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RESULTS MAGAZINE

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Special feature:

Growth through innovation: 'Green cars', 'Energy-efficient buildings' and 'Factories of the future' ■

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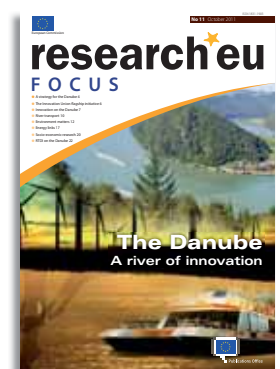
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Working together for new green, clean technologies

Industry and the environment are often seen as opposites, but research and new technologies have a vital role to play in making European industries cleaner, greener and more competitive.

The EU's Europe 2020 strategy for a smart, sustainable and inclusive economy includes initiatives aimed at supporting research, encouraging innovation and improving the way public and private sectors work together, in order to drive sustainable growth that can deliver a resource-efficient, greener and more competitive economy.

In November 2008, the European Commission announced three public-private partnerships (PPPs) to develop clean technologies for cars, construction and manufacturing, as part of its European Economic Plan. The European Council endorsed this package in December 2008, and three partnerships — 'Factories of the Future,' 'Energy-efficient Buildings' and 'Green Cars' — were launched in 2009.

In 2011, a group of experts made a first interim assessment of the three running research PPPs. The PPPs have all been successful in engaging top industrial companies, SMEs and research organisations within Europe, increasing significantly the large industry and SME participation, suggesting that they are seen as relevant to the needs of industrial companies while also focusing on pertinent research issues.

This issue of *research*eu results magazine* focuses on some of the projects supported via the three PPPs, as well as relevant results from some of the completed EU research in these industrial sectors.

In the regular 'energy and transport' section, starting on page 11, we have interviews with two projects, BEEM-UP and FC-DISTRICT, which have been supported by, and cooperate with, the PPP on 'Energy-efficient Buildings'. In addition, there is an interview with the REFORM project, funded by the PPP on 'Factories of the Future', in the 'industrial technologies' section, on page 33.

The rest of the 'energy and transport' and 'industrial technologies' sections showcase results from EU-funded research in the fields of green cars and fuels, energy-efficient buildings and future manufacturing technologies.

Our regular 'biology and medicine' section's top story on page 6 looks at the Eatwell project, which is investigating a variety of European policies aimed at reducing obesity, and the steps people will take to become healthy. The results of this study come at a time when healthy eating and increasing rates of obesity are becoming a major concern for people the world over.

The 'environment and society' section opens on page 19 with an article on researchers from the University of Nottingham in the United Kingdom who have designed an innovative technique to study the underground world of plants. The results of this research will lead to improved breeding techniques for crop varieties, as well as better yields.

The 'IT and telecommunications' section opens on page 25 with a survey of the research going into creating the future Internet of services, things and infrastructure, which will include everything from smart appliances that talk to each other to clothes that monitor our health, from cars that cannot crash to mobile technologies and cloud platforms that run our businesses.

The issue ends, as usual, with a list of events and upcoming conferences.

We look forward to receiving your feedback on this issue and on the research*eu publications in general. Send questions or suggestions to: cordis-helpdesk@publications.europa.eu

The editorial team



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Watch this space!

Coming up in issue 14 of *research*eu results magazine* — a special dossier on 'Creative and talented: nurturing Europe's next generation of scientists and building an inclusive, innovative society for the future'.

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There is something healthy in the state of Denmark

The people of Denmark are not only concerned about what they eat, but they are willing to pay more tax to eat healthier and make more informed eating choices. The findings are an outcome of the EU-funded Eatwell project, which has received EUR 2.5 million under the 'Food, agriculture and fisheries, and biotechnology' (KBBE) Theme of the EU's Seventh Framework Programme (FP7).

Eatwell¹ is looking into a variety of European policies aimed at reducing obesity and the lengths people will go to become healthy. The results of this study come at a time when healthy eating and increasing rates of obesity are becoming a major concern for people the world over. Despite this concern, however, government policies and actions have rarely been evaluated.

Data from the World Health Organization (WHO) show that obesity is responsible for 10% to 13% of deaths and 2% to 8% of health costs in Europe alone. In the case of the United Kingdom, it is believed that the over-consumption of salt, sugar and saturated fats, combined with an under consumption of fruit and vegetables, are responsible for 70 000 premature deaths.

These startling figures have led many EU Member States to design and implement a raft of policies aimed at encouraging healthier

eating habits through the promotion of fruits and vegetables, and at discouraging advertising certain foods to children. Other actions undertaken have included nutrition labelling, engaging with the food industry to improve the composition of food products that are manufactured, as well as regulating public sector canteens to ensure healthy food offerings. While all these efforts are encouraging, what has been lacking for many of these policy actions is a proper evaluation done in a systematic manner.

The Eatwell project is investigating these policies over 36 months and is set to end in October 2012. In particular, it aims at reviewing the policy actions undertaken and at identifying gaps, success and failure factors for these campaigns. Its final objective is to provide EU Member States policymakers with best-practice guidelines, and with valuable insights from private sector and communication agencies to develop appropriate policy

interventions that will encourage healthy eating across Europe.

At a recent workshop to discuss the Eatwell results, it was revealed that consumers in Denmark were both more willing to eat healthier and pay more to do so. 'Danes have the most positive attitude towards economic interventions within the nutritional area, and are also willing to pay more to eat more healthily,' said Jessica Aschemann-Witzel from Aarhus University, Business and Social Sciences in Denmark, a doctoral student who worked on the project.

The Eatwell project partners evaluated more than 3 000 consumers from five European countries, asking them whether they were willing to accept 'national economic interventions to promote healthy eating habits'. Close to 36% of Danes responded they were prepared to pay more tax in return for policies to promote consumption of healthier

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food and more information on what constitutes healthy food (only 16% called for a tax reduction). When the researchers turned to the other countries represented in the study, the answer to the same question plummeted to 30% or less. For some specific measures, like increasing taxes to subsidise the price of healthy foods, the gap is even larger, with almost 42% of Danes being supportive, compared to an average below 29% in other countries.

One reason for such a large difference is that the Danes have greater trust in their public institutions, the Eatwell partners found. 'Danes often have more faith in the public authorities and are used to paying high taxes, and therefore they are not as dismissive to changes in these areas as other populations,' commented Jessica Aschemann-Witzel.

The Eatwell consortium is focusing its efforts in reviewing the policy actions of Belgium,

Denmark, Italy, Poland and the United Kingdom.

- 1 'Interventions to promote healthy eating habits: evaluation and recommendations'.

Funded under the FP7 specific programme Cooperation under the theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 24753

Cure for the 'broken' heart

EU-funded heart experts have come together to study the mechanisms of cardiac development and regeneration seeking cell replacement sources.



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Myocardial infarction constitutes a major health issue in Europe. Currently, the only treatment for severe heart failure is heart transplantation. Emerging scientific evidence indicates that cardiomyocytes can divide post-natally opening up a window for

the development of regenerative treatments for cardiac diseases.

Cell therapy requires an in-depth understanding of how a tissue develops, is maintained and regenerates. The European Cardiocell¹ initiative is investigating heart

development and regeneration aiming to identify sources for cell replacement therapy.

To monitor *in vivo* proliferation of cardiomyocytes, project partners have developed a pre-clinical model system and screened the ability of various compounds to induce endogenous cell division in the heart.

The consortium explored different types of pluripotent cell sources including embryonic stem cells (ESC) and reprogrammed somatic cells — known as induced pluripotent stem cells (iPS) — to induce differentiation into the cardiomyocyte lineage.

Research on heart development identified a common ancestor cell for both skeletal and cardiac muscle. Combined with key factors that regulate the process of cardiac muscle regeneration, this discovery

will pave the way for the *ex vivo* development of cardiomyocytes for transplantation.

Overall, the Cardiocell project has already generated novel insight into heart development and regeneration. Researchers expect that the study's key findings will be implemented to derive cardiomyocytes *ex vivo* which could be utilised in transplantation procedures. The application of cell replacement therapy will significantly improve the outcome of patients with myocardial infarction.

The project was coordinated by Lunds Universitet, in Lund, Sweden.

- 1 'Development of cardiomyocyte replacement strategy for the clinic'.

Funded under the FP7 specific programme Cooperation under the theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 8448

Making competences more accessible

An EU-funded initiative has developed a prototype for better accessing and analysing life-science research projects and researcher competences. This stands to improve use of funds and enhance collaborative efforts.

Although research projects are producing a steady stream of results and advances, which are also disseminated, the competences of those behind it all need to be made more accessible. For grants offices, project coordinators, researchers and even the European Commission, such meaningful

information is key to setting up and benefitting from cutting-edge research projects. Also, information needs to be presented in a way that meets the specific needs of each target group. Previous efforts to meet these challenges often succumbed to difficulties in keeping information up to



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date and quality assured, or to the burden of long-term costs.

The LifeCompetence¹ project set out to deliver state-of-the-art competence management tools and processes that address these issues, thereby providing access to the competences in ongoing and future projects in the 'Life sciences, genomics and biotechnology for health' (LSH) priority. Project partners aimed to provide a means of leveraging EC research investments by improving and increasing

transparency in the research collaboration process between academia and industry.

Efforts focused on delivering an Internet-based competence platform that allows users to identify researchers, organisations and research projects with particular competences. Such a tool will also enable the EC to respond to policy-related questions and help administration on both sides of the project to better view their competences and ongoing activities. In turn, this will facilitate better

research collaborations and proactive marketing at an international level, and strengthen EU research on the whole.

LifeCompetence initially delivered a prototype for conducting searches and analyses, with feedback from user testing being used to update the data and functionality of the next release. The project's vision for the final product was for it to be the prime source of information about life science projects and research competences in Europe. This will prove

especially beneficial for the EC, industry representatives, and university and regional managers.

The project was coordinated by the Karolinska Institutet in Stockholm, Sweden.

1 'Life science competence in Europe'.

Funded under the FP6 specific programme 'Life sciences and health'.
<http://cordis.europa.eu/marketplace> >
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Organ regeneration in the elderly

A European initiative is investigating the developmental processes of organ repair and how normal organ development dysfunctions during ageing.

Organ development and regeneration are multi-factorial processes of tissue renewal, restoration and growth. In the elderly, normal repair dysfunctions giving way to progressive fibrosis and organ failure. Despite the severity of the problem, the mechanisms connecting ageing and organ repair remain poorly understood.

The objective of the EU-funded Resolve¹ project is to understand the mechanisms which shift primary organ repair towards fibroproliferative wound healing as a result of age-related loss of regulatory control.

By combining multidisciplinary expertise, project partners have modelled different forms of wound healing and human diseases to investigate the mechanisms underlying organ regeneration. A pre-clinical model of pulmonary repair has also been used to demonstrate increased fibrosis due to advanced age.

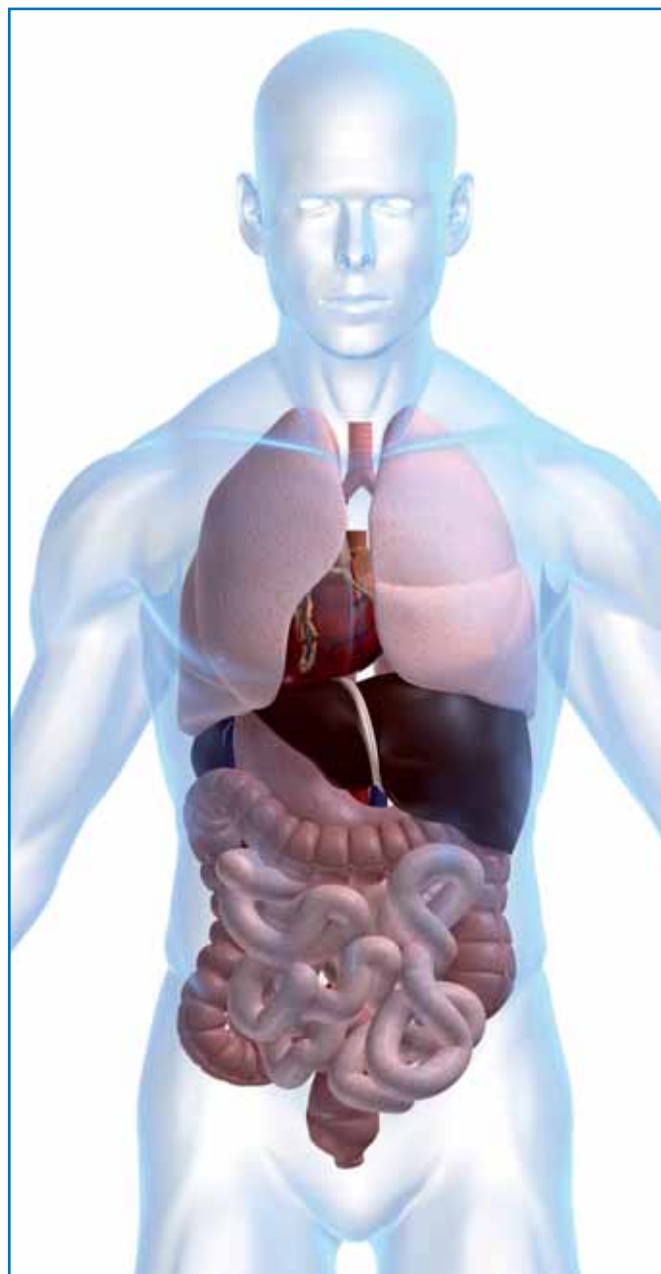
The findings of the Resolve project will enhance current knowledge on the mechanism of ageing and create

treatment strategies to prevent aberrant wound healing. This is expected to improve the quality of life of elderly people.

The project was coordinated by the Medizinische Universität Wien, in Vienna, Austria.

1 'Resolve chronic inflammation and achieve healthy aging by understanding non-regenerative repair'.

Funded under the FP7 specific programme Cooperation under the theme 'Health'.
<http://cordis.europa.eu/marketplace> >
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A grid-based 'Google' to fight neurological disease

Grid computing, long used by physicists and astronomers to crunch masses of data quickly and efficiently, is making the leap into the world of biomedicine. Supported by EU-funding, researchers have networked hundreds of computers to help find treatments for neurological diseases such as Alzheimer's. They are calling their system the 'Google for brain imaging'.

Through the Neugrid¹ project, the pan-European grid computing infrastructure has opened up new channels of research into degenerative neurological disorders and other illnesses, while also holding the promise of quicker and more accurate clinical diagnoses of individual patients.

The infrastructure, set up with the support of EUR 2.8 million in funding from the European Commission, was developed over three years by researchers in seven countries. Their aim, primarily, was to give neuroscientists the ability to quickly and efficiently analyse 'Magnetic resonance imaging' (MRI) scans of the brains of patients suffering from Alzheimer's disease. But their work has also helped open the door to the use of grid computing for research into other neurological disorders, and many other areas of medicine.

'Neugrid was launched to address a very real need. Neurology departments in most hospitals do not have quick and easy access to sophisticated MRI analysis resources. They would have to send researchers to other labs every time they needed to process a scan. So we thought, why not bring the resources to the researchers rather than sending the researchers to the resources?' explains Giovanni Frisoni, a neurologist and the deputy scientific director of IRCCS Fatebenefratelli, the Italian National Centre for Alzheimer's and Mental Diseases, in Brescia.

Five years' work in two weeks

The Neugrid team, led by David Manset from MaatG in France and Richard McClatchey from the University of the West of England in Bristol, laid the foundations

for the grid infrastructure, starting with five distributed nodes of 100 cores (CPUs) each, interconnected with grid middleware and accessible via the internet with an easy-to-use web browser interface. To test the infrastructure, the team used datasets of images from the Alzheimer's Disease Neuroimaging Initiative in the United States, the largest public database of MRI scans of patients with Alzheimer's disease and a lesser condition termed 'Mild cognitive impairment'.

'In Neugrid we have been able to complete the largest computational challenge ever attempted in neuroscience: we extracted 6,500 MRI scans of patients with different degrees of cognitive impairment and analysed them in two weeks,' Dr Frisoni, the lead researcher on the project, says, 'on an ordinary computer it would have taken five years!'

Though Alzheimer's disease affects about half of all people aged 85 and older, its causes and progression remain poorly understood. Worldwide more than 35 million people suffer from Alzheimer's, a figure that is projected to rise to over 115 million by 2050 as the world's population ages.

Patients with early symptoms have difficulty recalling the names of people and places, remembering recent events and solving simple maths problems. As the brain degenerates, patients in advanced stages of the disease lose mental and physical functions and require round-the-clock care.

The analysis of MRI scans conducted as part of the Neugrid project should help researchers gain important insights into some of the big questions



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surrounding the disease, such as which areas of the brain deteriorate first, what changes occur in the brain that can be identified as biomarkers for the disease and what sort of drugs might work to slow or prevent progression.

Neugrid built on research conducted by two prior EU-funded projects: Mammogrid, which set up a grid infrastructure to analyse mammography data, and AddNeuroMed, which sought biomarkers for Alzheimer's. The team are now continuing their work in a series of follow-up projects.

An expanded grid and a new paradigm

Neugrid for You (N4U), a direct continuation of Neugrid, will build upon the grid infrastructure, integrating it with 'High performance computing' (HPC) and cloud computing resources.

Using EUR 3.5 million in European Commission funding, it will also expand the user services, algorithm pipelines and datasets to establish a virtual laboratory for neuroscientists.

'In Neugrid we built the grid infrastructure, addressing technical challenges such as the interoperability of core computing resources and ensuring the scalability of the architecture. In N4U we will focus on the user-facing side of the infrastructure, particularly the services and tools available to researchers,' Dr Frisoni says. 'We want to try to make using the infrastructure for research as simple and easy as possible,' he continues, 'the learning curve should not be much more difficult than learning to use an iPhone!'

N4U will also expand the grid infrastructure from



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the initial five computing clusters through connections with CPU nodes at new sites, including 2,500 CPUs recently added in Paris in collaboration with the French Alternative Energies and Atomic Energy Commission (CEA), and in partnership with 'Enabling grids for e-science Biomed VO', a biomedical virtual organisation.

Another follow-up initiative, out-GRID, will federate the Neugrid infrastructure, linking it with similar grid computing resources set up in the United States by the Laboratory of Neuro Imaging at the University of California, Los Angeles, and the CBRAIN brain imaging research platform developed by McGill University

in Montreal, Canada. A workshop was recently held at the International Telecommunication Union, an agency of the United Nations, to foster this effort.

Dr Frisoni is also the scientific coordinator of the DECIDE project, which will work on developing clinical diagnostic tools for doctors built upon the Neugrid grid infrastructure.

'There are a couple of important differences between using brain imaging datasets for research and for diagnosis,' he explains. 'Researchers compare many images to many others, whereas doctors are interested in comparing images from a single patient against a wider set of data to help

diagnose a disease. On top of that, datasets used by researchers are anonymous, whereas images from a single patient are not and protecting patient data becomes an issue.'

The DECIDE project will address these questions in order to use the grid infrastructure to help doctors treat patients.

Though the main focus of all these new projects is on using grid computing for neuroscience, Dr. Frisoni emphasises that the same infrastructure, architecture and technology could be used to enable new research — and new, more efficient diagnostic tools — in other fields of medicine.

'We are helping to lay the foundations for a new paradigm in grid-enabled medical research,' he says.

Neugrid was coordinated by the National Centre for Alzheimer's and Mental Diseases, Brescia, Italy.

1 'A grid-based e-infrastructure for data archiving/communication and computationally intensive applications in the medical sciences'.

Funded under the FP7 specific programme Cooperation under the theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 8319

Nanosensors for studying neuronal activity

The nervous system uses a complex interaction of electrical and chemical signalling to perform its various functions. EU-funded researchers developed novel nanotechnology for monitoring electrical and chemical indicators of cell activity.

Cell membranes separate internal and external fluids creating electrical and chemical gradients that drive signalling processes. One of the major neurotransmitters, or chemicals responsible for transmitting nervous system information between cells, is glutamate. Binding of glutamate to cell membranes can induce changes in membrane voltage (potential) indicating neuronal activity.

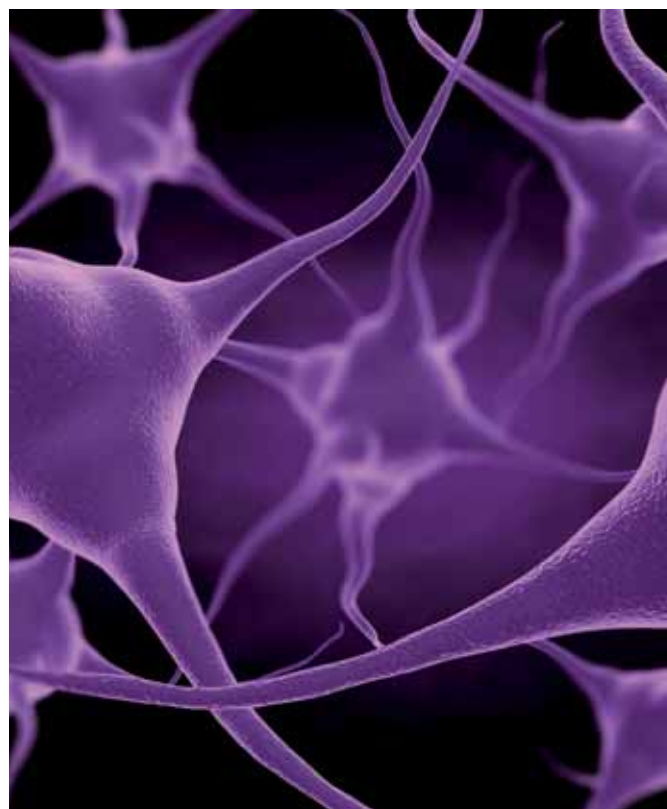
Researchers supported by funding of the VSNS¹ project set out to develop voltage-sensitive nanotransducers (VSNs) for long-term monitoring of neuronal membrane potential to overcome difficulties inherent in using traditional voltage-sensitive dyes. The technologies could be key in developing treatments for neurodegenerative diseases such as Alzheimer's.

Plasmon-resonant nanoparticles (NPs) are metallic NPs that scatter light with remarkable efficiency due to collective resonance (oscillation) of the metal's conduction electrons. A range of electrically

tuneable Plasmon-resonant nanoparticles/nanorods (NP/NRs) acting as voltage nanosensors were developed together with protocols for membrane binding. In addition, the team developed a method for binding and sensing the neurotransmitter glutamate as an indicator of neuronal activity.

Single NP spectroscopy enabled insight into fundamental processes linking changes in membrane-bound NP plasmon resonance (NPPR) with measurements of membrane potential. Using simultaneous control of neuronal membrane potential and optical imaging, the researchers studied VSNs bound to membranes in cultured neurons and in cortical tissue slices.

Finally, a setup for dark-field microscopy complemented by thermal lensing microscopy (TLM) should be particularly useful for studying changes in intensity, wavelength and phase of scattered light from neuron-bound NP/NRs in preparations such as tissue slices that produce significant scatter.



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Results of the VSNS project have great potential for use in studying neurodegenerative disease processes and also open the door to a number of new applications in biosensing and optoelectronics.

The project was coordinated by the Universitat Politècnica de Catalunya, in Barcelona, Spain.

1 'Notch signalling in development and pathology'.

Funded under the FP7 specific programme People (Marie-Curie actions).
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Interview: the EU's 'Energy-efficient buildings' initiative

The public-private partnership (PPP) for 'European energy-efficient buildings' (EeB) aims 'to promote green technologies and the development of energy-efficient systems and materials in new and renovated buildings with a view to reducing radically their energy consumption and CO₂ emissions.'

The research programme is financed jointly by industry and the European Commission under the Seventh Framework Programme for Research (FP7) and proceeds through coordinated calls for research proposals. It is one of the three PPPs the European Commission announced in November 2008 — intended to develop clean technologies for cars, construction and manufacturing — and endorsed by the European Council in December 2008.

Energy-efficiency for competitive industry

Construction accounts for more than 10% of the EU's GDP and employs 32 million people, whether in large, medium or small enterprises. The energy consumption of houses and buildings, taking into account the whole life-cycle, is responsible for 40% of total EU energy consumption and is the main contributor to greenhouse gas (GHG) emissions (about 36% of the EU's total CO₂ emissions). Reducing energy consumption over buildings' total life-cycle is therefore an effective action against climate change and will also contribute to decreasing the EU's dependence on energy imports.

The PPP's focus is on energy-efficient processes, products and services in order to reach the EU's climate change targets for 2020 and 2050 and contribute to improving the EU's security of energy supply. Funding and coordinating research on key technologies in order to develop a competitive industry in the construction sector will help transform these challenges into a business opportunity.

FC-DISTRICT¹, one of the projects funded by the PPP on 'Energy-efficient buildings', aims to optimise and implement an innovative energy production and distribution concept for sustainable and energy-efficient refurbished districts, or new energy-autonomous areas, by exploiting decentralised co-generation, as well as optimised building and district heat storage and distribution networks.

The BEEM-UP² project, also funded by the PPP, will demonstrate the economic, social and technical feasibility of retrofitting initiatives for drastically reducing the energy consumption in existing buildings, and lay the ground for market uptake.

*Research*eu magazine* asked Juliusz Żach of Mostostal Warszawa in Poland — coordinator of the FC-DISTRICT project — and Juan Ramón de las Cuevas Jiménez of ACCIONA Infraestructuras in Spain — coordinator of the BEEM-UP project — to tell us how work has been going.

*Research*eu magazine: What are the main themes and objectives of your projects?*

FC-DISTRICT is a large-scale project comprising a number of different technologies to increase the energy-efficiency of whole districts. We are working on the adaptation of 'Solid-oxide fuel cell' (SOFC) technology for stationary conditions, in order to function as dispersed cogeneration facilities and provide energy to groups of buildings. To complement these energy sources, and assure balanced heat and energy production, the project is also developing improved designs for district heating pipes using modern insulation materials.

Other research topics include an 'External thermal insulation composite system' (ETICS) for retrofitting and energy storage in building elements, and biogas generation ➤

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using food waste disposers, an intelligent waste settler and filtering tanks that will maximise production in anaerobic digesters.

The FC-DISTRICT concept also includes dynamic control and wireless communications. When introduced at the district scale, together these technologies should reduce primary energy use by 60%.

BEEM-UP: The main objective of BEEM-UP is to develop and demonstrate the cost-effective and high-performance renovation of existing multi-family residential buildings, in order to save up to 75% of their energy consumption.

Research*eu magazine: What is new or innovative about the projects and the way they address these issues?

FC-District: In replying to the first call for project proposals under the PPP, we proposed integrating the results from four previous European research projects into a single solution.

BEEM-UP: We have assembled expert partners from the fields of energy, building engineering and sociology in order to achieve our ambitious goals. The project will demonstrate its innovative insulation solutions, innovative tenant-involvement strategies and new methodologies for refurbishment strategies in three buildings in different locations across Europe.

Research*eu magazine: What first drew you to research in this area?

FC-District: Mostostal Warszawa is a large construction company and, when we started our research in 2005, the area of energy-efficiency was not our first, natural choice. We have noticed developments in the European construction market — some triggered by legal factors, such as the EU Directive on 'Energy performance of buildings' — and their influence on our clients' expectations.



Juliusz Zach, © FC-DISTRICT Project

BEEM-UP: The BEEM-UP project's goals are in line with the Europe 2020 strategy. We are focused on the integration of new technologies and methodologies into existing building stock. Our next steps will relate to larger scales, such as districts, and in the near future the approaches will focus on whole cities.

Research*eu magazine: What are the advantages of participating in an EU public-private partnership?

FC-District: The first advantage, and one of the sources for our success, is the network of contacts. In this case, the Energy Efficient Buildings Association, being the private part of the PPP, played an important role in bringing the consortium together. The rule that the funded research projects should be led by industrial partners is also positive.

BEEM-UP: It is clear for us that working at the EU level, instead of only the national level, will ensure the results of the project will bring benefits at a European level. The multinational project team will also bring knowledge to the project in a way that would be difficult for a national project.

Research*eu magazine: What are some of the difficulties you have encountered?

FC-District: I think we face the same problems as other projects. As always, it is challenging to ensure seamless communication, combine results produced by different partners and meet strict deadlines.

BEEM-UP: We participated in a round table at a workshop organised by the European Commission in Brussels in February 2012. We agree with one of the main issues raised there — data and knowledge communication flows between different projects.

Research*eu magazine: How do you go about solving them?

FC-District: This is our work as coordinator. We continue to clarify and adjust small issues. Luckily, there have been no major technical problems so far.

BEEM-UP: We try to participate in other workshops or forums, and distribute the results of our project to other interested parties. The role of the Commission is also relevant in maintaining contacts and supporting dissemination.

Research*eu magazine: What are the concrete results from the research so far?

FC-District: The project has been running for 21 months now and we have produced several prototypes, such as district heating pipes, a food-waste collection tank and various peripheral elements of the SOFC unit. One patent application has been submitted and an ETICS installation at a mock-up house in Greece has

been finished, and its performance monitored. A district-scale demo site has been equipped with hybrid wireless communication system, and this has passed field tests with positive results.



Juan Ramon de las Cuevas Jimenez,
© BEEM-UP Project

BEEM-UP: We are still evaluating the different strategies being followed in three test buildings, and it will not be until the end of the project that we will have real data from our monitoring systems. However, the simulations and other calculations by our experts anticipate high saving percentages in the demo sites.

Research*eu magazine: What are the next steps of the project, or next topics for your research?

FC-District: The FC-DISTRICT project is now entering an important phase. We are about to begin construction works at the district-scale demo site in Poland. Presentation of the new ETICS solution in one of the buildings will be done in June, but the main demonstration is to be performed next year. The FC-DISTRICT concept demo will show how three SOFC units can cooperate while located in three different buildings.

BEEM-UP: As in the title of the project itself, 'Building Energy-Efficiency for Massive market Uptake', our next steps will be focused on a strong dissemination campaign across Europe. We believe in the methodology we have developed to choose the best combination of measures to ensure cost-effectiveness, and we look forward to showing it to stakeholders.

- 1 'New μ -CHP network technologies for energy efficient and sustainable districts'.
- 2 'Building Energy-Efficiency for Massive market Uptake'.

For further information:

See FC-DISTRICT project website: www.fc-district.eu
Funded under the FP7 specific programme 'Cooperation' under the theme 'Nanosciences, nanotechnologies, materials and new production technologies'.
See BEEM-UP project website: <http://www.beem-up.eu/>
Funded under the FP7 specific programme 'Cooperation' under the theme 'Energy'.

ENERGY AND TRANSPORT



New hope for hydrogen-powered cars

Hydrogen has huge potential for the world's energy needs, but several technical challenges still remain. EU-funded researchers have advanced the use of a radical new material as an excellent candidate for hydrogen storage in mobile applications.



of gasoline. In addition, high-pressure compression of the gas still falls short of transport requirements due to volume, safety and energy considerations.

Researchers on the Hycones¹ project purified carbon cones (CCs), a new form of carbon now produced in industrial quantities, with funding provided by the EU.

Intensive modelling has led to characterisation of the fundamentals associated with hydrogen storage using this purified material. The CCs are able to store hydrogen efficiently, effectively and inexpensively. Most importantly, the investigators experimentally verified the ability of CCs to release hydrogen at near room temperature, thus confirming the technology's potential for use in hydrogen storage for transport applications.

The outcomes of the Hycones project have received international attention. The researchers developed links

for cooperation with European and international projects and hydrogen storage programmes, including those within the US Department of Energy.

The results should have a significant impact on the design and production of hydrogen cars in the future, decreasing our dependence on fossil fuels and protecting the environment. In addition, a European edge in the hydrogen car market could have significant impact on the European job market.

The project was coordinated by the National Centre for Scientific Research "Demokritos" in Greece.

1 'Hydrogen storage in carbon cones'.

Funded under the FP6 programme 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices'.
<http://cordis.europa.eu/marketplace> >
search > offers > 7509

Consumption of carbon-based fossil fuels continues to rise and these energy sources are becoming increasingly depleted. In addition, their burning releases billions of tonnes of carbon dioxide (CO₂) into the atmosphere, contributing to global warming.

Given that transportation contributes greatly to CO₂ levels and hydrogen has become an attractive energy source, hydrogen's major use seems

to be for road transport. However, hydrogen storage requirements for transportation are much more difficult to satisfy than are those for stationary purposes, such as providing electricity to homes and factories.

One of the greatest stumbling blocks is that, at the environmental temperature required for use in automobiles, hydrogen contains much less energy than an equivalent volume

Optimised 'ultracaps' for tomorrow's electric cars

EU-funded researchers developed control technology for a new generation of capacitors that could spur their widespread use in electric vehicles. This promises important benefits for the European economy and the environment.

Until recently, even the best capacitors were no match for batteries in terms of the amount of energy stored and their usefulness in applications such as hybrid or fuel-cell cars was limited. Thankfully, a new generation of capacitors, 'ultracaps', has enhanced energy storage and broadened the range of applications for capacitors.

Now, in addition to providing backup power for microcomputers and cell phones, ultracaps have found a home in some mass transit vehicles and industrial machines. Perhaps the most exciting potential for ultracaps lies in their use in electric cars.

The Hyheels¹ project was developed to optimise an ultracap energy storage and delivery system with respect to thermal behaviour, weight and cost for use in hybrid and fuel cell vehicles.

In order to be useful in electric cars, several capacitors must work together to supply the required total voltage. As a result, the functioning must be carefully controlled and modulated such that the capacitor charge is balanced to prevent voltage drift.

Hyheels researchers developed a new cell stack technology together with a controller to ensure reliable



operation of the module for all current and future automotive applications, thus overcoming the voltage drift issues of current systems. In addition, they developed novel simulation models to facilitate the design of ultracap modules for various vehicle

configurations. The operation was tested and validated on passenger cars and heavy duty vehicles demonstrating minimisation of voltage variation and power losses.

In a 'life-cycle analysis' (LCA) ultracaps scored >

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better than all assessed batteries with respect to environmental impact primarily due to low weight and high materials recyclability.

Hyheels has significantly advanced the technology required for

widespread application of ultracaps in electric vehicles. Commercial implementation of the concepts has the potential to position the European economy in a leadership role in the electric vehicle market. Such advances are poised to revolutionise individual and mass

transport, with important benefits for consumers, industry and the planet.

The project was coordinated by Continental Automotive GmbH in Germany.

1 'Hybrid high-energy electrical storage'.

Funded under the FP6 programme
"Sustainable development, global change and ecosystems".
<http://cordis.europa.eu/marketplace> >
search > offers > 8221



One step closer to hydrogen cars

For eco-friendly vehicles to run on hydrogen, they require the appropriate infrastructure and procedures. An EU project has worked to standardise these across Europe in order to make hydrogen cars a more viable transport option.

As vehicles move towards more eco-friendly fuels such as hydrogen, there is a need to standardise regulations for 'Hydrogen refuelling stations' (HRS). However, permit-related issues have long delayed the growth of fuelling stations and introduction of hydrogen vehicles.

The EU-funded HyApproval project developed a guide for authorities to approve hydrogen refuelling stations and overcome obstacles for exploitation. In addition to the handbook, the project worked on refuelling station guidelines and international standards.

The project team began by defining three types and sizes of HRS for certification in European

countries, with a scope including safety equipment and regulations. It collected all the required information to create the handbook, incorporating considerations by relevant authorities in various European countries. In addition, relevant information from China, Japan and the USA was collected.

The handbook covered safety issues for HRS design, construction and operation, supplemented by risk assessment workshops and accident scenario simulations to develop best practices in the field.

HyApproval also produced technical reports including vehicle receptacle geometry, data exchange between the vehicle and HRS, refuelling processes and



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safety during refuelling. Moreover, a manual for drivers was developed and met with international success. Raising public awareness about HRS and dissemination of the handbook were also part of the project's mandate.

The handbook that finally emerged from the project features two parts: 'Guidelines for design, operation and maintenance of an HRS' and the 'Permitting process'. This is an important first step towards the establishment of common European policy and a basis for

national authorities to adopt similar permitting processes.

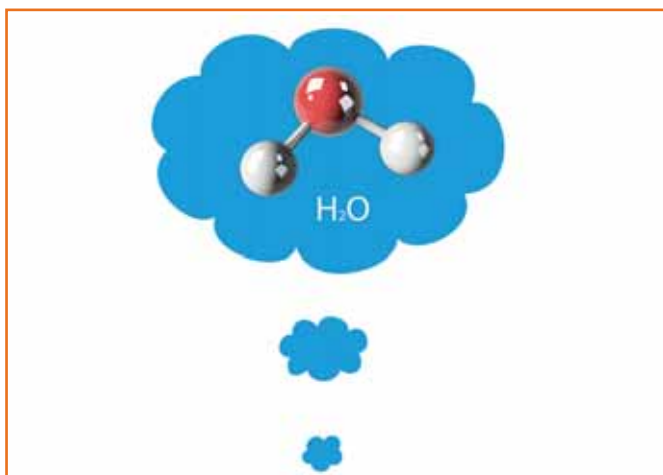
The project was coordinated by L-B-Systemtechnik GmbH, based in Germany.

1 'Handbook for approval of hydrogen refuelling stations'.

Funded under the FP6 programme
"Sustainable development, global change and ecosystems".
<http://cordis.europa.eu/marketplace> >
search > offers > 7132



Hydrogen-rich methanol for fuel cells



Fuel cells based on the use of hydrogen have gained widespread interest as the best clean energy alternative to fossil fuels, particularly for compact portable devices such as cars, medical equipment, 'Auxiliary power units' (APUs) and security cameras. In particular, 'Proton exchange membrane' (PEM) fuel cells, first used for the NASA Gemini programme in the 1960s, are currently being developed for many such applications.

PEM fuel cells are structured something like the locks that allow boats to pass along a waterway with different levels, where there is a barrier between the two bodies of water (low and

high) and a bridge over the top. Hydrogen comes into the lock (the anode) and is split into protons (positive hydrogen ions) and electrons. The protons pass through the lock (an electrolyte solution

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with a membrane) to the other side (the cathode) where they combine with oxygen to produce water and heat. Both reactions require catalysts. The electrons go over the bridge (an electrical circuit) to produce electricity to power devices. To produce adequate power, numerous cells are combined in a so-called 'stack'.

Many PEM fuel cells currently use pure hydrogen as the input or fuel. However, the use of pure hydrogen has posed numerous storage and processing challenges that have inhibited its widespread use.

EU researchers working on the Morepower¹ project developed new materials and methods enabling the use of hydrogen-rich and readily available methanol and, to a lesser extent, ethanol as a fuel source.

Specifically, the investigators developed new proton exchange membranes demonstrating superior performance and properties compared to Nafion membranes. They optimised the anode and cathode reactions and demonstrated enhanced catalytic activity. The researchers carried out extensive experimentation and modelling

to produce a novel 'Membrane-electrode assembly' (MEA) design for efficient operation at low temperatures with realistic flows and pressures. Finally, they built two single cell test stacks producing 350 Watts of power operating with a 1 Molar methanol solution at 60° Celsius.

The opportunities for exploitation of methanol in hydrogen-based fuels cells are exciting. Methanol is a stable, widely produced biodegradable liquid at room temperature and it contains more hydrogen than any other liquid fuel. It is well positioned to spur Europe's

hydrogen-based fuel-cell market to new heights and the Morepower project added fuel to its fire.

The project was coordinated by the GKSS Forschungszentrum GmbH in Germany.

1 'Compact direct (m)ethanol fuel cell for portable application'

Funded under the FP6 programme
'Sustainable development, global change and ecosystems'.

<http://cordis.europa.eu/marketplace> >
search > offers > 7906



Cars of the future

A full study of current and future battery technologies will help identify the way forward for electric-powered vehicles. Manufacturers, suppliers, consumers and the environment all stand to gain from such an initiative.



It has long been a dream to create non-polluting electric vehicles based on super-efficient batteries. The EU-funded SUBAT¹ project investigated the battery market to help boost sustainable transport in the future for the EU.

Three European universities and four stakeholder organisations came together to assess current and future battery technologies worldwide. The consortium did not involve any supplier or manufacturer of batteries in order to guarantee the project's neutrality. It closely assessed energy, power, life cycle, costs, temperature, charging, maintenance, safety and efficiency of battery systems, as well as recyclability, energy efficiency and commercial viability.

SUBAT analysed all batteries in the context of battery-electric and hybrid vehicles. It considered necessary peripheral systems as well as the battery management system, which plays an important role in battery performance. The project team also identified the best software to analyse the life-cycle of different batteries.

In the first stage of the project, SUBAT compiled a comprehensive technical overview of battery technology that could prove very useful to stakeholders. It then conducted a full environmental assessment of industrial battery systems taking the nickel-cadmium battery

as a benchmark. The project team then conducted a cost assessment for the industry and consumers, analysing factors that raise battery costs for users. They also compared the European vs. non-European markets in battery sales and trade balance.

On the green front, SUBAT analysed emissions of potentially harmful substances and resources consumed, enabling better comparisons between systems and batteries. At the end, the project produced an overall assessment of the battery technologies. It ranked environmental, technical and economic parameters in an objective way considering different perspectives with regard to consumers, manufacturers and the political environment. These studies will be of use to all manufacturers, suppliers and consumers, helping them identify the best road forward and bringing Europe a step closer to energy-efficient, eco-friendly electric cars.

The project was coordinated by the Vrije Universiteit Brussel (VUB) in Belgium.

1 'Sustainable batteries'.

Funded under the FP6 programme
'Research for policy support'.

<http://cordis.europa.eu/marketplace> >
search > offers > 7517

ENERGY AND TRANSPORT



New hybrid vehicles without batteries

Hybrid electric vehicles have become the bridge between conventional transport vehicles and the hydrogen-powered fuel-cell vehicles of the future. EU-funded researchers have developed innovative designs which replace batteries with supercapacitors and intelligent components that could have significant benefits in terms of weight, efficiency and cost for tomorrow's hybrid vehicles.

Hybrid electric vehicles typically use a combustion engine as a primary energy source for cruising and a secondary electric power storage system for handling short-term energy demands such as those related to acceleration and braking.

Batteries used for energy storage are typically heavy, expensive and maintenance intensive. On the other hand, supercapacitors are lightweight, high-power energy storage devices with long operational lifetimes. Recent efforts have focused on using supercapacitors together with batteries.

Researchers working on the Intellicon¹ project sought to eliminate the need for an energy storage battery entirely, by employing a fuel-cell power plant together with a supercapacitor. The former would provide continuous average (cruising) power via an 'intelligent' DC/DC converter while the latter would provide on-board energy storage

and immediate power on demand for acceleration and braking.

Important design innovations included isolation of the fuel-cell output from the main DC bus and traction system enabling independent optimisation of both and thus enhanced vehicle performance and energy efficiency.

In addition, using an intelligent DC/DC converter could enhance safety and reliability by monitoring and responding to changes in levels of contaminants, hydrogen and air pressure and temperatures, among others. Furthermore, the device should stabilise supercapacitor voltage during acceleration and deceleration to maintain optimal power flow from the fuel cell.

Finally, the Intellicon system should significantly reduce maintenance costs and weight (leading to reductions in fuel costs) while tremendously enhancing



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efficiency, by using proactive energy management, and improving the operational life of the fuel cells due to protection against variable loads.

Although the concept was originally conceived for vehicles used in materials handling, airports, factories and consumers, it is also expected to be advantageous in larger applications such as light rail systems.

The project was coordinated by Hiltech Developments Ltd, based in the United Kingdom.

1 'Intelligent DC/DC converter for fuel cell road vehicles'.

Funded under the FP6 programme 'SME activities'.
<http://cordis.europa.eu/marketplace> > search > offers > 8440



Clearing the air for next-generation diesel engines

A new generation of diesel engines promises greater fuel efficiency and lower emissions. But the emissions they do produce still need to be treated before they are released into the atmosphere.



'Homogeneous charge-compression ignition' (HCCI) engines have been around for a long time. However, despite their superior fuel efficiency and their cleaner combustion of fuels compared with conventional motors, HCCI engines have not been widely used due to a variety of factors. These include a relatively small power range and the possibility of damage to the engine due to high peak pressures inside the cylinders.

The major hurdle that has stood in the way of widespread commercialisation of HCCI engines is difficulty in controlling the auto-ignition event required to get the motor

running. However, a variety of methods have been developed to induce the necessary conditions for auto-ignition and to enable HCCI engines to increase their power range, thereby paving the way for greater commercialisation.

Although HCCI engines emit far fewer pollutants than traditional spark ignition motors, they still do emit relatively high levels of carbon monoxide (CO) and hydrocarbons. With the increasing viability of these engines comes a pressing need to reduce these emissions.

The EU-funded Pagode¹ project set out to provide a comprehensive,

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system-oriented view of viable after-treatment processes for the next generation of HCCI diesel engines. One avenue the project explored was the use of an oxidising catalyst in a next-generation catalytic converter.

Pagode investigated the dynamics of low-temperature oxidation of CO and hydrocarbon emissions in order to gather reliable data for further system definition and to supply boundary conditions for the simulation tools.

The research partners also investigated and benchmarked the performance of newly developed catalytic technologies in order to determine the best catalyst components and preparation routes. The newly developed technology exhibited significant improvements compared with standard diesel oxidation catalysts.

Pagode also experimented with the incorporation of plasma treatment technology into the diesel exhaust line. Earlier results had been

disappointing in terms of energy efficiency and cost of materials, but initial results from the project's attempts to inject ozone suggest that this is one promising way of addressing these two challenges.

The project also synthesised its findings and tested them out on the HCCI engine with promising outcomes. Pagode's results will help the automotive industry to develop affordable and innovative technical solutions for the after-treatment of emissions in HCCI engines.

The project was coordinated by Peugeot Citroën Automobiles SA, based in France.

1 'Post-treatment for the next generation of diesel engines'.

Funded under the FP6 programme 'Sustainable development, global change and ecosystems'.
<http://cordis.europa.eu/marketplace> > search > offers > 7503

Smart glazing for energy savings

Window glazing can help heat buildings in winter but may sometimes cause overheating. New intelligent glazing technology has emerged to overcome the weaknesses of traditional window glazing.

Glass buildings and windows across Europe have been built or retrofitted with thermochromic glazing, a transparent layer that helps heat interior spaces intelligently. However, the same glazing can overheat these spaces in warmer periods, which pushes

up the energy needs of a building by up to 30%. This represents around 40% of total energy consumption in Europe, a significant amount that must be reduced.

The EU-funded Termoglaze¹ project developed a durable,

cost-effective and energy-efficient thermochromic glazing technology for different climate conditions. The new technology is based on a principle known as 'Atmospheric-pressure chemical-vapour deposition' (APCVD), allowing the glazing to respond to pressure and temperature.

APCVD demonstrated many advantages over existing glazing, most notably high shading and high heat gain at lower

temperatures, as well as low shading and low heat gain at higher temperatures. Improved visibility and transparency were also achieved.

In addition, glazing applications featuring a thermochromic pigment applied to polycarbonate — to reduce energy consumption — were developed for use in greenhouses. These different varieties of glazing have been designed for quicker production processes and significant cost-effectiveness, providing enhanced solutions at better prices.

The long-term results are set to bring important energy savings and increased competitiveness in Europe with respect to glazing technology.

The project was coordinated by Labor Srl, based in Italy.

1 'Production of thermochromic glazings for energy saving applications'.

Funded under the FP6 programme 'SME activities'.
<http://cordis.europa.eu/marketplace> > search > offers > 7076



ENERGY AND TRANSPORT



Next-generation solar systems for buildings

Technology to produce heat as well as electricity simultaneously from sunlight has recently reached an appropriate level of maturity and could help buildings reduce their carbon footprint.



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In the search for major consumers of energy, one needs look no further than the buildings we inhabit, be they residences or workplaces. Looking to a more sustainable

future, it makes sense to produce the energy as close to home, so to speak, as possible. This is where renewable energy sources (RES) can have a positive impact.

The EU-funded Multisolar¹ project examined the potential of incorporating solar panels into the structural elements of buildings. The aim was to cover not only electricity needs, but also requirements for hot water and heat.

The first challenge entailed making sure that the size of the system installed is adequate to satisfy the building's energy needs. For this reason, accurate estimates of the building's annual electricity, hot water and heating needs must be obtained. The ability of the Multisolar collectors to match these needs must also be determined, thus special equipment was developed to enable simultaneous measurement of various outputs.

Several existing buildings were then selected as case studies where the Multisolar collectors and sensors were installed.

Analysis of the data collected helped the Multisolar team define the system's components. It should also be noted that architects will have the choice of incorporating the special solar collectors into the roof as well as into the buildings' facade.

So while buildings may be energy hogs, there is hope that in the not so distant future they may have the capacity to become autonomous.

The project was coordinated by Millenium Electric TOU Inc, based in Israel.

1 'Development of an integrated solar system for buildings'.

Funded under the FP6 programme 'SME activities'.
<http://cordis.europa.eu/marketplace> > search > offers > 8169



Energy economy eyes gas cylinders

Home cooking and heating rely on gas cylinders in much of Europe. More efficient filling and less leakage can help realise important savings and keep the cylinders secure.



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Liquid gas cylinders form an important part of energy needs in European households, particularly for cooking and heating. As these are flammable gasses, the safety

of these cylinders is of utmost importance. Another key consideration is cost-efficiency through accurate filling.

The EU-funded TARE-IT¹ project worked to address these issues. The project developed effective ultrasonic scanning equipment for 'Liquefied petroleum gas' (LPG), butane and propane refilling centres and industries to detect corrosion leaks during filling. Team members overcame the technical challenges of using ultrasonic sensors to automatically detect residual weight during re-filling through novel software and systems.

The system could offer the over 7,500 filling and test stations with an alternative technology to identify 'tare' (unused amount in each cylinder). This will tackle leak detection, help reduce the EUR 1.2 million in waste among SMEs and enhance safety.

In all, the novel non-contact, non-destructive testing hybrid laser and air ultrasonic testing system can be applied in 30 seconds to verify leakages, pressure

and cylinder capacity used. It will represent a powerful tool in saving energy, improving delivery and increasing safety. Lastly, the emerging knowledge and research is considered important for learning about defects in steel and composite pressure cylinders, corrosion and cracks.

The project was coordinated by Norgaard Teknik A/S, based in Denmark.

1 'A novel tare identification and corrosion detection system to improve filling accuracy, productivity and safety for SME LPG, butane & propane gas vendors'.

Funded under the FP6 programme 'SME activities'.
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Going underground for optimal crops and yields

Researchers from the University of Nottingham in the United Kingdom have designed an innovative technique to study the underground world of plants. Presented in the journal Plant Physiology, the results of this study will lead to improved breeding techniques for crop varieties, as well as better yields.

The novel approach is based on the same X-ray technology used in hospital 'Computed tomography' (CT) scans. It integrates new image analysis software that can automatically distinguish the roots of plants from other soil-based materials.

The researchers, from the Centre for Plant Integrative Biology (CPIB), tested this approach on the roots of maize, wheat and tomato. They studied the architecture, what experts refer to as the shape and branching pattern, of roots in soil by using X-ray micro-computed tomography (micro-CT). The team then entered the information into the new RooTrak software, which enabled them to differentiate between roots and other soil elements.

'This technique is a hugely important advance,' says Dr Sacha Mooney, an expert in soil physics at the School of Biosciences. 'The application of X-ray CT for visualising roots has been limited because we simply couldn't see a large portion of the root structure. RooTrak has enabled us to overcome this and has opened up the use of the technology for exploring the key questions regarding how we can manipulate plants and soils for improving our food security.'

The innovative software works by obtaining a stack of virtual slices through the root-bearing soil. According to the researchers, RooTrak treats each slice as a movie frame. The slice's static roots are treated as moving objects that can be tracked. So the software can tell the difference between root and water or organic elements in the soil, doing away with any glitches resulting from other techniques. This latest technique offers a three-dimensional (3D) detailed and accurate root architecture.

'Thinking of micro-CT data as a sequence of images allows us to solve the problems caused by variations in the appearance of plant roots and the similarity of some roots to the surrounding soil,' says Tony Pridmore, head of data at CPIB and an expert in tracking and analysis software. 'This is important because we can now extract descriptions of root architecture quickly and objectively.'

Adds CPIB's Professor Malcolm Bennet, an expert in root biology: 'Root architecture critically influences nutrient and water uptake. A key impediment to genetic analysis of root architecture in crops grown in soil has been the ability to image

live roots. Recent advances in micro-CT and RooTrak software at Nottingham now make this possible.'

The Nottingham team has clinched a European Research Council (ERC) Advanced Investigator Grant, for a project called FUTUREROOTS1, worth EUR 3.5 million under the EU's Seventh Framework Programme (FP7). They will use this software along with an innovative micro-CT-based imaging approach to image the roots of wheat, and choose new varieties with optimal water and nutrient uptake efficiencies.

The new project is coordinated by the Centre for Plant Integrative Biology in the United Kingdom, supported by experts from Australia, Europe and Mexico.

1 'Redesigning root architecture for improved crop performance'.

Funded under the FP7 specific programme Ideas by the European research Council (ERC).
Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 24134

ENVIRONMENT AND SOCIETY

Consolidating efforts for environmental protection

An EU-funded initiative conducted multidisciplinary and comprehensive ecosystem studies of the Syr Darya River Basin and affected areas. Project outcomes highlighted severe problems and promoted the benefits of eco-education to improve conditions.

Irrigation practices in the former USSR, combined with inadequate agricultural policy and widespread use of pesticides, have led to chemical contamination and weakened soil fertility. This has resulted in reduced crop yields and has also affected biodiversity and human health. Although various organisations investigate and monitor the Syr Darya River Basin, a lack of coordination and funds does not bode well for any hope of improving conditions.

The Syr Darya¹ project was designed to consolidate important information and cooperation in investigations of the river basin. Project partners proposed that scientific activities aimed at the protection and sustainable management of various habitat types

must be coordinated for any positive outcomes.

Efforts in this direction included studies of various areas around the basin. Among others, these focused on animal life, geology, hydrology and population. They also took into account levels of local awareness relating to matters of environmental sustainability.

Four study areas located in Kazakhstan, each characterised by different natural conditions and various anthropogenic pressures, were determined at a project workshop. Studies identified the main threatening factors: these include reduction of the runoff volume of rivers leading to a deficit in fresh irrigation water, and reduction of arable land areas due to soil-cover



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degradation. It was discovered that local soils and agricultural products are also starting to show signs of contamination by heavy metals.

Syr Darya partners highlighted that 'Ecological education' (EE) in tested regions and in Kazakhstan must necessarily continue. Recommendations included integrating EE into folk pedagogies, across-the-board schools and higher education, as well as engaging non-governmental organisations (NGOs), governmental structures and international cooperation. The project also determined that a united EE

system for all age groups should incorporate new teaching methods from various countries and their adaption to national eco-conditions.

The project was coordinated by Warsaw University in Poland.

- 1 'Co-ordination of scientific activities towards elaboration of common strategy for environmental protection in Syr Darya River Basin, in Uzbekistan and Kazakhstan'.

Funded under the FP6 programme
'International cooperation'.
<http://cordis.europa.eu/marketplace> >
search > offers > 8328

Agriculture adjusts to climate change

New findings and recommendations that enable the agricultural sector to mitigate climate change will support Europe in its long-term goals and help keep the economy in top shape.

Agriculture in Europe, which is a vital part of putting food on the table for the continent's citizens, is under threat from global warming. The EU has acknowledged the urgent need to address the effects of climate change on agriculture.

The EU-funded project Adagio¹ studied solutions to address the effects of climate changes on agriculture. It examined large European regions (Mediterranean, Central Europe, Eastern Europe) and categorised them according to the needs required. The project then integrated climate change precautions into the EU's Common Agricultural Policy (CAP) and rural development initiatives.

Adagio surveyed farmers and stakeholders on the ground and combined existing research to identify potential risks and develop effective methods. It found that farmers resisted applying simple recommended measures to combat climate change. The project also revealed major differences in agriculture production to help it outline new regional strategies and policies.

After its analysis, Adagio found that optimising sowing and transplanting time, as well as selecting alternative species and varieties, represented the most ideal strategy for the Mediterranean. Improved irrigation and water use were also advocated.

With respect to Central Europe, the efficient use of agricultural, soil and water resources, in addition to changes in crops, sowing patterns and livestock practices were recommended. The solutions for Eastern Europe considered the region's transition to the free-market economy and incorporated socio-economic issues, giving way to viable new mitigation strategies.

Adagio produced recommendations for management practices on local, regional and national levels, in addition to an in-depth outline of risks and vulnerabilities for different countries. If properly applied, these results will lead to more efficient agriculture, a more sustainable economy and a better fed Europe.

The project was coordinated by the University of Natural Resources and Applied Life Sciences, Vienna, Austria.



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- 1 'Adaptation of agriculture in European regions at environmental risk under climate change'.

Funded under the FP6 programme
'Research for policy support'.
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search > offers > 8333

Helping small businesses to go green

Small and medium-sized enterprises (SMEs) often struggle to comply with legislation and international standards because of their limited resources. The Ecodis project was therefore set up to help SMEs develop environmental management practices and achieve international standards such as ISO 14001.



X-Mat system was produced that allowed businesses to monitor and manage their manufacturing processes and materials. The X-Pro module was developed for conducting life-cycle analyses, while the X-Rec was used to assess and determine different end-of-life scenarios. These systems helped manufacturers to design products that can be reused and recycled.

Ecodis¹ also helped to 'green' the supply chain through the transference of data and the traceability of information along the supply chain. The X-Change module enabled SMEs to monitor the environmental status of their suppliers thereby demonstrating to customers that they have followed eco-design principles. A roadmap was also developed for implementing an eco-design approach in the company that resulted in a 'Product-oriented environmental management system' (POEMS).

Success of the project has helped European SMEs meet their environmental commitments and demonstrate their compliance in achieving international standards. These enabled companies to be more environment-friendly and efficient by reviewing and improving their production processes, thus also allowing them to better compete in the global marketplace.

The project was coordinated by Ecodesign Interactive Systems in Paris, France.

The EU-funded initiative brought together industry associations and groupings (IAGs) from across Europe to help SMEs make their production processes more environment-friendly. The companies were involved in plastic conversion, mechanical processing, electrical goods and electronics manufacturing, and automotive parts

production. Project partners developed an innovative 'eco-design' platform that enabled companies to meet the requirements of their customers and legislators.

A tool kit for design teams was created that could be operated through installed software or over the Internet. An interactive

1 'Ecodesign interactive systems'.

Funded under the FP6 programme
'SME activities'.
<http://ecodis.europa.eu/marketplace> >
search > offers > 8371

Boosting fresh water production

A project focused on the feasibility of using existing plants for water production discovered this is possible with minimal costs. Results have the potential to widely impact the renewable energy sources approach in low-tech countries.

The Aqua solis¹ project set out to demonstrate that the technology of trough-type solar concentration plants is mature enough to be applied in relatively low-technology countries. The idea was to find applications of the Sixth Framework Programme-funded REACT² project, beyond heat and refrigeration.

The focus of the project was not the technical feasibility of the proposed applications, but the quantitative assessment of their potential economic and environmental benefits as compared to existing solutions. Thus, the aim of this Specific Support Action (SSA) was to perform a complete feasibility study in order to

investigate the possible applications of the REACT system in certain areas. The main possibilities considered by the project related to clean water production by processes such as solar distillation, atmospheric condensation and waste processing.

Aqua solis discovered that the technology used in such plants can be used to generate fresh water without additional costs for equipment. Also, this could be realised at times when there is an availability of excess energy that would otherwise be lost. Project partners conducted simulations of the proposed technologies, paying special attention to the generality of



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the system being investigated, with less regard for in-depth accuracy.

Study results showed that fresh water obtained from atmospheric humidity or from desalination using solar concentrating plants can be used to store solar energy and transform it into a useful product. The Aqua solis approach showed it was possible to use small-size plants for small communities where fresh water is a by-product of a multipurpose approach.

Future testing with real multi-generative plants is necessary to verify the economic gains that the Aqua solis study indicated are possible. Further work is also needed to better understand the economic and technical implications of producing fresh water from solar concentrating plants. Furthermore, Aqua solis proposed that careful assessments be conducted regarding the safety of distilled water for human consumption.

Overall, project outcomes indicated that the diffusion of plants that can produce water as an additional economic output to heating and cooling may be regarded as a boost for renewable energy. This has the potential to kick-start the diffusion of solar energy in Mediterranean countries.

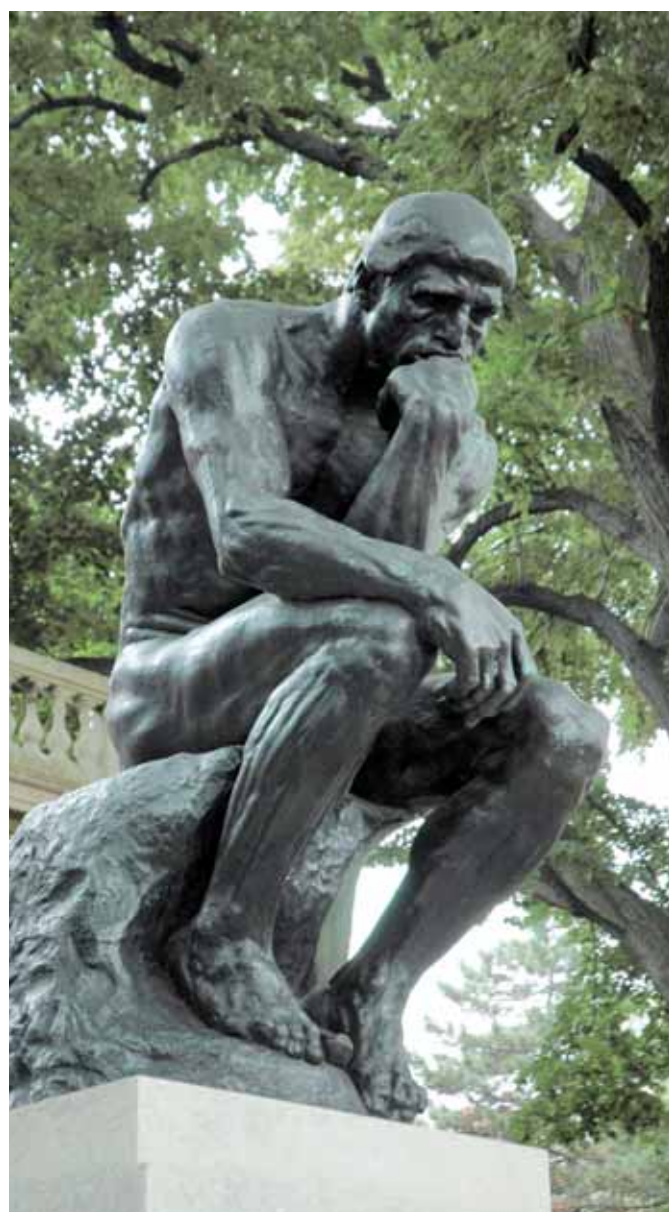
The project was coordinated by the Consorzio Interuniversitario Nazionale per la Scienza Tecnologia dei Materiali, in Florence, Italy.

- 1 'Innovative applications of solar trough concentration for quality fresh water production and waste water treatment by solar distillation'.
- 2 'Self-sufficient renewable energy air-conditioning system for Mediterranean countries'.

Funded under the FP6 programme
'International cooperation'.
<http://cordis.europa.eu/marketplace> >
search > offers > 8329

Europe's identity through philosophy

A 20th century Spanish philosopher who has drawn on contemporary German philosophy and Classical Greek philosophy can help us understand the roots of a true European identity.



José Ortega y Gasset, 1883-1955, was a great 20th century Spanish liberal philosopher who, along with Nietzsche, espoused perspectivism, a vision related to European thought first pioneered by Leibniz. The EU-funded Ogplie¹ project examined Europe's cultural reality and consciousness of life through local customs. It looked at notions of culture and cultural consciousness through a combination of philosophy and Spanish studies yet in the context of European studies.

The project aimed to highlight the philosopher's work as a pioneer in European integration. It examined how he combined Mediterranean and German thinking traditions as well as his own integrative philosophy of life, his concept of historical reason and his overall notion of Europe.

Ortega y Gasset saw European identity as a system of convictions, beliefs and common values resulting in European collective habits, public opinion, law and balance of power. Beliefs and common habits were the most important of these. He firmly believed in a common European identity, universality of reason, inalienable dignity and uniqueness of each human individual.

Furthermore, he saw that while we were conscious of our ideas, we lived in our beliefs making use of them unconsciously, and that the notion of Europe was a belief in which we lived. It was the reality in which we existed and projected our lives.

Interestingly, Ortega y Gasset justified many of his beliefs through Greek thought, advocating that discovery of reason as an independent reality and system gave birth to science, technology and philosophy. He saw man as different from other living creatures in that he had privileged access to the rationality which inhabited the world, a cosmos ordered according to principles of reason. With this, the philosopher concluded that Socrates' discovery of reason was the discovery of Europe, a theory which today could illuminate the European identity from an exciting new angle.

The project was coordinated by the Agencia Estatal Consejo Superior de Investigaciones Científicas in Madrid, Spain.

- 1 'Ortega y Gasset's philosophy of life and his idea of Europe'.

Funded under the FP7 specific programme
People (Marie-Curie actions).
<http://cordis.europa.eu/marketplace> >
search > offers > 8484

A Bronze Age identity for Europe

The dynamics of migration and cultural influences in the Bronze Age may hide more interaction among European peoples than meets the eye. A European team of young researchers investigates.



Europe in the Bronze Age, between 3000 BC and 500 BC, boasted enigmatic exchanges, unexpected migrations, transfer of intriguing artwork and discovery of strange tools. The EU-funded Forging Identities¹ project looked at inter-cultural mobility of peoples in the Bronze Age and their cultural links to the new metal.

Supported by research in archaeology, metallurgy, biochemistry and bone studies, the project investigated how movement of culture impacted social life during this epoch and how common identities emerged. Forging Identities also aimed at creating a network that would enhance the career prospects of young scholars through an interdisciplinary training strategy, strengthening European identity at the same time.

Forging Identities conducted summer schools in Hungary and Romania in addition to holding several science training courses related to the Bronze Age. Its results have so far brought forth many interesting conclusions on peoples and cultures of that time. For example, they revealed that although materials, ideas and people tended to migrate over short distances, some made it over much larger distances by

land and sea. These migrations influenced local cultures significantly, sowing the seeds of social change in new regions of the continent.

The ongoing project is expected to refine our knowledge about the Bronze Age and its cultural dynamics, adding a new twist to shared European history and interaction. The disciplines of history, science, archaeology and others stand to progress in novel ways given the project's exciting revelations.

The project was coordinated by the Institute of Anthropology Archaeology and Linguistics at Aarhus University in Denmark.

1 'Forging identities: the mobility of culture in Bronze Age Europe'.

Funded under the FP7 specific programme People (Marie-Curie actions).
<http://cordis.europa.eu/marketplace> >
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Encouraging debate that will shape the future

An EU-funded initiative worked to raise awareness of issues of convergence technologies in the social sciences and humanities. The vision was to mobilise European research capacities in this regard.

Relations, synergies or fusions between broad fields of research and development (R&D), such as biotechnology and the life sciences, nanoscience and nanotechnology, 'Information and communication technologies' (ICT), cognitive science and neurotechnologies, are at the core

of the 'Converging technologies' (CT) concept.

Discussions of fast-paced developments in these areas, including robotics and artificial intelligence (AI), are critical to examining the future impact of all science and engineering.

Given Europe's path toward a knowledge-based society, the relevant research community must be prepared to face and address a wide range of pertinent issues and questions.

The Specific Support Action (SSA), Contecs¹, was set up to

facilitate the establishment of a research agenda with regard to CT. Project partners thus set out to address the roles that the 'Social sciences and humanities' (SSH) could play in the phenomenon of technological convergence as well as their potential influence in its shaping. An integrated and systemic approach was also used to explore the ever important societal and ethical implications of developments in the field of CT >

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and ways in which SSH could best address them.

Europe has adopted a demand-driven approach that includes interdisciplinary cooperation, whereby CT are seen to respond to societal demands and needs. This aims to extend the focus on 'human enhancement', which is seen to have largely influenced the CT discourse and sparked debates across a broad range of related topics.

Contecs studied the historical and institutional origins of CT and focused on visions of trans-humanism, viewed as a powerful instrument in the shaping of this convergence. As such, the study

highlighted that decisions as to which SSH approaches are appropriate for arriving at a better understanding of CT are themselves shaped by the ontological politics. For example, the political construction of 'nano-convergence' in one particular country may point to the major role played by funding institutions in setting the relevant agenda or even determining its goals and content.

Members of the Contecs team also noted that methods of textual analysis can be used to understand the role of ontological politics in contemporary discussions and debates that do not explicitly attend to visions of

CT. That is, rather than contributing to policy debates on CT, they formulate questions and concerns about what CT might be, the work being carried out and by whom, and to which organisations or agencies actors are accountable.

All are vital to progressing discourse on CT and are the means by which scientists, academics and policy-makers, among others, learn how to speak about the phenomenon. Project efforts therefore highlight the importance of such discussions in contributing to a better understanding of CT.

The project was coordinated by the Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung in Munich, Germany.

- 1 'Converging technologies and their impact on social sciences and humanities'.

Funded under the FP6 programme
'Citizens and governance in a knowledge-based society'.
<http://cordis.europa.eu/marketplace> >
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Future Internet ... a thing of beauty and promise

The Internet world we live in today shows that we already depend on information technology for many fundamental aspects of our lives. We socialise, do banking, gamble, and book everything from holidays to hair appointments, all online. EU-funded research is helping to build a Future Internet that will take these transformations further.

'Growth in the future will depend more and more on harnessing information technology,' noted European Commission President José Manuel Barroso in his recent State of the Union speech, in which he emphasised the need for 'a digital single market, which will benefit each and every European by around EUR 1500 per year.'

The Internet of tomorrow, and the web of tomorrow, will need to be even more powerful, more connected, more intuitive and more a part of our everyday lives, at home, at work and on the move. This Internet of services, things and infrastructure, will include everything from smart appliances that talk to each other to clothes that monitor our health, from cars that can't crash to mobile technologies and cloud platforms that run our businesses. The Internet will truly become the all-pervasive nervous system of the planet.

The future, now!

This is the mantra of the Commission's 'Future Internet public-private partnership' (FI-PPP) which is working to deliver a 'shared vision for harmonised European-scale technology platforms and their implementation'. This means

bringing together the relevant policy, legal and regulatory frameworks and mechanisms to support the Digital Agenda for Europe — Europe's efforts to create an online 'Digital single market' spanning seamlessly across all 27 Member States, and, more broadly, an inclusive knowledge society.

The FI-WARE¹ project, the core platform for the FI-PPP, is working to boost the EU's global competitiveness by introducing an innovative infrastructure for cost-effective e-services creation and delivery, with the necessary quality of service guarantees. The key deliverables will be an open architecture and a reference implementation for a new service infrastructure, building on the reusable building blocks developed in earlier research projects. This infrastructure should support emerging Future Internet services and show quantifiable improvements in the productivity, reliability and cost of service development and delivery. Use-cases will include the 'environmental services', 'public safety' and 'logistics' sectors.

FI-PPP supports eight such 'use-case' projects which follow an industry-driven approach to the

R&D lifecycle. For example the Finseny use-case is taking a holistic view of the energy sector, from de-centralised generation to storage to demand, with the aim of developing smarter energy solutions and infrastructure to meet Europe's needs in 2020 and beyond. The project aims to identify the ICT requirements of 'Smart energy systems', leading to the definition of new solutions and standards, verified in large-scale pan-European smart energy trials. Project results should contribute to the emergence of sustainable 'smart energy infrastructure', based on new products and services, enabling new functionality while reducing costs and relieving the environment.

Another use-case, the FI-PPP Instant Mobility² project, has created a concept for a virtual 'transport and mobility Internet', a platform for services that supports radically new types of connected applications for different kinds of travellers. They will receive personalised and real-time solutions to help reach their destination according to current personal preferences and constraints, real-time traffic status and public transport availability along the journey. Local authorities, public transport operators and professional drivers should all benefit from the project's open



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information platform, enabling new ways of optimising urban traffic while enhancing the safety and privacy of travellers and promoting car sharing and car-pooling.

Working together

Apart from FI-PPP, the EU also supports hundreds of other research and technology-oriented collaborative projects, particularly in the domains of 'Pervasive and trusted network and service infrastructures', under the Seventh Framework Programme (FP7) for ICT research. Projects focus on a range of subjects from fundamental long-term research to more applied R&D, in domains such as Future Internet architecture, networks, media, search, services, applications, and more.

Take for example the IoT-A³ 'European light-house' integrated project, which is bringing new meaning to the 'Internet of Things' (IoT). The idea of a 'globally interconnected continuum of devices, objects and things' draws on advances in sensor technology and ubiquitous use of 'Radio frequency identification' (RFID) tags in everything from shopping bags to shipping crates. But with this mass of 'talking' things the Internet of yesterday is struggling to keep up, its foundations are creaking as the quantities of traffic and devices increase. IoT-A (where 'A' stands for architecture) is building and testing designs for a better, stronger and more secure foundation for the Future Internet to handle the growing needs of this Internet of things.

iCORE⁴ meanwhile plans to put IoT into a 'cognitive framework' to ensure users and stakeholders (owners of the 'things' or objects and the means of communication) can reap its benefits. According to the project team, the cognitive framework will include three levels of functionality: virtual objects (representations of real things like sensors and devices which shield the user from the underlying technologies), composite virtual objects (combinations of interoperable virtual objects and associated services) for delivering tailored services, and building blocks reflecting the user/stakeholder perspective.

One application being considered for these virtual objects and composites is the 'smart city', where information about a city (on entertainment, traffic, public services and utilities) is packaged, personalised and composed on the fly in readily usable formats and media. Other application domains for iCORE's cognitive framework could be 'smart meeting', 'smart home' and 'smart business' which offer value-added services through, for example, self-configuring networks and objects, and better interactivity among users.

From the Internet of Things, we venture to the Internet of innovation. Composing future Internet services on the fly turns users into service developers, blurring the separation between actors. According to the Webinos⁵ project, we need an open innovation community for web and

open-source (OS) technology with open-source governance. And we need to speed up the standardisation process of such open environments, giving multiple parties the chance to innovate collaboratively with their competitors, but in a clean 'sand-boxed' domain that minimises the commercial risk to the participants.

But there is no simple fix. The Webinos team offers some valuable insight in two key reports which present the industry landscape, and specific recommendations. The general thrust of Webinos' vision is that we need to provide the web with 'Application programming interfaces' (APIs – software modules with generic functionality available for use by anybody) which can run in any environment on any platform. Webinos sees itself as a communal asset offering paths to implement these universal APIs.

'We need to be able to share stuff socially and securely,' suggests Nick Allott of Webinos. APIs are the 'stuff' in this simple equation; the ability of one device to use another device's capability ('share'), and the need for people ('socially') to do this with confidence ('securely') in a standardised way. We also need 'true network innovation and optimised network behaviour', he says. We need to give consumers control over their data while at the time setting up open commercial ecosystems. And all this needs to be ubiquitous and interoperable. Mobile devices are important, stresses Mr Allott, but 'PCs count, cars count and TVs are important too.' It all needs to work everywhere.

And building networks

EU-funded projects are also deeply involved on the network side of the Future Internet. The SAIL project, for example, is working on what it calls 'scalable and adaptive internet solutions' but its chief focus is on developing technologies for the networks of the future, as well as the techniques to streamline the transition from today's networks to future concepts that can evolve.

As an industry-led consortium of operators, vendors and research institutions, the innovative tools developed will, according to Ericsson's Thomas Edwall, coordinator of the SAIL⁶ project, 'ensure broad acceptance within industry, and enhance the possibilities for standardisation of solutions fostering the networks of the future'. SAIL leverages state-of-the-art architectures and technologies in developing prototypes which it plans to test-drive in six scenarios and 21 use-cases built round three major dimensions in future networks: video, mobility and flash crowds.

As another example, the 4WARD⁷ project is developing networks and networked applications faster and easier, and has brought a fresh, 'clean-slate' approach to the Future Internet. Today's lack of adequate ways to design, optimise and interoperate new networks has

led to an architecture that is sub-optimal for many applications, and which cannot support further innovations. 4WARD overcomes this impasse through a set of radical architectural approaches. It aims to improve the design of interoperable and complementary network architectures, enabling the co-existence of multiple networks on common platforms through virtualisation of networking resources, and enhancing the utility of networks by making them self-managing. These innovations should improve communication end-to-end, from fibre backbones to wireless and sensor networks.

Meanwhile, the COAST⁸ project is building a content-centric network architecture meeting the demands of the Future Internet, in particular for network-wide service level agreements. In this case, users specify which content they need and the COAST framework finds and delivers the most relevant data in a fast and user-friendly way.

The user also has pride of place in the COMET⁹ project which is working on a 'content mediator architecture for content-aware networks'. This is important groundwork for the ever-growing quantities of user-generated content on the Internet. Finding content today usually means dedicated searches on well-known intermediaries, like online photo and video platforms or social networks. COMET is keen to unlock Internet search in readiness for the Future Internet. It will introduce a unified approach which includes a global naming scheme and tools to optimise both content source selection and distribution-mapping the content to the appropriate resources based on transmission requirements, user preferences and the network state.

What all the above Future Internet projects and initiatives illustrate is that the EU takes its commitments to the Digital Agenda very seriously. Though many of them face huge challenges, dealing with legacy systems and practices and the fast-changing Internet landscape, the size of the task only amplifies the measure of the achievement when EU-funded research delivers the goods.

'In this economic climate, politicians are forced to make radical decisions,' according to Zoran Stancic, Deputy Director General at the European Commission's DG Information Society and Media. 'But that decision should be to invest in the future.' And what better place to start than the Future Internet, he suggested.

The proposed EUR 80 billion budget for the EU's next research funding framework programme, Horizon 2020, already shows Europe's commitment to research and innovation as pillars of the Europe 2020 strategy of 'smart, sustainable and inclusive growth'. The Commission has proposed that the ICT funding under this new research programme should be

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increased by 46% in comparison to the current framework programme FP7. The EU's Digital Agenda has also ensured that almost EUR 9.2 billion will be available for building up the broadband infrastructure needed for the Future Internet through the Connecting Europe Facility (CEF).

These were some of the take-home messages offered by Mr Stancic and others at the recent Future Internet Assembly (FIA) held in Poznan under the auspices of the Polish EU Presidency. FIA is a collaboration of EU-funded projects which recognise the need to strengthen Europe's contribution to the Future Internet

to maintain its competitiveness in the global marketplace.

As services and applications become context aware, they will also be able to deliver more localised value to users. The Future Internet may therefore have the effect of bringing services back 'on shore' to European and local economies.

'We must innovate,' Mr Barroso has said. 'Modern industrial policy is about investing in research and innovation.'

When it comes to the Future Internet, we are already starting to see the results.

- 1 'Future Internet Core Platform'.
- 2 'Instant Mobility for Passengers and Goods'.
- 3 'Internet of Things Architecture'.
- 4 'Internet Connected Objects for Reconfigurable Ecosystems'.
- 5 'Secure WebOS Application Delivery Environment'.
- 6 'Scalable & Adaptive Internet solutions'.
- 7 'Architecture and design for the future Internet'.
- 8 'Content Aware Searching, retrieval and streaming'.
- 9 'Content Mediator architecture for content-aware networks'.

All projects mentioned in this article are funded under the FP7 specific programme Cooperation under the theme 'Information and communication technologies'.
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Satellites zoom in on the new Europe

Poland and other young EU States are warming up to satellite-based technology that could see 'Global positioning system' (GPS) and other satellite applications buoy their high-tech sector.

Europe's advanced satellite navigation system, Galileo, has enabled European businesses to employ state-of-the-art technology for different applications based on GPS and other satellite navigation features. The EU-funded Galileoapp¹ project sought to bring Galileo applications to more Member States.

Galileoapp helped advance research in Galileo-based applications and bring them closer

to the market. It also helped articulate national policy to facilitate use of these services. The project established the Galileo Information Point at the Space Research Centre of the Polish Academy of Sciences located in Poland's capital, Warsaw.

The Information Point brought the different players from Poland and beyond together, helping exploit Polish potential within Europe's 'Global navigation satellite

system' (GNSS) community. It promoted the Galileo programme in the country, provided information on it to stakeholders and raised public awareness on the technology's benefits.

In 2004 and 2005, Galileo Point organised many conferences in Poland on satellite navigation and the satellite-based augmentation system EGNOS, with emphasis on small and medium-sized enterprises (SMEs) in the

field. It also organised events in the Czech Republic and Latvia to strengthen cooperation in the field and replicate the success in Poland. The events provided important networking opportunities in the sector of satellite navigation and created positive media hype around the subject.

Dissemination of the project's efforts was realised through the project website and the development of a database containing Polish and foreign institutions to network in the GNSS field. Lastly, Galileo Point also published a book on the subject titled 'A positioning system Galileo: strategic, scientific and technical stakes'. These efforts will help enable Poland and other new Member States tap into satellite navigation and reap the economic rewards.

The project was coordinated by the Polish Academy of Sciences, based in Warsaw, Poland.

- 1 'Support for development and utilisation of Galileo applications in Poland and other accession countries'.

Funded under the FP6 programme 'Aeronautics and space'.
<http://cordis.europa.eu/marketplace> > search > offers > 8435



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New frontier: Chips transfer data at light speed

The computer industry is nearing a crisis: microchips get smaller and faster but they struggle to transfer data at sufficient speeds. Electrons flowing through standard chip connections are just too slow. Now EU-funded researchers have shown how chips with built-in lasers which use multiple wavelengths of light could in the future transmit data at terabit speeds.

Lasers are great for transmitting information. Every time you use the Internet or make a telephone call data, in the form of light pulses or photons, travels hundreds of kilometres through the optical fibre networks that crisscross the continent.

But the insides of computers still stick to old fashioned electronics. Microprocessors do their calculations with electrons, and they transfer data within and between chips using electrons too.

'Electronics is fast approaching a crunch point,' explains Dries Van Thourhout from the Department on Information Technology at Ghent University, an associated lab of imec, in Belgium. 'Up to now we have been trying to increase the speed of transistors, but that performance has stopped increasing now, it is just a question of packing more into a smaller space. But the biggest hindrance to performance is the speed of the connections between chips and devices. We call it the "interconnectivity bottleneck".'

Imagine a sweet factory which makes thousands of sweets per second, but the plant can only bag the sweets and dispatch them to the shops at a rate of a few hundred per second. Unless you slow down production you will end up with sweets piling up, rolling over the floor and clogging the system.

The powerful microprocessors in computers today use vast quantities of data and perform millions of calculations per second. You need to transfer this data around your computer (or your mobile phone for that matter). But the connections cannot keep up; they simply cannot shift electrons fast enough. The only way to cope is to slow down data production.

This is where light comes in: you can use lasers to send photons down silicon 'wires' (light at infra-red wavelengths travels remarkably well through silicon, says Mr

Van Thourhout) instead of electrons. But the speed of light is not why optical interconnects are better. The real trick is that light can be 'multiplexed'; basically you can send photons of different wavelengths through your interconnect at the same time. Use three wavelengths and you effectively triple the speed of data transmission.

Divide and conquer

With this in mind the Wadimos¹ project set out to develop a demonstration chip with multiplexing optical interconnects. The chip was based on technology developed in a predecessor project (PICMOS²) which created the first ever microchip with integrated microlaser light sources, thanks to a unique bonding 'glue' developed by the PICMOS partners.

'The PICMOS project was a great success. We showed that optical interconnects could be manufactured and that they would work,' says Mr Van Thourhout. 'But it is one thing to make and demonstrate something in the lab. You won't get chips like these into the mainstream or solve that interconnectivity bottleneck unless you can manufacture them at the industrial scale, making millions of them. PICMOS demonstrated the principle of optical interconnects. Wadimos is proving that multiplexing is possible and that the chips can be made in a standard CMOS fabrication plant.'

Europe's largest chip manufacturer STMicroelectronics has worked in collaboration with universities and research institutions from France and Italy and a Dutch SME which specialises in lithography (etching) for electronic components. Together these partners have extended the results of PICMOS and adapted them to more commercial manufacturing processes.

One of the biggest challenges was to replace the gold connections on the microlasers in the PICMOS prototype. 'You can't have gold in a chip fabrication plant,' explains Mr

Van Thourhout. 'Gold is a contaminant, so partner CEA-LETI developed a process that would mean the integrated lasers mounted on the chips could be connected using metals commonly used in chip manufacturing such as aluminium, titanium and titanium nitride.'

Belgian project partner imec has also worked to optimise the passive router structures in silicon and investigated the feasibility for their industrial production. Other project partners have contributed their expertise: the Lyon Institute of Nanotechnology (INL) in France demonstrated a new type of 'micro-source' for which you can control the output wavelength. INL also worked with STMicroelectronics to develop a way to simulate the optical network on a chip. Finally the University of Trento, Italy, designed and demonstrated a new type of silicon router which could be used to 'switch' photons down particular optical pathways.

Bringing these developments together, the Wadimos team has produced a network of eight fully interconnected silicon blocks. The researchers have demonstrated successful multiplexing across these connections and the feasibility of optical filtering to direct and control the passage of photons through the silicon interconnects and their subsequent detection.

There is still plenty of research to do, however, especially to keep the lasers working in the high temperature environment of a chip's surface. Mr Van Thourhout says that they will need to find new materials that can cope with the heat.

'Nevertheless, we are very hopeful that this approach will prove very successful in the long term,' he asserts. 'We are taking an exploratory approach.' He explains that other research groups, especially those in the US, have developed optical interconnects that use an 'off chip' laser source; the laser



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beam is split and redirected for each interconnect.

'These chips are more advanced and will soon be used in supercomputers,' says Mr Van Thourhout, 'and may eventually trickle down to mainstream computing, but in the long run it will be more efficient to have chips with integrated laser sources.'

'We expect the Wadimos interconnects to allow computer processing power to continue to increase and overcome the data transmission bottleneck. Our goal is to make optical interconnects a standard technology that will support the development of yet more powerful, smaller microprocessors capable of transferring data at rates of 100 terabits per second.'

The Wadimos project received EUR 2.3 million (of a total EUR 3.2 million project budget) in research funding under the EU's Seventh Framework Programme (FP7), ICT (Next-Generation Nanoelectronics Components and Electronics Integration) programme.

The project was coordinated by imec, based in Ghent, Belgium.

- 1 'Wavelength Division Multiplexed Photonic Layer on CMOS'.
- 2 'Photonic Interconnect Layer on CMOS by Waferscale Integration'.

Funded under the FP7 specific programme Cooperation under the theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 8361

Advancing computer-aided design

A European training network aims to upgrade existing computer-aided design (CAD) capabilities by devising new algorithms for more advanced representation of surfaces and three-dimensional (3D) shapes.



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CAD constitutes an integral part of the design and development process of many products. Current technology is based on classical and computational geometry. However, with the advent of information technology (IT) processing,

complex geometrical models can be easily digitised, posing a challenge for existing CAD.

To advance performance of CAD systems, the EU is funding researchers under the SAGA¹

training network. The main aim is to advance the mathematical foundations of CAD technology and offer the opportunity to learn geometric modelling both from the industrial and the fundamental mathematics perspectives.

The network is addressing the issue of implicit representation of shapes in CAD and focusing on geometric computing and algebraic tools. The aim is to combine real algebraic geometry and spline surface representation in CAD so that it can be extended to the theory of multivariate algebraic splines. Partners are in the process of developing different techniques for dealing with and manipulating procedural curves and surfaces by using evaluation schemes.

Another focus of the project involves the algebraic geometry for CAD applications. To meet the challenges of representing various surfaces and 3D volumes, as well as isogeometric

representations, scientists have adopted exact representations rather than approximate solutions. They have also addressed practical industrial problems such as accurate modelling of the structures of wood. Algorithms have been devised to allow computer-aided manufacturing and analysis of wooden products.

SAGA training is preparing young scientists to master the challenges of combining CAD and algebraic geometry. The project results are expected to improve existing CAD technology and further broaden its applications.

The project was coordinated by the Stiftelsen Sintef, based in Oslo, Norway.

1 'Shapes, geometry and algebra'.

Funded under the FP7 specific programme
People (Marie-Curie actions).
<http://cordis.europa.eu/marketplace> >
search > offers > 8473

Safer, more active and independent: the proven benefits of 'Ambient assisted-living' technology

Loneliness from being disconnected from friends and family, fears about health and safety and worries about security are some of the many burdens of old age. EU-funded researchers are proving how technology can alleviate the problems.



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'When I am less worried, I do not think about the fact that I'm alone': the words of an older Swedish person who participated in a recent trial of European technology that supports active ageing.

Like the person quoted above — who, according to carers, now talks about 'Ambient assisted-living' (AAL) technology 'a lot' — dozens of older people across Europe have recently experienced first-hand the benefits of ICT applications that can make them feel safer and more secure, monitor their health and help them stay in touch with family and friends.

As part of the EU-funded Monami¹ project, more than 80 elderly

people living alone and in care homes in Spain, Slovakia and Sweden tested a wide range of AAL applications.

'The user feels much better — he went to the patio to plant flowers because he feels safer with the panic button... he is willing to engage in more activities due to Monami,' noted one carer involved in the Slovakian trial.

'It affects her everyday life in terms of confidence and security. The user suffers from episodes of dizziness and now, with the Monami system, is much more confident and feels safer... (more confident especially in regards to not feeling alone),' observed another. ➤

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The trialled services use sensors, actuators and smart software as part of an ambient intelligent environment that communicates with users and carers via alarms, TVs, computers or mobile devices. The services were run on Monami's innovative open software platform, which allows bundles of applications to be easily installed and tailored to individual users' needs, overcoming the interoperability, customisation and scalability issues that have often hampered the roll-out of AAL systems to date.

With applications such as DoorSure, WindowSure and DoorVue older trial users of the Monami system were automatically alerted if their door or windows were left unlocked and they could check via a camera who was ringing the bell. With AppSure they were reminded if they had left the kettle or cooker on. And with PresenceVUE and SUREZone carers were alerted in the event of an accident, a health problem or if something in the home appeared to be amiss.

'Europe's population in general is getting older, and one side-effect of that is that increasing numbers of older people are living alone. They don't have their families close by and they need to find ways to cope: they might forget to take their medicine, turn off the stove or suffer an accident at home. They are in a risk zone that can be addressed by ICT,' explains Theresa Skehan, the Monami

project manager at the Swedish Institute of Assistive Technology (SIAT). 'Applications such as those deployed in the Monami trials give older people the support they need; they can deal with safety issues and make them more comfortable.'

Safer... and more independent

Indeed, applications focused on increasing safety and security were identified as the most beneficial features of the Monami system by the vast majority of trial users, particularly at test sites where older people were living at home alone rather than in assisted-living facilities.

The system not only made users 'feel' safer, it also made them safer. In one incident, also in Slovakia, Monami's SMOKESure fire alarm service enabled the son of an elderly trial user to awake his father after he had fallen asleep while making tea, preventing a fire.

Martin Knapp, the director of the Personal Social Services Research Unit of the London School of Economics, coordinated the Monami trials, which involved 87 users: 31 at a care home in Spain, 25 people living by themselves in Slovakia and 31 in Sweden, who were also living alone. Users filled in questionnaires about how they thought the technology might help them before the start of the trials and were then reassessed after using

the Monami applications for two or three months.

Knapp notes that besides the direct benefits of the technology, such as making older people feel safer and more secure, there were also many less tangible ones.

'Most of the people involved in the trials had not had much exposure to computers or smart phones before — for many of them it was a real revelation,' Knapp says. 'Though in some cases there was resistance to the technology at first, after a while, many people started using not only the Monami applications but became interested in using the devices for other purposes such as going on the Internet or communicating with family. One man in Sweden was really happy when he found he could receive photos on his phone of his grandchildren who live in another part of the country.'

In Slovakia, for example, one carer reported that an older woman she was taking care of 'learnt how to use Skype, and now uses it regularly and independently. She didn't even have an interest before.'

It also gave users something new to focus on and become involved with: 'The user is occupied with the technology and not so oriented towards his health problems. They can talk about something else since Monami was installed,' another Slovakian carer noted.

For their part, carers were also highly appreciative of the benefits of the technology, noting, among other things, that it gives them greater peace of mind that the people they are looking after are ok and that they can be more active and independent than before.

'The carer feels freer when she is not taking care of the user. She is less worried and more relaxed,' evaluators of the Slovakian trial noted. They added: 'One care staff would recommend the MonAMI system "to all elderly — everyone over 70 should have the possibility to have such a system".'

Since the project ended in May 2011, the Monami partners have gone on to form part of the AAL Open Association (AALOA), an alliance of more than 40 AAL-focused European research projects set up to help create an open market for AAL technologies.

Information Source: Theresa Skehan, Swedish Institute of Assistive Technology (SIAT), & Martin Knapp, director of the Personal Social Services Research Unit of the London School of Economics

1 'Mainstreaming on ambient intelligence'.

Funded under the FP7 specific programme Cooperation under the theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 7989

Phase-sensitive optical data transmission: a new frontier

Fibre-optic cables are becoming the backbone of the Internet, from the main trunk lines between cities, countries and continents to the network of cables running from telephone central offices to individual homes and mobile phone base stations. A pioneering approach to data transmission, supported by EU funding, promises to increase the capacity, range and efficiency of fibre-optic networks.

Traditionally, commercial fibre-optic communications have relied on encoding the data in the amplitude of a light beam (varying the intensity of the light to transmit information). Placing devices called 'Erbium-doped fibre amplifiers' at intervals along the fibre to periodically boost signal strength overcomes propagation loss,

but provides a relatively inefficient use of fibre potential.

Using the phase, rather than amplitude, of a light beam to encode data can potentially offer exponential increase in the information carrying capacity. But the extent of the improvement possible is limited: due to

noise added during optical amplification and cross-talk between the different wavelength channels caused by non-linear optical interactions.

'Fibre-optic cable has huge data carrying capability and commercial systems still have orders of magnitude excess capacity, but in recent years we

have started to hit the practical limits in laboratory research using existing transmission techniques and conventional optical amplifier technology,' explains Professor David Richardson, Deputy Director of the Optoelectronics Research Centre (ORC) of the University of Southampton in the United Kingdom.

'Phase-sensitive amplification' (PSA) was identified theoretically as long ago as the 1960s as a potential means to amplify optical signals without adding noise. More recently it was demonstrated that it offered a means to remove phase noise (and to a lesser extent amplitude noise) from optical signals degraded during transmission — a function known as 'optical regeneration.'

Realising that improvements in optical component technology meant that a practical PSA might now be possible, a team of researchers from eight partner organisations in seven countries launched the Phasors¹ project. Supported by EUR 2.7 million in funding from the European Commission, their work has helped phase-sensitive fibre amplifiers make the leap from theoretical curiosities to practical devices.

Cutting noise and channel cross-talk

'We knew that PSA should allow very low noise amplification as well as the removal of phase noise within optical communication systems, but there were big technological challenges ahead of us,' Prof Richardson, the scientific coordinator of Phasors, says. 'We successfully showed that PSA is possible, in a practical setting, and demonstrated many of its beneficial noise reduction properties along with the associated enhancements in network performance.'

Focusing on developing the technology for 40 gigabit-per-second (Gbps) broadband core networks, the Phasors team demonstrated two main devices — a phase sensitive amplifier and an optical regenerator for phase-encoded signals — that showed dramatic reductions in transmission system noise.

Phase noise — rapid, short-term, random fluctuations in the phase of a signal — is caused by a variety of processes, including quantum noise added in the amplification process, and signals on different wavelengths interacting with each other in the same transmission fibre. It degrades signal fidelity and impedes network performance.

Unlike traditional amplifiers which are phase-insensitive, the Phasors amplifier is phase-sensitive and was shown to reduce the noise figure to just above 1 dB. That compares with

traditional erbium-doped fibre amplifiers which have a noise figure of at least 3 dB, and typically closer to 5 dB.

'Achieving noiseless optical amplification is the ultimate dream in optical amplifier research,' Prof Richardson notes. 'The Phasors amplifiers certainly represent a major step in that direction.'

The Phasors optical regeneration sub-system eliminates interference for high-speed binary-phase-encoded signals. Whereas previous signal regeneration devices convert the optical signal into an electronic signal, slowing data transmission rates, the Phasors device directly reduces both phase-noise and amplitude-noise build-up, all within the optical domain.

The project also demonstrated the possibility of scaling the basic regeneration approach to allow the regeneration of signals with far higher levels of phase encoding than just binary, for example showing regeneration of 'Quadrature (four-level) phase-shift keying' (QPSK) for the first time.

'When we started Phasors we set out to show what is and isn't possible with all-optical signal processing and the amplification of phase-encoded signals. These devices demonstrate that the technology does work, not just in theory but in practice, and enable some very useful and enabling functionality,' Prof Richardson explains.

From research to commercial applications

With many researchers in Europe, the United States and elsewhere following up the work of the Phasors team, the researchers' achievements, in the long term, promise to enable significant improvements in the speed, capacity, range and efficiency of fibre-optic networks. In addition, the technology has important applications in a range of other fields such as optical test and measurement, sensing, and metrology.

Members of the Phasors consortium are developing commercial devices and technologies on the back of the significant advances made within the project. Components, including specialty optical fibres and high performance lasers, are already generating significant sales. Swedish partner EXFO, a global telecom test and service assurance solutions provider, has developed and is selling a test and



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measurement device for characterising complex phase and amplitude encoded signals based on their work within the project.

'Although the Phasors project is now over, its impact is certain to be felt for a long time into the future,' Prof Richardson explains. 'High performance components and measurement systems are already on the market and research interest in the area of PSA technology in telecommunications and adjacent application areas is increasing. In Europe alone there are a number of nationally funded projects continuing on from our research, and there are several other major projects starting around the world.'

'Phasors has also generated a lot of interest academically,' he continues. 'A significant number of high profile papers^{2, 3} have been published in leading scientific journals such as *Nature Photonics*, and we've presented prestigious papers at major international conferences, including most recently at the European Conference on Optical Communications (ECOC 2011)

held in Geneva Switzerland and the Optical Fiber Communications Conference (OFC 2012) in the United States where a substantial number of papers were presented on phase sensitive optical signal processing.'

The project was coordinated by the Optoelectronics Research Centre (ORC) at the University of Southampton in the United Kingdom.

- 1 'Phase Sensitive Amplifier Systems and Optical Regenerators and their applications'.
- 2 'All-optical phase and amplitude regenerator for next-generation telecommunications systems', *Nature Photonics* 4, 690–695, 2010.
- 3 'Multilevel quantization of optical phase in a novel coherent parametric mixer architecture', *Nature Photonics* 5, 748–752, 2011.

Funded under the FP7 specific programme Cooperation under the theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 8486

IT AND TELECOMMUNICATIONS

Enhanced metals separation for electronics recycling

Electrical equipment includes a huge range of products from simple hair dryers to complex computers and mobile phones. EU-funded researchers applied advanced spectral methods to enhance effective separation and recycling of equipment with important benefits for business, consumers and the environment.

All objects reflect, absorb or emit electromagnetic (EM) radiation based on their specific compositions. Multi- and hyper-spectral imagers evaluate the spectral 'fingerprint' of materials enabling identification of components. European researchers set out to employ spectral technology for the separation of metals in 'Waste from electric and electronic equipment' (WEEE).

The EU-funded Sormen¹ project focused on overcoming shortcomings of current separation technology that is primarily manual and thus labour and time intensive as well as incapable of producing pure recycled materials.

Non-ferrous metals such as aluminium, copper and lead account for approximately 13% of total WEEE weight. Current recycling technology produces waste fractions of small size that still contain significant quantities of non-ferrous metals and stainless steel, decreasing the value of the scrap and thus the price at which it can be sold by the recycling small and medium-sized enterprises (SMEs).

Researchers developed a classification algorithm, for use with multi- and hyper-spectral analysis, capable of perfectly separating metals in a sample. Such classification was previously unattainable manually for metal

pieces of similar shape, size and colour in the visible spectrum, such as is the case with aluminium and stainless steel.

The algorithm was integrated with a camera, an illumination module, a feeder-transportation-separation module and a controller producing a fully automated system for separation of non-ferrous metals from WEEE, as well as the capability of separating aluminium from stainless steel previously impossible with conventional methods.

Sormen project researchers thus delivered an automated system for separation of metals in WEEE. The system has the potential to significantly increase the competitiveness of European recycling SMEs via reduction in processing and labour time as well as enhancement in purity of final product, enabling resale at a higher price. In addition, commercialisation of the

method could help reduce costs associated with destruction, disposal and land filling, and contribute to sustainability of the huge worldwide electric and electronic components sector.

The project was coordinated by the Fundacion Robotiker in Zamudio, Spain.

- 1 'Innovative separation method non-Ferrous metal waste from electric and electronic equipment WEEE based on multi and hyper spectral Identification'.

Funded under the FP6 programme 'SME activities'.
[http://cordis.europa.eu/marketplace > search > offers > 8436](http://cordis.europa.eu/marketplace/search)





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Interview: the EU's initiatives on 'Factories of the Future'

The public-private partnership (PPP) for 'Factories of the Future' (FoF) aims 'to help EU manufacturing enterprises, in particular SMEs, to adapt to global competitive pressures by improving the technological base of EU manufacturing across a broad range of sectors.'

The research programme is financed jointly by industry and the European Commission under the Seventh Framework Programme for Research (FP7) and issues coordinated calls for research proposals every July. It is one of the three PPPs the European Commission announced in November 2008 — intended to develop clean technologies for cars, construction and manufacturing — endorsed by the European Council in December 2008.

The REFORM¹ project, funded by the 'Factories of the Future' PPP, is developing cleaner and more resource-efficient manufacturing processes for composite components — for use in different industrial sectors, such as transport, energy and construction. The project focuses on 'Fibre-reinforced polymer' (FRP) composites, which can reduce weight and allow for innovative designs that have a lighter energy footprint over the course of the service-life of products they are used in.

In order to move to a total life-cycle approach, one that includes the manufacturing process and the product's end-of-life reuse, recycling or disposal, REFORM is working to improve the manufacturing of FRP components. The team are developing environmentally-friendly process technologies for forming, machining

(including cutting and trimming), assembly and recycling, as well methods for integrating these technologies into the eco-factory of the future.

In order to learn more, *research*eu magazine* asked Richard Scaife, project manager for REFORM at the University of Sheffield in the United Kingdom, to explain.

What are the main themes and objectives of the REFORM project?

The main theme of REFORM is green production of composites components. We are looking at every phase of the manufacturing process and trying to reduce the environmental impact. This means that the project has a very wide range and focuses on issues from lay-up and curing to cutting, assembly and handling, as well as recycling and later re-use of the recycled fibres. Our aim is to contribute to the EU Ecolabel for composites production.

What is new or innovative about the project and the way it is addressing these issues?

REFORM takes into account the whole life-cycle of composites production. We are using real industrial parts from a number of sectors — aerospace, automotive, civil engineering and maritime — to focus the research and

ensure that it meets industrial needs and produces practical results.

We are not just looking at measuring the current environmental impact, but in improving every part of the process and creating a business case for producers to show the benefits of environmentally-friendly production. The interesting thing about REFORM is that it considers the whole life-cycle of single parts, so we will measure the impact of every aspect of the process chain and try to reduce it. This will ensure that improvements in one area of the chain don't lead to higher impacts up or downstream.

What first drew you to research in this area?

The pressure on everyone to reduce energy use, particularly in the transport sector, is pushing the use of composites, which are increasingly being used in many applications due to their high strength to weight ratio. This allows them to replace metal alloys in many areas, where low-weight high-strength products are needed.

Currently the manufacturing process is not very green and there is an issue with recycling and reclaiming fibres. These are



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usually chopped up during the recovery process, which means they can't be used for large parts — such as those in civil engineering applications — which require long, virgin fibres to ensure part quality. It's an exciting area in which to work, which is going to become a lot more important in the near future.

What are the advantages of participating in an EU PPP?

The partnership has given the end-users the opportunity to be involved in the project, which brings valuable information to the consortium. It also allows us to work with experts in the field from across Europe and gives us a wider base through which to disseminate our results.

By their nature, PPPs are very close to market, which is an advantage for us as it means that the benefits from the project will very quickly be seen in industry. The PPP also gives us access to a number of dissemination channels and to EU support, such as links to the standardisation bodies — which are very helpful when trying to create new best-practice guidelines.



Richard Scaife, © REFORM Project

What are some of the difficulties you have encountered?

We are a very young project, as we only started six months ago, so we haven't encountered any real difficulties. A large challenge is to choose representative case-study parts that will present a real research problem, and allow a broad scope for research.

As with any project, it can be hard to get accurate data where there are issues of commercial confidentiality, or where the environmental impact will vary with the part made and parameters used, so it's important to measure impacts ourselves, rather than relying on aggregate data from machine tool manufacturers.

Problems can also arise when considering what to measure, so it's important to work closely with other projects to ensure compatibility and correlation of results.

How do you go about solving them?

The case study parts will be carefully chosen to make sure they represent real challenges for the researchers, and that improvements can be made along the manufacturing chain. Partners will measure the current impact of production, in order to provide a baseline against which REFORM benefits can be quantified at the end of the project. We have also made links to other projects to make sure that the methodologies used in the project meet all existing standards and are compatible with their results.

Are there any results from the research so far?

As we have only just started, we do not have many results yet. We have carried out some preliminary experiments on cutting of composites and have a paper out at the 2012 'International conference on water jetting' in Ottawa, Canada in September.

We have also developed some models for the water-jet cutting of straight cuts which predict the taper, jet lag and cutting quality, based on the 'machinability' of the material, the thickness of the part and other process parameters.

We have already produced a draft handbook of appropriate joining and assembly methods, which will be refined in the next stages of the project. We are also investigating easy solutions for projecting instructions during hand-layup, which can be implemented in the short term by partner companies.

What are the next steps of the project, or next topics for your research?

The next steps in our work are to carry out 'Gap analysis' on one of the case studies so we can see where it would be best to focus our efforts. This will allow us to fully investigate the most appropriate technologies for laying up, machining, joining and recycling composite parts.

We are also liaising with the EU on the best way of contributing to the Ecolabel, and investigating promising recycling methodologies.

- 1 'Resource-Efficient Factory Of Recyclable Manufacturing composite components'.

For further information:

For more on the project, please consult the REFORM project website:
<http://www.shf.ac.uk/>
 For more on the EU Ecolabel, please see: <http://ec.europa.eu/environment/ecolabel/>

New method to clean and treat polluted water for extraction of chemicals

Scientists in Poland have discovered an easy way to clean and treat polluted water for the extraction of valuable chemicals, such as those used in drug production. There is no need for the use of plants or factories; only the Sun and a 'magic' powder are required.

Researchers from the Institute of Physical Chemistry of the Polish Academy of Sciences (IPC PAS) in Warsaw say this almost alchemical transformation is made possible by

photocatalysts. The study, presented in the journal *Bioresource Technology*, was funded in part by the PHOTOBIO23JC¹ project, which is backed with a Marie-Curie International Reintegration



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grant worth EUR 100 000 under the EU's Seventh Framework Programme (FP7).

There are areas of our planet where water is highly polluted by organic chemicals from industrial waste. Thanks to the work carried out by the Polish team, we know that the biomass can be successfully transformed into chemicals and fuel. Photocatalysts facilitate the transformation of polluted water into clean water. Another advantage is that specialised facilities are not needed, as the transformation occurs under conditions that are commonly found in nature.

Typically, catalysts support or accelerate chemical reactions, and recover once the reaction is finished. Catalysts are often activated only at high temperatures and pressures.

'Photocatalysts studied by us differ in many respects from traditional catalysts,' says Dr Juan

Carlos Colmenares from the IPC PAS. 'They are activated by light, and the temperature has no significant effect here.'

With support from the photocatalysts, the key reactions studied by the project occur with exposure to the sun's rays, at temperatures of around 30° Celsius and in normal atmospheric pressure. These conditions, say the researchers, occur naturally in many equatorial countries all year round.

The photocatalysts are solids based on titanium dioxide, TiO₂. The catalysed reaction occurs in liquids containing organic pollutants. Once the reaction is completed, the catalyst can be isolated almost without losses and used again, according to the team.

'My work somewhat resembles alchemy,' Dr Colmenares comments. 'I take a "magic" powder, pour it into polluted water, stir and expose to the Sun. After

several hours, I get clean water plus chemicals that can be used to make useful things, for instance drugs.'

Since the 1960s, researchers around the world have been investigating the photochemical degradation of pollutants, often using intense ultraviolet (UV) irradiation.

The work conducted by the IPC PAS team targeted a reaction that can occur without the use of specialised equipment. They also targeted processes for the degradation of biomass that stop at a precisely defined stage. The researchers generated carboxylic acids through titania-based photocatalysis. These acids then have uses for the pharmaceutical and food industries, among others.

Says Dr Colmenares: 'In laboratory conditions, the reactions of the biomass with participation of photocatalysts are already

promising. In this year we are going to attempt the first tests in the pilot biochemical photoreactors at the University of Cordoba, Spain. The reactions will occur there in liquids with volumes measured in tens of litres.'

The project was coordinated by the Institute of Physical Chemistry of the Polish Academy of Sciences (IPC PAS) in Poland.

1 'Synthesis of novel nanostructured metal-supported photocatalysts: characterization and promising applications in the production of high value chemicals from lignocellulosic biomass'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions). Promoted through the Research Information Centre. <http://ec.europa.eu/research/infocentre> > search > 24013



Enhancing Europe's mechatronics paradigm

Mechatronics combines mechanical, electronic, computer, software, control, and systems design engineering to design and manufacture useful products. The approach combines various engineering disciplines so as to improve functionality.

The Eumecha-pro¹ project worked to improve prospects for the European mechatronics research community by envisioning production systems for factories of the future. The EU-funded project approached its goal using a commonly agreed strategy and through strong cooperation with industry.

Various Eumecha-pro activities resulted in the development of industry roadmaps and research roadmaps. Industry roadmaps, established for various production equipment sectors, offer a structured view of future industrial expectations. Emerging technologies and integrated design approaches were linked to industry requirements and highlight novel industrial opportunities. Research roadmaps have industrial targets orienting research towards market needs and provide a

common framework for the efficient coordination of Europe's research resources.

Other project efforts concentrated on promoting the practice of the mechatronics design paradigm in industry. Team members identified best practices of mechatronic design, which were then promoted through industry-oriented workshops.

A better educational framework was investigated so that manufacturing industries can benefit from the excellence of young mechatronic engineers. This entailed the analysis of mechatronics education requirements and approaches, and resulted in a European vision on how to improve related education efforts while at the same time making them more uniform across Europe.



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Eumecha-pro project members also managed to improve the coordination of various research and development funding mechanisms. This was achieved by entering project outcomes into the 'Eureka factory' platform and the European Commission's Manufuture initiative. Information was exchanged, shared and made accessible through the Internet, publications and a series of small committee network meetings.

The project was coordinated by Agoria ASBL, based in Belgium.

1 'European mechatronics for a new generation of production systems'.

Funded under the FP6 programme 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices'. <http://cordis.europa.eu/marketplace> > search > offers > 7021

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Improved industrial robots are more versatile

An EU-funded project successfully applied new technology to improve the performance of robots in the workplace. This marks a step forward in industrial robot design.

The goal of the Arflex¹ project was to improve industrial robots through application of the latest technology. Researchers employed advanced control theory, sensors and electronic embedded systems to enhance robot performance in industry, as well as extend it to small and medium-sized enterprises (SMEs) and new applications.

Project partners began with existing state-of-the-art industrial robots, improving their flexibility, adaptability and the range of tasks they could carry out on the factory floor. This was done

by introducing a new sensor system that enabled a higher level of control to be achieved by generating a correcting command. The command can be added to the reference signal from the user interface in order to obtain the expected level of improvement in the robot's performance.

Research conducted by the Arflex consortium stands to have a significant impact on the industrial robot sector, which can be extended to all manufacturing systems. This will be achieved through the intimate integration of mechanical engineering with



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electronics, by embedding intelligent sensors and control theory into the design of advanced software and hardware technologies.

The success of the Arflex project will also enable European manufacturers of industrial robots to compete more effectively in the world market.

The project was coordinated by EICAS Automazione S.p.A. in Italy.

- 1 'Adaptive robots for flexible manufacturing systems'.

Funded under the FP6 programme 'Information society technologies'.
<http://cordis.europa.eu/marketplace>
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Better coordination for micro- and nano-manufacturing

'Micro-nano-manufacturing technologies' (MNMTs) are emerging at an accelerated rate requiring coordination of research activities in a way that links organisations and initiatives on national and international levels, disseminates and promotes results, and facilitates their rapid passage from laboratory to industry. EU-funded researchers have established a related technology platform and research agenda that promises to do just that.

EU-funded researchers developed the Microsapient¹ project to create and implement a focused and sustainable European-wide infrastructure and roadmap linking MNMTs in support of a number of critical EU sectors.

The consortium sought to broaden the range of micro-systems-based products, and enhance their capabilities with new materials and processes compatible with current integrated circuit-based industrial fabrication methods.

A thorough analysis of emerging projects, and gaps preventing their industrial integration, enabled three critical and lasting contributions to the coordination of European MNMT projects. First, the project consortium formed the 'Micro- and nano-manufacturing' (MINAM) European Technology Platform (ETP). Second, it created the associated Strategic Research Agenda (SRA) consisting of manufacturing roadmaps subsequently used to formulate Seventh Framework Programme (FP7) calls for proposals. Finally, the Microsapient project team created the project website and published a project newsletter both aligned with MINAM.

In addition to the above, numerous promotional activities were undertaken including presentations at key European, Asian and North American forums.

The Microsapient project made significant progress in establishing coordination and consolidation entities for European micro- and nano-manufacturing research and technology development (RTD) as well as providing roadmaps for related strategic research plans. Better coordination of MNMT projects should help facilitate an expansion of micro-systems-based products and capabilities and position the EU as a leader in MNMT.

The project was coordinated by the University of Nottingham, the United Kingdom.

- 1 'Synergetic process integration for efficient micro and nano manufacture'.

Funded under the FP6 programme 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices'.
<http://cordis.europa.eu/marketplace>
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INDUSTRIAL TECHNOLOGIES



Painting goes high-tech

An eco-friendly robotic painting system can save on paint and speed up production considerably.

Europe is differentiating itself on the world market by offering more competitive, scalable and user-friendly solutions for different sectors of industry and manufacturing. Automatic painting systems can be improved on and robotised to offer quicker, better production methods.

The EU-funded Eco2Painter¹ project developed new technology for self-programming painting robots that are capable of learning. The technology can enable eco-efficient, high-quality painting up to 100 times more quickly than conventional methods and for much smaller batches if needed.

The technology is based on sensors used to closely study and deconstruct the object to be painted. The project team developed a prototype robotic painting system that programmes itself by using a 3D 'what we see is what we paint' approach. The system offers minimal down-times and products changes, reducing the amount of paint used and increasing quality. This is enhanced by improved scheduling and the ability to deal with complex surface geometries and critical regions.

In more specific terms, the new technology can control the smoothness of the paint, as well as motion and paint strokes. Thus, it considerably minimises unnecessary strokes and overspray.

There is even the ability to specify paint direction for certain parts.

Project results are expected to bring an eco-friendly and rapid method of painting for use by industry. This will empower small and medium-sized enterprises (SMEs) to respond better to market needs and become more competitive.

The project was coordinated by Profactor GmbH, in Austria.



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1 'Economical and ecological high quality painting at highly scalable batch sizes'.

Funded under the FP6 programme 'SME activities'.
<http://cordis.europa.eu/marketplace> >
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Making smaller better with nano-manufacturing

'Micro- and nano-manufacturing' is a relatively new term that does not have a standard definition. Most generally, it refers to manufacturing processes or products that have to do with objects on the scale of one micron (1 one millionth of a metre) or measured in nanometres (one billionth of a metre, on the scale of atoms and molecules).

Although many industries have been making parts on the scale of microns for some time, the focus is increasingly on smaller and smaller components with more and more capabilities, particularly in the medical and electronics industries.

The Ipmman¹ project was designed to provide a strategic roadmap for European micro- and nano-manufacturing. The research group focused on all application possibilities with potential industrial added value. In addition, they concluded that development of this sector requires totally new manufacturing methods, not simply adaptation of macro-manufacturing techniques.

Finally, the researchers collaborated closely with industrial end-users to ensure commercial relevance of conclusions as well as provide justification for recommendations to the European Commission.

In summary, the Ipmman project successfully defined a strategic roadmap for the European manufacturing sector regarding micro- and nano-manufacturing. The results will be presented to the European Commission with important implications for future research and technology development in this very important technology sector.

The project was coordinated by Profactor GmbH, in Austria.



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1 'Improvement of industrial production integrating macro-, micro- and nanotechnologies for more flexible and efficient manufacturing'.

Funded under the FP6 programme 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices'.
<http://cordis.europa.eu/marketplace> >
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INDUSTRIAL TECHNOLOGIES



Mimicking marine organisms to design novel materials

A European initiative is developing polymers inspired by marine organisms for various consumer and industrial applications.

Synthesis of biomimetic materials, inspired by various biological systems, constitutes a popular research field with great applicability. In line with this, the project Blue4glue¹ is studying bio-adhesives used by marine organisms and which have the ability to work in the presence of water.

The EU-funded Blue4glue project is a partnership between two European academic institutions and Procter and Gamble (P&G) technical centres. The plan is to either develop bio-adhesive compounds with synthetic methods or extract them from natural marine organisms, for utilisation in various consumer products.

Partners have followed the 'Fluorenylmethyloxycarbonyl' (Fmoc) 'Solid-phase peptide synthesis' (SPPS) technique to synthesise peptides with repeating sequences, modified with Dopa amino-acids to create a strong

bond with various surfaces. These peptides mimic the efficient water-resistant adhesive mechanisms of the substrates of marine organisms. They are subsequently connected to 'Polyvinyl chloride' (PVC), PEG and silicon polymers and the resulting biopolymers are tested for their interaction with hard surfaces.

The biopolymer synthesis is being optimised and the adsorption onto surfaces is being monitored using the optical method of ellipsometry. Several model biopolymers have been tested for their ability to adhere to any surface and act as deposition aid for home and healthcare products. Polymers with adhesive release properties have also been generated for production of anti-sticking films.

Blue4glue deliverables to date demonstrate the applicability of basic scientific knowledge for development of industrial



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products. The synthesised biopolymers have the potential to meet the challenges of a fast-moving world of consumer products and improve on existing technologies.

The project was coordinated by Procter and Gamble, based in the United Kingdom.

- 1 'Reinforcing capacity towards industrially relevant research on bio-inspired materials and delivery mechanisms'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
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New cost-effective, eco-friendly steel packaging cans



EU-funded researchers sought to develop industrial-scale production processes for polymer-coated sheet steel and associated steel-based cans. Outcomes will potentially satisfy consumer demand for more attractive designs while reducing manufacturing costs and protecting the environment.

Numerous consumer products from soft drinks to foods to paints and more are packaged in metal cans of various types. The choice of material (typically aluminium, tin or steel) depends in part on the contents, with considerations including whether the product is food or drink, whether it is corrosive, and the like.

The Polycoat¹ project set out to develop new polymer-coated steel sheet systems enabling steel-based containers to

compete with currently available alternatives.

Steel cans are fully recyclable and provide safe long-term storage of food and beverages. In addition, steel packaging is resistant to a wide range of potential contents, to external corrosion and to tampering. Furthermore, use of polymer-coated sheet material eliminates the need for washing and lacquering thereby reducing both cost and environmental impact.

INDUSTRIAL TECHNOLOGIES

Finally, steel sheets are highly formable, making it possible to develop new container configurations using the new polymer-coated steel systems, as well as existing ones.

Polycoat researchers thus set out to develop experimental and computational methodologies and expertise for the European

can industry, facilitating development of large-scale industrial manufacturing processes for novel and attractive can designs.

Project outcomes should increase the competitiveness of the European can industry, in particular as related to food and beverages, while enhancing

consumer and environmental safety.

The project was coordinated by Rockfield Software Ltd. in the United Kingdom.

- 1 'Economical exploitation of polymer coated steel sheet in large-scale production of new can types by the European can industry'.

Funded under the FP6 programme
'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices'.
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Enhancing separation membrane selectivity

Many industrial processes require the separation of components in gaseous mixtures via membranes. EU-funded researchers developed novel nano-structured materials and used them in membranes, demonstrating enhanced permeability and selectivity.

Gas separation via selectively permeable membranes is used to recover hydrogen gas, to remove carbon dioxide (CO₂) and to dehumidify air, to name only a few uses.

The Compose¹ project sought to develop novel nano-structured materials with highly selective permeability to regulate the flux of substances. Investigators focused on two classes of nano-structured materials, namely hybrid materials and self-organised materials.

While selective gas separation using polymeric membranes is a rapidly growing branch of membrane technology, the existing materials are often inadequate as permeability is sacrificed at the expense of selectivity and vice versa.

Hybrid materials (consisting of both organic and inorganic components) — such as 'Mixed-matrix membranes' (MMMs) formed by incorporating inorganic particles into organic polymeric structures — show great

potential for improving gas-separation properties.

Self-organised supramolecular copolymers, on the other hand, self-assemble based on chemical and physical properties to form thin films much like the cellular membrane that selectively separates the internal from the external cellular environment. Understanding and exploiting nature's organisation holds promise for a completely new

paradigm in separation membrane technology.

Investigators manufactured various types of MMMs with promising results. Membranes composed of nanoparticles (NPs) incorporated into polymers including polyacetylenes, cellulose-based polymers and polydimethylsiloxane rubber exhibited excellent permeability with significantly enhanced selectivity.

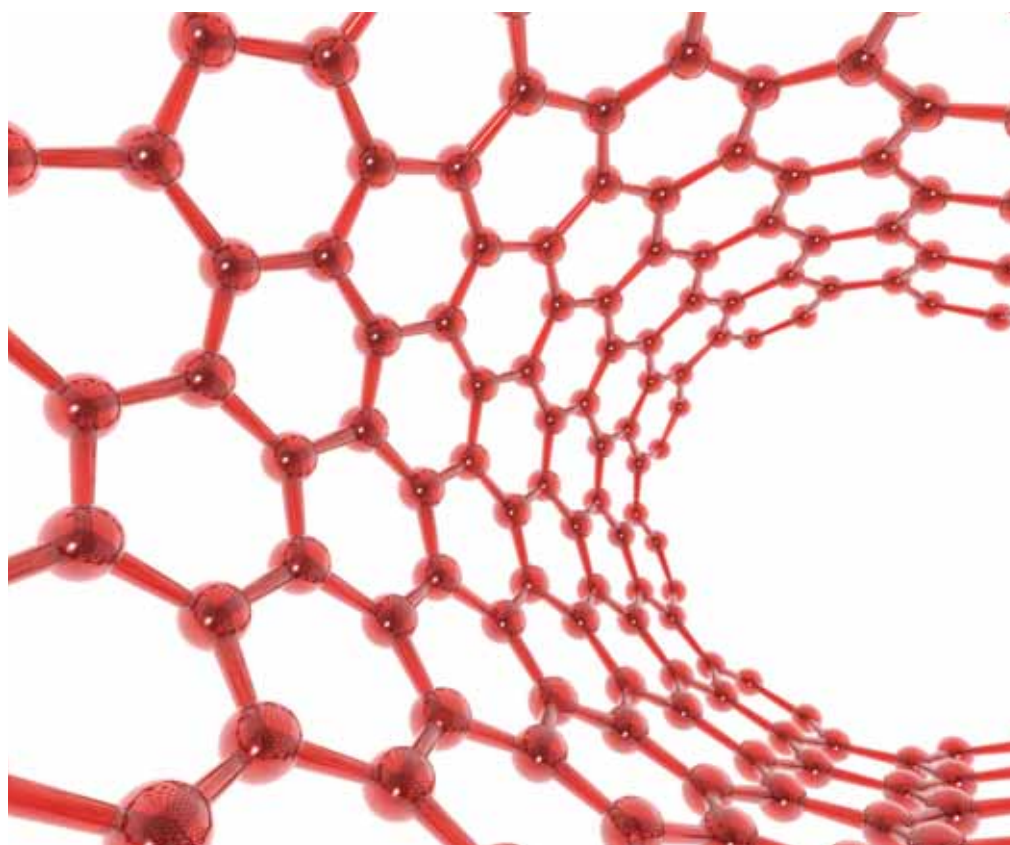
Researchers also employed a combination of self-assembly and classical membrane formation to produce a membrane with a highly ordered self-assembled top layer over a porous non-ordered support layer.

Compose have developed new nano-structured materials and manufactured them into separation membranes, enhancing both permeability and selectivity. Commercial availability of the membranes has the potential to enhance selective transport and separation in a variety of fields with positive effects on European industrial and energy applications as well as CO₂ sequestration and global warming.

The project was coordinated by GKSS Forschungszentrum Geesthacht GmbH, based in Germany.

- 1 'Multicomponent nanostructured materials for separation membranes'.

Funded under the FP6 programme
'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices'.
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EVENTS

Info Day and brokerage event on Call FP7-KBBE-7-2013

There will be an Info Day and brokerage event on the FP7 call on 'Food, agriculture and fisheries, and biotechnology' on 16 July 2012 in Brussels, Belgium.

The objective of the event is to bring together research stakeholders, from both the public and private sectors from the EU and Third Countries, together with Commission officers and provide information and ground for discussion and networking.

For further information, please visit:

http://ec.europa.eu/research/bioeconomy/news-events/events/20120716_en.htm

'Energy landscapes'

An event entitled 'Energy landscapes' will take place from 16 to 21 July 2012 in Obergurgl, Austria.

In chemical physics, the behaviour of many systems is typified by the presence of competing interactions. This means that topography and topology, as defined by the potential energy function, are very complex, with an exponential number of local minima separated by energy barriers. Usually no suitable approximation schemes are available to compute dynamic or thermodynamic properties directly for such complex many-body systems.

Nevertheless, in many cases, predictions can be made from knowledge of the stationary points of potential energy function, such as from points with vanishing gradient. These types of techniques are commonly referred to as energy landscape methods. This approach allows researchers to map dynamical as well as thermodynamic phenomena onto properties of the energy landscape.

The conference will include:

- lectures by invited high-level speakers;
- short talks by young and early-stage researchers;
- poster sessions and open discussion periods;
- forward-looking panel discussion about future developments.

For further information, please visit:

<http://www.esf.org/index.php?id=9134>

Transport Research Information Days

The Transport Research Information Days will be held on 18 and 19 July 2012 in the Charlemagne building, Brussels, Belgium

The transport theme under the EU's Seventh Framework Programme for Research and Technological Development (FP7) welcomes excellent research proposals looking for innovative solutions to today's transport-related societal challenges.

Any SME, company, research institution or university interested in learning more about how to participate in the transport theme under FP7 can meet EC officials and potential partners at the 'Info Days' and find out all about the work programme for 2013. The aim of the two-day event is to inform potential researchers about FP7 and the new Transport Calls for Proposals under the specific programme 'Cooperation'. Details will also be given on the main legal and procedural conditions, and questions answered. Participants will also have the chance to network with potential project partners.

For further information, please visit:

http://ec.europa.eu/research/transport/events/infodays/index_en.htm

Workshop on data mining in life sciences

A workshop on data mining in life sciences will take place on 20 July 2012 in Berlin, Germany.

Data mining in biology and medicine is a core component of biomedical informatics. It is also one of the first intensive applications of computer science to this field, whether in a clinic, laboratory, or research centre. Current biomedical data mining applications are taking on multifaceted roles in knowledge discovery in databases as well as machine-learning approaches.

The event will be a forum for identifying important contributions and opportunities for research on data mining as it applies to biological and medical data. It will also be a chance to promote the systematic study of how to apply data mining to biology and medicine, and to showcase applications of data mining in biology and medicine. The conference programme is designed to foster an informal atmosphere where participants are encouraged to ask clarifying questions throughout the talks and take part in longer discussions after each presentation.

For further information, please visit:

http://www.data-mining-forum.de/w_life_sciences.php

International conference on security and cryptography

An 'International conference on security and cryptography' will take place from 24 to 27 July 2012 in Rome, Italy.

In recent years, computer applications and internet services have been contributing extensively to society. At the same time, they are vulnerable and are subject to frequent attacks. Cryptography is an indispensable tool for protecting information in computer systems. Theoretical and practical advances in the fields of cryptography and coding are a key factor in the growth of data communications, data networks and distributed computing.

The conference will not only focus on the mathematical theory and practice of cryptography and coding, along with other aspects of information systems and network security, but also applications and information systems development in the context of e-business, internet and global enterprises.

The conference will be a forum for discussions and exchange for researchers, mathematicians, engineers and practitioners interested in security aspects of information and communication.

For further information, please visit:

<http://secrypt.icete.org/>

Seventh International Workshop on Artificial Neural Networks and Intelligent Information Processing

The Seventh International Workshop on Artificial Neural Networks and Intelligent Information Processing will take place from 30 to 31 July 2012 in Rome, Italy.

Over the past few years, bio-inspired artificial intelligence has shown significant potential to meet applicative and technological challenges in industrial, socio-economic or environmental fields.

Increased interest from researchers on this relatively new area is leading to a multidisciplinary synergy between a large number of scientific communities. The event will highlight advances, new experimental discoveries and novel technological improvements.

For further information, please visit:

<http://www.icinco.org/ANNIIP.aspx>

Eighth International Conference on Urban Climate

The Eighth International Conference on Urban Climate will take place from 6 to 10 August 2012 in Dublin, Ireland.

Climate change can cause significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. Science has made progress in understanding climate change and its causes, and is beginning to help develop a strong understanding of current and potential impacts. This understanding is crucial because it allows decision-makers to place climate change in the context of other large challenges facing individual nations and the world at large.

This event will examine research and urban climate effects in all scales and set important benchmarks for the development of the field. It will also be a forum in which urban climatologists can discuss modern developments in research, and the application of climatic knowledge to the design of better cities.

For further information, please visit:

<http://www.icuc8.org/>

'East-Meets-West on Innovation and Entrepreneurship' Congress and Exhibition

The European Office of Cyprus will organise a Congress on Innovation and Entrepreneurship on 1 to 4 September 2012 in Nicosia, Cyprus.

The Congress will explore new tools to bring researchers and enterprises together from all over the world. The Congress aims to harness the potential of entrepreneurship to transfer innovation ideas into products and services.

The main objective of the conference is to promote cross-national collaboration between east and west as a tool to overcome national limitations on knowledge, financial resources, technology, and services.

For further information, please visit:

<http://www.eastmeetswest.eu.com/>

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