonstration of environmental, social and economic benefits from tourism in the Slītere national park - A NATURA2000 territory

Beneficiary: Latvian Country Holiday Association "Lauku Ceļotājs"

Contact: Asnāte Ziemele

Email: asnate@celotajs.lv

Website: <http://www.polprop.celotajs.lv>

Period: 01-Feb-2009 to 31-Jan-2012

Total budget: €501 000

LIFE contribution: €245 000



Sweden: Improving environmental sustainability across industrial sectors

The TOSCA project has provided tools and awareness for improving the environmental sustainability of whole industries along their supply chains, defining guidelines and best practice for sector-wide, lifecycle approaches.



The TOSCA project showed the different actors along the chain all have a responsibility to improve a product's sustainability performance

There is increased understanding that any business looking to improve its environmental sustainability cannot limit itself to considering its own activities in isolation. It should take into account the whole supply chain, including the impact of both upstream and downstream activities from manufacturing, through use and end-of-life. This consideration of a product's lifecycle helps identify inefficiencies in resource use that need to be addressed.

However, an even more complete understanding of the potential for improved sustainability can come from the assessment of industry-wide value chains. This involves understanding the complex interactions between the individual value chains of different products and between different economic actors. However, such approaches require a high level of communication, information-sharing and cooperation.

Many industries do not know how to go about fostering such sector-wide sustainability improvements. The LIFE project TOSCA sought to provide guidance and tools to help industrial sectors improve the sustainability of their value chains.

Investigating good practice

TOSCA started by investigating the current state-of-the-art in promoting environmentally-sustainable value chains. It

specifically examined three key aspects of existing practice: tools used to identify, implement and monitor sustainability improvements; systems for handling and managing data; and structures for communication within companies and across sectors.

The project worked to collate good practice examples that had been identified from different businesses and sectors and explored case study examples from two companies participating in the project: the beneficiary, AkzoNobel, an international chemicals company; and SCA, a global paper products manufacturer.

For example, it drafted reports on the current organisational structures within the partner companies and conducted detailed studies of data management in eight of their business units. It also mapped their communication with other stakeholders in their wider value chains.

Finally, TOSCA studied the possibilities for including social aspects within sustainability assessments. This primarily involved a literature review on the means and methods of including social aspects in work towards sustainability. It identified important differences in the definition of social aspects, which represents a key challenge for their coherent inclusion in sustainability assessments.

The environmental impact of a product to the product value

Life Cycle Assessment

- ✓ Impact on climate change
- ✓ Other environmental impact

Carbon footprint

- ✓ Impact on climate change



Eco-efficiency

- ✓ Environmental impact related to product value

Web-based tools and guidance

This background work enabled the project to produce guidance and recommendations for promoting sustainable development in industrial sectors. The project made these recommendations available on a web platform in the form of information, tools and guidelines in three sections, covering:

1. Sustainable development;
2. Supply-chain activities; and
3. Guides to getting started.

The section on 'sustainable development' provides an explanation of the concept of environmentally-sustainable economic development, its history and its value from a business perspective. It goes on to discuss its practical implementation and to present current trends and issues related to the environment, resources and production, population and society, and the prospects of a new economy.

The 'supply-chain activities' section presents tools that companies can use to examine and improve sustainability in different parts of the supply chain. These cover how to identify a product's value chain—examining the upstream supply chain, own manufacturing, customers and consumers, and products at end-of-life. It also provides guidance on formulating sustainability strategies, appropriate organisational structures, developing more sustainable products, and working and communicating with other stakeholders.

The 'guides to getting started' explain to companies what they can do in practical terms to improve their environmental sustainability by measuring and analysing sustainability aspects throughout their supply chains. They explain where they can find the data they need to carry out the relevant assessments and how to use the results. Specific guides are provided on Lifecycle Assessment (LCA) and Eco-Efficiency Assessment (EEA).

To make things clearer, the guides also provide practical examples from the two partner companies involved in the project of how the tools can be applied to improve environmental sustainability. These examples address organisational and operational aspects, environmental assessment and good communication with stakeholders.

Conclusions

The LIFE TOSCA project has provided the means for companies and industrial sectors to improve their environmental performance by addressing sustainability in value chains extending both upstream and downstream. Through the participation of AkzoNobel and SCA, it has also demonstrated that such a process can be integrated into the business practices of large companies.

It provides the key message that with the active engagement of several players in the value chain, economic development can be much more environmentally sustainable. However, the ultimate impact of the project will depend on the extent to which companies and industries heed the project's message and use its tools.

Project number: LIFE07 ENV/S/000912

Title: TOSCA - Towards sustainable value chains through a common approach for company strategic work and daily operations

Beneficiary: Akzo Nobel Surface Chemistry AB

Contact: Johan Widheden

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Website: www.tosca-life.info

Period: 01-Jan-2009 to 31-Dec-2011

Total budget: €2 054 000

LIFE contribution: €1 027 000



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

Period covered (LIFE+) 2007-2013.

EU funding available approximately EUR 2 143 million

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

LIFE+ projects

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

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

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

Contact

European Commission – Directorate-General for the Environment LIFE Unit – BU-9 02/1 – B-1049 Brussels – Internet: <http://ec.europa.eu/life>

LIFE Publication / Best Environment projects 2012

Luxembourg: Office for Official Publications of the European Union

2013 - 48p - 21 x 29.7 cm

ISBN 978-92-79-32960-9

ISSN 2314-9329

doi:10.2779/33943

