



European
Commission

research^{eu}

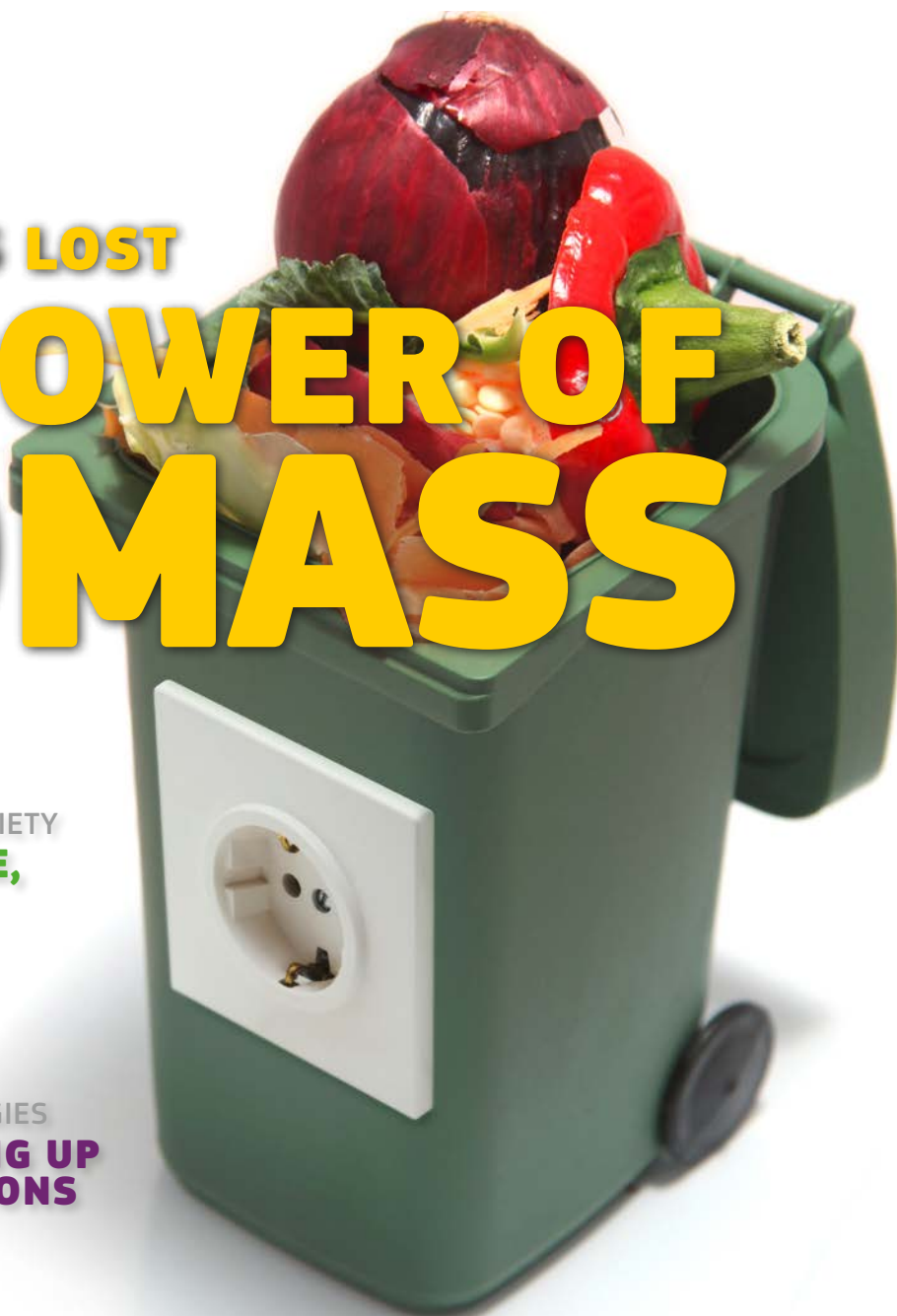
RESULTS MAGAZINE

N°34
JULY-AUGUST 2014

SPECIAL FEATURE

NOTHING GETS LOST

THE POWER OF BIOMASS



ENVIRONMENT AND SOCIETY
**CLIMATE CHANGE,
MEET CYBORG
PLANTS**

» PAGE 27



INDUSTRIAL TECHNOLOGIES
**WIBRATE: PICKING UP
ON BAD VIBRATIONS**

» PAGE 38



Published by

The Community Research and Development Information Service (CORDIS) managed by the Publications Office of the European Union
2, rue Mercier
2985 Luxembourg
LUXEMBOURG
cordis-helpdesk@publications.europa.eu

Editorial coordination

Gyn Nilsson

The *research*eu results magazine* is published by the Community Research and Development Information Service (CORDIS) and managed by the Publications Office of the European Union. Content is prepared using several sources, including CORDIS, the Research Information Centre, ERC, as well as original material collected specifically for this publication.

The *research*eu magazines* are free of charge.

For all issues of the *research*eu results magazine* you can:

- download the PDF or e-book version
- order single paper copies
- subscribe to have every issue posted to you at <http://cordis.europa.eu/research-eu>

Disclaimer

Online project information and links published in the current issue of the *research*eu results magazine* are correct when the publication goes to press. The Publications Office cannot be held responsible for information which is out of date or websites that are no longer live.

The technologies presented in this magazine may be covered by intellectual property rights.

ISSN 1831-9947 (printed version)

ISSN 1977-4028 (PDF, EPUB)

© European Union, 2014

Reproduction permitted, provided the source is acknowledged. Neither the Publications Office nor any person acting on its behalf is responsible for the use that may be made of the information contained in this publication or for any errors that may remain in the texts, despite the care taken in preparing them. For reproduction or use of photos and any other artistic material, permission must be sought directly from the copyright holder. Excluded from this constraint are the photos and artistic material owned by the European Union.

Cover photo © LisaStrachan and tomasworks, Thinkstock



EDITORIAL

by the editorial team

ADVANCING SUSTAINABILITY WITH BIOFUELS

Have you ever heard of the circular economy? This relatively new concept — which was at the heart of the European Commission's Green Week last month — probably sounds more abstract than it really is. Here is a concrete example: in the foreseeable future, throwing out-of-date food or scraps in the bin will not only be generating waste, it will also be considered — literally — as a waste of valuable resources and energy.

For the European Commission, the advent of a circular economy is 'the great innovation challenge of the next decades.' Depleting resources and a growing population have made our model of 'extracting-using-throwing away' increasingly unsustainable, and there is no going back. In addition to this challenge, the need to reduce our environmental footprint requires new, sustainable raw materials for both products and energy. The solution could very well reside in biomass which, with the right technology, can be used to produce anything from plastics and textiles to electricity.

Whilst the first generation of biofuels was heavily criticised for competing with land use for food production, the second and third

generations respectively have been using waste and algae as biomass in order to keep up with society's growing environmental awareness and energy needs.

This edition of the *results*eu magazine* celebrates these new generations of biofuels by focusing on eight projects which will soon — or are already on track to — change the way we produce goods, heat our houses and travel. This list notably includes an interview with Dr Pieternel Claassen from Wageningen UR Food & Biobased Research in Germany, who told us about her quest for creating 'green' hydrogen from biofuels. The HYTIME project, which she coordinates, is developing large-scale and high-rate bioreactors for increased hydrogen production at low nutrient cost.

These projects are followed by our usual seven sections on biology and medicine, social sciences and humanities, energy and transport, the environment, IT and telecommunications, industrial technologies and space. The magazine closes with a list of upcoming events.

We look forward to receiving your feedback. You can send questions or suggestions to: cordis-helpdesk@publications.europa.eu



Want more information on the contents of this issue?

For online versions or information about the contributors in this issue of *research*eu results magazine*:

CORDIS

- <http://cordis.europa.eu/projects>
- <http://cordis.europa.eu/stories>
- <http://cordis.europa.eu/news>

European Research Council

- <http://erc.europa.eu>

EC DG Research and Innovation

- <http://ec.europa.eu/research/infocentre>



Focus on
Bacteria -
small
organisms,
big impact

4

SPECIAL FEATURE

NOTHING GETS LOST

THE POWER OF BIOMASS



4 Turning bio-waste into green hydrogen

- 6 Europe strives for a bio-based economy
- 6 Biomass by numbers
- 8 New device to harvest microalgae
- 8 From biomass to biocommodity
- 9 Biofuels produced sustainably from waste
- 10 Reading 'ash' reveals wood pellet quality
- 10 Textiles for seaweed cultivation

11 BIOLOGY AND MEDICINE

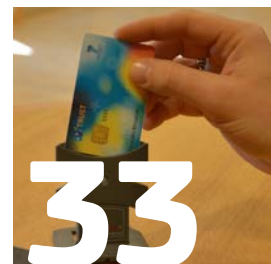
- 11 **Technology supports diabetic patients and their doctors**
- 12 Thalassaemia treatment tailored to children
- 13 Genetic predisposition to lupus
- 14 A novel implant to record brain activity
- 14 New device improves cell analysis
- 15 Novel coronary stent materials reduce heart inflammation risk
- 16 Towards a food pathogen biosensor
- 16 A biomimetic implant to treat osteoarthritis



- 31 Improving technology transfer to farmers
- 31 A new biosensor for fungal toxins
- 32 Water treatment membranes activated by the Sun

33 IT AND TELECOMMUNICATIONS

- 33 **Security and Privacy? Now they can go hand in hand**
- 34 Warming up to multimedia
- 35 Complete crisis management
- 35 Airport security training redefined
- 36 Environment-friendly hi-tech fashion
- 37 Socially networked businesses



17 SOCIAL SCIENCES AND HUMANITIES

- 17 **Policies to support media independence**
- 18 Surveillance and society
- 19 A new look at Islam in Medieval Europe
- 20 Helping teachers teach science
- 20 Protecting European consumer privacy



38 INDUSTRIAL TECHNOLOGIES

- 38 **WIBRATE: Picking up on bad vibrations**
- 39 New automated sewer cleaning system
- 40 Environmentally friendly plumbing pipes
- 40 Cat's eyes that see the big traffic picture
- 41 Mitigating electromagnetic disturbances
- 42 Unique products for unique customers



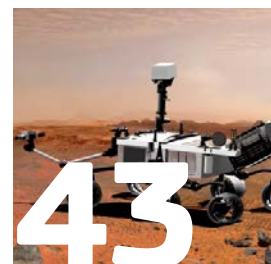
21 ENERGY AND TRANSPORT

- 21 **Greener furnaces for energy-intensive industries**
- 22 Revolutionary aircraft design on the horizon
- 23 Lighter-weight, more efficient hybrid cars
- 24 Silent, zero-emission delivery for Europe
- 24 Transportation information service
- 25 A sensible solution for wind turbine electrical faults
- 26 The future of buses



43 SPACE

- 43 **On a mission to Mars**
- 44 Getting into gear for space travel
- 45 Novel shields that can take the heat



27 ENVIRONMENT AND SOCIETY

- 27 **Climate change, meet Cyborg plants**
- 28 EU research 'clears' the way for high quality lakes and reservoirs
- 29 New smart irrigation management system
- 30 An environmental standards information portal for Europe



46 EVENTS



SPECIAL FEATURE

**NOTHING GETS LOST
THE POWER
OF BIOMASS**

INTERVIEW

**TURNING BIO-WASTE
INTO GREEN HYDROGEN**

Whilst hydrogen cars look set to be the next big thing in an increasingly carbon footprint-aware society, sustainable methods to produce hydrogen are still in their early stages. The HYTIME project is working on a novel production process that will see green hydrogen being produced from grass, straw and food industry residues.

When sustainability and bioeconomy are being discussed, the words 'hydrogen' and 'biomass' are usually not too far away — although rarely mentioned in the same sentence. But what if hydrogen could be produced directly from second generation biomass?

Starting in 2000 with the Dutch project 'Hydrogen from biomass' and followed up with funding under FP5 and 6, Pieter Claassen's quest for creating an efficient, marketable hydrogen production process from bio-waste has recently reached a new high. HYTIME (Low temperature hydrogen production from second generation biomass), an EU-funded project due to be completed in December, aims to increase the productivity of fermentative hydrogen production, thereby accelerating its implementation in industrial processes.

The stakes are high: in the EU, some 118 to 138 million tons of bio-waste

are currently produced every year. With the HYTIME technology, these could be converted into 0.34 million tons of hydrogen and provide a significant contribution to the EU's sustainability targets.

In an exclusive interview with *research*eu magazine*, Dr Claassen, researcher at Wageningen UR Food & Biobased Research, explains how the combination of the nine participants' expertise in biomass logistics and pre-treatment, thermophilic hydrogen production and gas upgrading technologies will enable HYTIME to go beyond the state-of-the-art of current fermentative hydrogen production.

★ **What are the main objectives of the project?**

Dr Claassen: Nowadays 'green' hydrogen can only come from two sources: biomass and electrolysis using 'green' electricity. HYTIME focuses on the former, particularly on

biomass resources having a high moisture content where existing technologies such as gasification are less efficient.

We have two main objectives. First, we aim to achieve production of 1 to 10 kg of hydrogen per day from second generation biomass. This is a rather symbolic quantity — which could cover the electricity needs of four households — but we hope this will be enough to convince stakeholders that, on a larger scale, hydrogen production by bacteria is achievable.

Then, we target the reduction of time to market for biohydrogen through the combination of this production process with 'anaerobic digestion' (AD). The latter allows for the conversion of by-products — mainly organic acids — to CH₄ (and CO₂), which in turn is expected to cover (part of) the energy demand of the hydrogen production process.



Dr PIETERNEEL CLAASSEN

★ **What is new or innovative about this approach to hydrogen production?**

In natural anaerobic digestion systems, biomass is converted to biogas (CH_4 and CO_2) by a consortium of micro-organisms working together. These micro-organisms produce organic acids and hydrogen, but the latter is immediately consumed by hydrogenotrophic bacteria which convert it into methane or acetic acid. These bacteria are our enemies, and the HYTIME innovation consists in working with extreme thermophilic bacteria — which have superior yield — to make their life miserable and produce more hydrogen.

★ **How does the hydrogen generation process work?**

In anoxic environments, i.e. no oxygen present, bacteria ferment sugars into CO_2 and reduced compounds, such as hydrogen, or into organic reduced metabolites, such as ethanol or butanol. In nature however, hydrogen is immediately consumed by methanogenic or hydrogenotrophic organisms, leaving only methane behind. Our aim is to decouple hydrogen production from hydrogen consumption by creating an environment where hydrogen-consuming organisms cannot survive.

★ **What kind of businesses do you see using your technology in the future?**

Potential interest may arise from stakeholders involved in electricity production, and chemistry, as well as from biomass owners. The point is that hydrogen's fate in the energy sector is bound to that of fuel cells. As soon as we see a breakthrough in fuel

cells, the interest in hydrogen coming from renewable resources will increase.

HYTIME research and development will also deliver spin-off technologies, which have the potential to reach the market quicker than the whole process. These include sensors for gaseous components (H_2 , H_2S , etc.) — which are often observed in the production of biogas — as well as the automation for managing fermentations thanks to our online monitoring and control systems.

We also foresee that biomass owners will be interested in finding new applications for their organic residues. Agro-industrial businesses such as the potato processing industry, the sugar industry and beer producers may find our technology useful either for producing and selling hydrogen or for using it to cover their own electricity needs.

★ **What are the next steps for the project, and after its end?**

The next step will be to demonstrate the production process with all operation units being physically connected. This means proceeding to the pretreatment and hydrolysis of biomass to supply the sugars for the hydrogen fermentation on site. During the latter step the gas will be recovered simultaneously with its production and the liquid effluent will be pumped into an anaerobic digester. The sizes of the hydrogen fermenter and the anaerobic digester need to be adjusted to enable a continuous flow of liquids.

★ **What do you expect from the project in terms of market impact?**

The market impact is regarded as significant. As I already mentioned, hydrogen is a widely used chemical. The current outlook for society is a move towards a bio-based economy, and hydrogen can be used in numerous businesses aiming to switch to green technologies. Moreover, the project's new monitoring and control devices and systems are applicable in current installations for anaerobic digestion and waste water treatment systems and are expected to increase their efficiency.

“The next step will be to demonstrate the production process with all operation units being physically connected.”

The concept for gas upgrading, based on low energy demand, is innovative and will add to the development of more sustainable gas separation processes.

HYTIME

- ★ Coordinated by DLO in the Netherlands.
- ★ Funded under FP7-JTI.
- ★ http://cordis.europa.eu/projects/rcn/101993_en.html
- ★ Project website: <http://www.hy-time.eu/>





EUROPE STRIVES FOR A BIO-BASED ECONOMY

New biorefinery processes promise to help the EU edge closer to a bio-economy and improve its exploitation of biomass.

One of Europe's key drives to improve sustainability is to build a bio-based economy that relies on the evolution of the biotechnology industry. Promising to revolutionise sectors such as agriculture, health, cleaner energy and the chemical industry, a bio-economy requires the development and implementation of innovative biorefinery processes.

"A bio-economy requires the development and implementation of innovative biorefinery processes."

This is the aim of the EU-funded project EUROBIOREF (European multi-level integrated biorefinery design for sustainable biomass processing).

The project is working on building a multi-faceted approach that involves several non-edible feedstocks, multiple biochemical or thermochemical processes, and a myriad of products such as aviation fuels and chemicals. It seeks to overcome fragmentation in the biomass industry through enhanced efficiency and networking.

More specifically, EUROBIOREF is building five lignocellulosic plants and establishing large test fields for feedstocks such as willow, safflower and castor. It is working on more efficient biotech systems and developing a biomass supply logistics model for several products addressed under the project.

A key achievement so far involves the construction of a new, highly efficient pilot plant in Norway to process lignocellulosic material rapidly. Achievements also include the filing of 15 new patents (e.g. for vegetable oil conversions) as well as articulation of six value chains — corresponding to six different process scenarios — for biorefineries.



The project is expected to have important socioeconomic impacts such as creating specialised jobs in rural areas and encouraging business in local communities. EUROBIOREF is preparing an exploitation plan to advance the use of these processes and bring benefits to industry and the economy. With more such processes and initiatives, Europe can slowly but surely move to a more sustainable bio-economy.

EUROBIOREF

- ★ Coordinated by CNRS in France.
- ★ Funded under FP7-ENERGY.
- ★ http://cordis.europa.eu/projects/rcn/93922_en.html
- ★ Project website: <http://www.eurobioref.org>
- ★  <http://bit.ly/1nP4nJQ>

BIOMASS BY NUMBERS

The use of biomass from plants as a renewable energy source is not new. Yet surprisingly, the positive net economic and environmental benefits of biomass energy exist only on paper. This is about to change thanks to the largest experimental tree plantation in the world, which is taking place in East Flanders.

Professor Reinhart Ceulemans and his team are working to get the numbers needed to inform evidence-based decisions on the role of renewables in future energy policies. The results of small-scale experiments show that using biomass energy sources is very attractive: they are both carbon-neutral and renewable. This is why wood-based biomass is already a commercial technology of much interest to policymakers. However, the theoretical basis for clean biomass energy remains exactly that — theoretical.

'There are three questions that have never been fully answered about energy from wood-based biomass,' explains Reinhart Ceulemans. 'Is it efficient? Is it economically profitable? And, above all, does it truly save on greenhouse gas emissions?' To answer these questions, he and his team from Belgium's University of Antwerp are implementing the POPFULL (System analysis of a bio-energy plantation: full greenhouse gas balance and energy accounting) project with a five-year ERC Advanced Grant to undertake a complete 'Lifecycle analysis' (LCA) for a large-scale

biomass plantation. They are measuring all inputs and outputs along with the costs and benefits they have for the environment.

In Flanders' fields (and forests)

Close to Ghent, the team has established a mixed plantation of fast-growing poplar and willow tree varieties: 100 000 trees covering over 18 hectares. They are investigating 'Short-rotation coppicing' (SRC) where the trees are cut back to the ground every two years and their



stems and branches harvested, chipped and used to generate energy by burning.

The research project covers two harvesting cycles in 2012 and 2014. As a vital part of the LCA, all inputs and outputs from the SRC process are measured, such as the fuel used by plantation machinery, the 'greenhouse gas' (GHG) emissions from biomass combustion and the energy produced. In addition, the eco-system carbon balance is measured, meaning the GHG inflows and outflows in the plantation, including CO₂, CH₄, N₂O and others. 'By combining the SRC process measurements with those on the eco-system we will arrive at a full LCA carbon balance for short-rotation coppicing and a quantitative result on its contribution to global warming,' explains Ceulemans.

New tools and tall towers

'The measurement of greenhouse gas fluxes is the key element in our work — it is only recently that the new tools and techniques to do this have become available,' says Ceulemans. Among the rows of trees is a tall mast supporting the three-dimensional anemometer and highly-sensitive gas analysers. 'We continuously measure the wind speed in three directions and the GHG concentrations in the atmosphere to obtain the net fluxes into and out of the plantation. The difference is the uptake of gases by the trees, mainly through photosynthesis. The instruments are highly sensitive, as we can see photosynthesis dropping off as night falls and even the rise in CO₂ when we have large groups of visitors.'

Much of the valuable work on measuring GHG fluxes was undertaken by Dr Donatella Zona, a key researcher in the team, supported by a Marie Curie Grant. 'This is a unique plantation, the first in the world with the equipment to measure the full greenhouse gas balance and thus produce a full life-cycle analysis,' explains Ceulemans, 'so we have seen a lot of interest — even National Geographic magazine has made a documentary on the project.'

Harvesting results

'After one rotation we have seen that we get twice the energy out as is put in, and the second rotation will be better; so the plantation is energy efficient. For the evaluation of the greenhouse gases' effects we still need the results from the second rotation following the second harvest in February 2014 which will be a key moment for the research project. So far the process has not been fully carbon neutral, but we are saving considerable amounts of greenhouse gases compared to fossil fuels,' says Prof. Ceulemans. This means that the greenhouse balance is probably highly favourable. 'There is an economic dimension to the success of this innovative bio-energy production. We suspect that, without subsidies, SRC will only be economically viable over a period of 20 years or so. Yet, many energy sources are subsidised, so this is a matter of policy rather than simple economics,' he explains.

"Even National Geographic magazine has made a documentary on the project."

'Looking more widely, when POPFULL is complete we will have the hard numbers that will allow science- and evidence-based policy-making to help biomass find its right place in the energy mix of the future.'

POPFULL

- ★ Coordinated by the University of Antwerp in Belgium.
- ★ Funded under FP7-IDEAS-ERC.
- ★ <http://erc.europa.eu/erc-stories/biomass-numbers>
- ★ Project website: <http://uahost.uantwerpen.be/popfull/>
- ★  <http://bit.ly/1pl7MgA>





NEW DEVICE TO HARVEST MICROALGAE

Commercial cultivation of microalgae is a rapidly growing industry in Europe and worldwide. A consortium of small companies has created a method for harvesting microalgae that greatly reduces related material and energy costs.

Microalgae are cultivated for human and animal nutrition, cosmetics, pharmaceuticals, biofuels and wastewater treatment. However, the energy used in conventional harvesting methods makes up approximately 30% of total biomass production costs.

The EU-funded OPERATION SWAT (High algal recovery using a Salsnes Water to Algae Treatment (SWAT) filter technology) project aimed to design a universal harvesting technology that would yield 95% recovery at 40% lower costs. Three small technology companies each contributed apparatus or know-how to the project.

Researchers began by studying particle size and other characteristics of seven commercial microalgae species to help

identify the correct filters. They also investigated 20 different flocculating agents to improve the filtration.

Two prototype systems were designed and installed in different microalgal production facilities. After modifications, the final prototype — which operated continuously — could remove 97% of suspended solids and used significantly less power than conventional methods.

The companies involved in OPERATION SWAT are in the process of bringing the novel algal harvesting system to market. They expect sales to begin by the end of 2014.

OPERATION SWAT

- ★ Coordinated by Salsnes Filter in Norway.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/100969_en.html
- ★ Project website: <http://www.swattechnology.no>

FROM BIOMASS TO BIOCOMMODITY

In the face of major challenges, such as climate change and diminishing fossil fuel resources, the use of lignocellulosic biomass as a source of renewable energy and carbon is becoming a key focus to drive the bioeconomy transition. Accordingly, an EU-funded project has investigated a biorefinery concept for the sustainable processing of agricultural residues and woody biomass into biofuels, bulk chemicals, polymers, speciality molecules, heat and power.

In order to convert the present-day petro-economy into a bioeconomy, it is vital to optimise all parts of the lignocellulosic biomass-to-products value chain, including collection and exploitation of plants that provide both food and non-food products. Simultaneously, it is necessary to ensure that the value chain is sustainable, minimising negative environmental and social impacts while making sure it is economically viable.

The BIOCORE (Biocommodity refinery) project focused on the development of a biorefinery concept for the conversion of lignocellulosic biomass into energy carriers, chemicals and materials and food ingredients. During the project, all aspects of the value chain were examined, and strategies to minimise the carbon footprint and maximise energy and water efficiency were researched.

In one part of BIOCORE, researchers developed a strategy to explore how biorefineries can work in specific local environments. This included an assessment of local biomass availability and predictions of future availability taking into account predictable competition for biomass. One finding from these studies was that feedstock-flexible biorefineries will be

advantageous in European regions where biomass availability is limited.

In terms of processing technologies, the BIOCORE team showed how the introduction of a process step prior to organosolv processing, which uses organic solvent to solubilise lignin, can remove extractables from straw, such as waxes and proteins, thus procuring a higher quality cellulose pulp. Similarly, the use of process residues (wheat and fine rice straw) as combustibles for heat and power production revealed that this option can be feasible in certain processing conditions.

Work focused on the use of lignins from lignocellulosic biomass, revealing that organosolv lignin can be used directly as a substitute for phenol in phenol-formaldehyde resins, which are used in the preparation of plywood panels and particle boards.

Other work focused on process design and optimisation and revealed that the biorefinery processes that had previously been retained for validation at pilot scale can be vastly improved through process integration, which can procure attractive energy savings of up to 70%.

Overall, given the very promising nature of the results obtained during



the BIOCORE project, it is expected that the BIOCORE concept will be suitable for further maturation at demonstration scale, and ultimately in industrialisation. In the meantime, the results provide important insights into how small-to-medium-scale biorefineries could sustainably generate a variety of products using lignocellulosic biomass feedstocks.

BIOCORE

- ★ Coordinated by INRA in France.
- ★ Funded under FP7-KBBE.
- ★ http://cordis.europa.eu/result/brief/rcn/9910_en.html
- ★ Project website: <http://www.biocore-europe.org/>
- ★ <http://bit.ly/1kNjDIP>



BIOFUELS PRODUCED SUSTAINABLY FROM WASTE

Biofuels are seen as an important alternative to fossil fuels. An EU and Latin American partnership enabled the development of important technologies to exploit biomass sustainably for the profitable production of biofuels and other valuable chemicals.

Biofuels could reduce imports of fossil diesel fuels. Added advantages are the utilisation of increasing quantities of organic waste and the minimised impact of energy production on global climate change. However, many of the current feedstocks for biofuel production face technical, economic and environmental challenges when it comes to meeting diesel needs.

EU and Latin American scientists investigated solutions to these problems within the scope of the EU-funded project DIBANET (The production of sustainable Diesel-Miscible-Biofuels from the residues and wastes of Europe and Latin America). The focus was on production of 'Diesel-miscible-biofuels' (DMBs) such as ethyl-levulinate from wastes. The team studied conversion of biomass to 'levulinic acid' (LA) and co-products (formic acid and furfural) for subsequent production of ethyl-levulinate.

Fast pyrolysis and gasification produce valuable intermediates that can be recovered and further processed to produce other valuable biofuels such as clean syngas or upgraded bio-oil. Researchers planned to upgrade 'Acid hydrolysis residues' (AHRs) by thermal and catalytic processes to produce a bio-oil for direct use or as a DMB after hydro-treating. After examining the results of AHR pyrolysis, the team focused on AHR upgrading through steam gasification and catalytic steam gasification to produce a syngas rich in hydrogen.

DIBANET demonstrated that acid hydrolysis is an important process for the sustainable and profitable development of biofuels and platform chemicals from lignocellulosic biomass. Optimising process engineering will produce high yields of LA and furfural — of higher value than ethanol — from a variety of feedstocks. These could subsequently be used to synthesise biofuels.



© udeFun, Thinkstock

In addition, robust kinetic models for acid degradation of biomass pointed to shortcomings that can now be overcome with commercialisation of DIBANET technologies. A patent was filed on the pre-treatment process. The team has developed a technology transfer business plan for both the EU and Latin America that includes policy implications and socio-economic issues.

Scientists have provided important technologies to reduce the dependence of the EU and Latin America on fossil diesel imports, thus improving the security of energy supply and reducing environmental impact. Improved cooperation between the two regions on biofuels research is an added benefit.

“The team has developed a technology transfer business plan for both the EU and Latin America.”

DIBANET

- ★ Coordinated by the University of Limerick in Ireland.
- ★ Funded under FP7-ENERGY.
- ★ http://cordis.europa.eu/projects/rcn/91952_en.html
- ★ Project website: <http://www.dibanet.org/>
- ★  <http://bit.ly/1l2Cnmf>



READING 'ASH' REVEALS WOOD PELLET QUALITY

An increasing number of homeowners and businesses are looking for new ways to power and heat their property. An EU-funded project promotes the use of wood pellets by developing a guide on fuel quality and appropriate equipment that suits their needs.

Standards, specifications, analysis and accreditation schemes help the buyer to identify wood pellets of a suitable quality for their purpose. The European standard for solid biofuels, EN 14961, describes three grades according to virgin fibre and ash content. A high ash content is a sign of contaminants, such as too much bark and moisture, that can damage the wood pellet boilers.

The ASHMELT (Development of a practical and reliable ash melting test for biomass fuels, in particular for wood pellets) project was set up to advance the existing testing methods and help overcome operational problems due to ash-related issues. In particular, the burning of wood pellets can sometimes lead to lumps of residues that are unable to burn and result in the boiler clogging up. This calls for detailed investigation to determine ash melting

behaviour and content of different ash-forming elements in pellets.

Several milestones were achieved in this direction. Nine different currently applied methods to determine chemical and physical fuel properties were reviewed. Using these methods, the ash content was determined by heating the sample under specified conditions. The rapid slag test, Ciemat ash test and Danish Technological Institute slag analyser provided a better measure of performance.

With this as a starting point, ASHMELT researchers selected 15 different wood pellets as well as agricultural residues in pellet form. Furthermore, 'exotic' fuels like distillers dried grains and solubles, usually used as nutrient for cattle, were combusted in a small-scale biomass boiler. Specifications that may be used to describe different grades of

wood pellets were established based on the results of their ash melting behaviour.

The efficiency and reliability of the heating system depends on the quality of the pellets. Furthermore, quality depends not only on the standard of the product as it leaves the factory, but also on the way the product is used. The ASHMELT quality specifications are the basis for the development of a European standard — evidence of the accuracy of the proposed ash testing methodology.

"ASHMELT researchers selected 15 different wood pellets as well as agricultural residues in pellet form."

ASHMELT

- ★ Coordinated by Bioenergy 2020+ in Austria.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/101254_en.html
- ★ Project website <http://www.ashmelt.eu/>
- ★  <http://bit.ly/1uCMZZI>

TEXTILES FOR SEAWEED CULTIVATION

Seaweed is a good source of biomass for energy production, as well as food supplements and animal feed. A new research project is developing advanced textiles for the cultivation of seaweed in the open ocean.

Biomass is a promising source of clean, renewable energy. Seaweed, or macroalgae, is ideal for biomass production because it is fast-growing and does not take up space on land that could be better used for food crops.

The EU-funded AT~SEA (Advanced textiles for open sea biomass cultivation) project aims to develop advanced textiles to demonstrate open sea cultivation of macroalgae for biomass production.

AT~SEA started by studying the demands of open sea cultivation, such as location, wave force and currents, and used

this to determine the requirements for the project. Three different textiles will be developed: a 3D substrate material that incorporates nutrients or slow-release fertilisers, a textile for cables and connections to anchor the substrate, and a coated textile for flotation tubes and storage tanks.

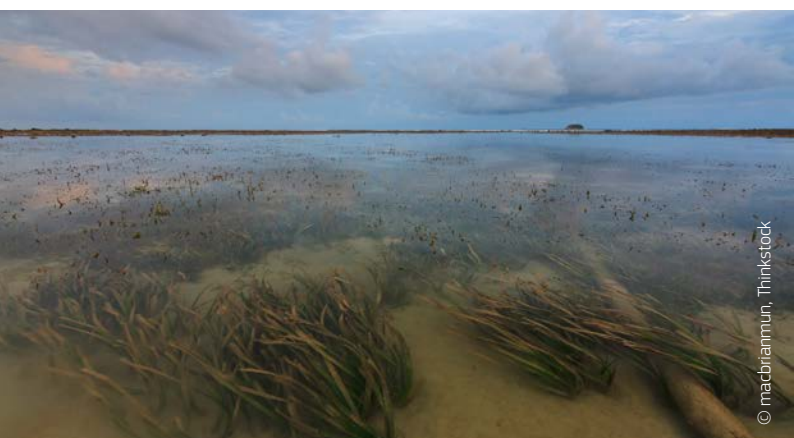
Researchers tested whether juvenile seaweed would grow on a wide range of textiles. The most promising textiles were made into 1 m² test substrates and subjected to real-life conditions in the North Sea.

Several prototype buoys and storage tanks made from different coated textiles were also tested at sea over a 14-month period. These showed no signs of degradation, but they are being further tested for any physical changes.

A pre-demonstration prototype system has also been built and deployed to test how the various parts work as an integrated system. Once complete, the AT~SEA system could revolutionise the cultivation of macroalgae.

AT~SEA

- ★ Coordinated by Sioen Industries in Belgium.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/projects/rcn/103076_en.html
- ★ Project website: <http://www.atsea-project.eu>





BIOLOGY AND MEDICINE

TECHNOLOGY SUPPORTS DIABETIC PATIENTS AND THEIR DOCTORS

Diabetes affects around 10% of the population, according to the World Health Organisation (WHO). The disease places a huge financial burden on healthcare systems, and also leads to early death and poor quality of life. However, patients and healthcare professionals will now be able to partner up and manage the illness in better, more effective ways.

The REACTION (Remote Accessibility to Diabetes Management and Therapy in Operational healthcare Networks) project, an EU-funded health ICT research project that came to completion in February this year, has developed an exciting set of tools and technologies that are helping patients with diabetes and their doctors to better manage the condition.

REACTION project coordinator Lydia Montandon says: 'The main goal of REACTION was to investigate how information and communication technologies (ICT) can support patients and healthcare professionals in managing diabetes, by providing efficient and scalable tools that can be used in different healthcare contexts across Europe. The result is an intelligent service platform that can be used for remote monitoring and therapy management, facilitating continuous and tight control of blood glucose levels and other vital signs that are crucial

for good diabetes management and insulin therapy.'

Learning from patients and professionals

The REACTION project has involved patients and healthcare providers since its inception. Patients at the Medical University of Graz in Austria and patients at primary care who are being treated at the Chorleywood Health Centre in the UK have been using the system to manage their condition. At every stage the users of the system have given feedback that has helped the researchers to design a system that is effective and intuitive.

In the hospital, nurses and doctors both said that the tools used (REACTION GlucoTab® system) helped them to create better care plans for their patients. The improved on-site documentation and predictions provided by the system meant that they could give more accurate doses of insulin. The result is

that patients' glucose levels stayed far more stable in the recommended target range. In the health centre, patients used the system to keep a close eye on their symptoms and their vital signs. They could then share these readings with their doctor or nurse, and were much better able to stay healthy as a result.

Going beyond technology for better health

During the research project, the teams developed a number of tools, including GlucoTab®, a tablet-based system that advises doctors and nurses on the best course of treatment for each patient, a smartphone app that allows patients to monitor their nutrition, and networking protocols that allow patients and healthcare professionals to share readings from a range of sensors worn or temporarily located on the patient's body. Additionally, it has made significant progress in the research on automatic glycaemic control, integrating blood glucose sensors and the insulin dosing algorithm developed in the project.

But beyond the high-tech developments, REACTION has also looked at the social, economic and legal implications of the technology. Throughout the course of the project, the researchers documented the way users and healthcare professionals felt about the technology, to better understand what might make tools like this more socially or professionally acceptable. They also studied the legal frameworks in

the member states regarding privacy and liability. Moreover, the REACTION GlucoTab® system was CE marked and can now be used in a clinical routine. The monitoring devices adapted for primary care patients and the gateway passed safety and EMC tests and have also obtained a CE mark. As a result, the REACTION project has brought advanced technology for diabetes management much closer to reality.

“The result is an intelligent service platform that can be used for remote monitoring and therapy management.”

Finally, in May 2014 the GlucoTab® system won the research prize for Human-Technology-Interface in the category “Economic Applications” awarded by the government of the federal state of Styria in Austria.

REACTION

- ★ Coordinated by ATOS in Spain.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/story/rcn/13068_en.html
- ★ Project website: <http://www.reaction-project.eu/>
- ★ <http://bit.ly/1ivsQFg>

THALASSAEMIA TREATMENT TAILORED TO CHILDREN

An EU-funded project has advanced treatments for children affected by thalassaemia, a gene disorder causing the weakening and destruction of red cells. The team is creating a new formulation of deferiprone, the most efficient treatment for related cardiac complications to date, which is adapted to children.

Thalassaemia is classified as a monogenic disease, that is, a disorder resulting from modifications in a single gene which causes the carrier to have fewer circulating red blood cells than normal. It is also the most inherited disease of its kind, with approximately 7% of the world's population carrying the gene and more than half a million affected children born each year according to the UK Thalassaemia Society. It can cause health issues such as iron overload, bone deformities and cardiovascular disease.

Whilst blood transfusion helps prevent death in childhood, each unit of blood contains about 200-250 mg of iron which the body cannot eliminate, ultimately resulting in cardiac complications. Of the existing chelation therapies that are used to reduce tissue iron levels, deferoxamine shows poor compliance and results in iron accumulation in the heart over the long term. The two oral chelators - deferiprone and deferasirox - are more appreciated by patients but have their own shortcomings, although deferiprone has proved to be more



effective against cardiac iron accumulation.

'In my experience there have been two main obstacles to a larger diffusion of deferiprone. The first one is the well-known tendency of this drug to reduce the number of white blood cells (mainly in the first period of its use and only rarely inducing risky infections), requiring frequent blood cell counts in patients. The second one has been the need to take the drug three times a day and using a formulation which finds resistance in children. The pills are too big to

swallow and the liquid formulation tastes bad,' explains DEEP Project Scientific Coordinator Prof. Adriana Ceci.

DEEP (DEferiprone Evaluation in Paediatrics) is a four-year project bringing together 17 recruiting centres. It aims to gather and analyse all existing information on deferiprone use in patients with iron overload in order to produce a new oral liquid formulation of deferiprone suitable for paediatric use.

The need for such research had arisen in 2005, when the European Medicines

Agency (EMA) stated there was no scientific data supporting the use of deferiprone in children under six and little information on older children, to support a more widespread use of this drug. It was then agreed with EMA that the project would target patients up to 18, and all congenital rare anaemias (including sickle-cell diseases) rather than thalassaemia only. 'This broader scope testifies to the huge interest in the drug, mostly due to its anticipated capacity to effectively reduce iron accumulation in the heart,' notes Prof. Ceci.

Over the past three years, the project, has generated results from well conducted, investigator-driven studies on deferiprone to be used for a new 'Paediatric-use marketing authorisation' (PUMA). The Research Consortium acted

as a sponsor of these trials, created trial infrastructures, engaged recruiting centres and guaranteed ethical and legal child protection at the highest standards requested by the EU.

This undertaking successfully led to a new formulation with a better taste, as well as valuable data on the correct dosage to be administered for each age group. 'The new formulation is being tested in experimental studies. We expect that our commercial partner will complete the PUMA procedure for authorisation and marketing of the new formulation no later than one year after the end of the project,' says Prof. Ceci.

The lessons learned so far? 'The project takes advantage of the participation of private pharmaceutical companies experienced in developing

"This undertaking successfully led to a new formulation with a better taste."

medicinal products and making them available on the market. Without such collaboration it would be unlikely that the drug would be distributed to all children in need. The lesson learned is that public and private efforts should (and can) be brought together to address the patients' best interest.'

DEEP

- ★ Coordinated by CVBF in Italy.
- ★ Funded under FP7-HEALTH.
- ★ http://cordis.europa.eu/projects/rcn/97667_en.html
- ★ Project website: <http://www.deeproject.eu/>

GENETIC PREDISPOSITION TO LUPUS

'Systemic lupus erythematosus' (SLE) is an autoimmune disease where the immune system attacks the cells of the body. An EU-funded study found genetic links to the disease in the European population.

SLE constitutes an enigmatic disease as its pathology is often mistakenly diagnosed for something else. As with the majority of autoimmune diseases, the precise aetiology is unknown and disease management mainly relies on the administration of anti-inflammatory and immunosuppressive drugs.

Accumulating evidence indicates that there is a genetic component that contributes to SLE development. Among the identified susceptibility genes, the major histocompatibility complex loci — an array of genes that encode surface molecules implicated in immune cell interaction — show the strongest association. Given the small-scale nature of previous studies, the EU-funded GENETICS OF SLE (Genetics of systemic lupus erythematosus in northern and southern European populations) project worked to expand on patient numbers and perform a large-scale 'Genome-wide association study' (GWAS) in northern and southern Europe.

Researchers carried out the largest-to-date GWAS of SLE, screening over 4 000 cases and 8 000 controls. Additionally, they performed meta-analyses on previous European studies, adding a further 1 698 cases and 4 650 controls. A total of 52 loci were identified with potential SLE association, 15 of which were novel. These findings were further confirmed in an independent genetic study of 1 630 cases and over 9 000 controls.

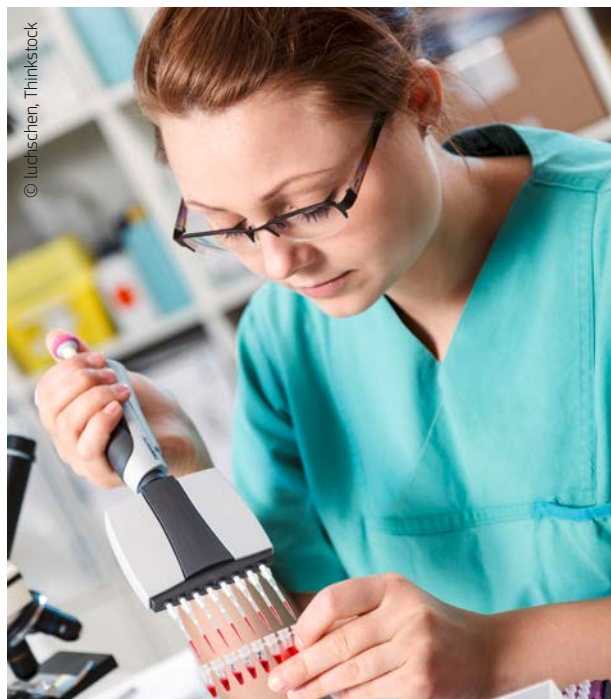
Research efforts were particularly focused on genetic polymorphisms of the 'Fc-gamma receptors' (FCGR) responsible for antibody binding and phagocytosis. A previously associated copy number variation in FCGR3B was shown to reduce receptor expression on all cell types and to induce expression of another family member, FCGR2B. However, FCGR2B is associated with reduced clearance of immune complexes, possibly leading to pathological inflammation and thereby increasing the risk of SLE.

Overall, the GENETICS OF SLE study is proof of how a large GWAS could lead to the discovery of robust genetic factors

and allow a full description of the genetic architecture underlying a particular disease. This information could form the first step towards understanding how these genetic variants are responsible for disease pathology. From a clinical perspective, the outcome of the study could be implemented for the development of genetic tests and provision of genetic counselling.

GENETICS OF SLE

- ★ Coordinated by King's College London in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/projects/rcn/98016_en.html



© iudischen, Thinkstock

A NOVEL IMPLANT TO RECORD BRAIN ACTIVITY

Recording brain activity can reveal significant information on how we process information and is also important for diagnosing mental illness. European scientists generated a biocompatible device for recording neurophysiological activity in the brain.

The information processing ability of the human brain constitutes an astonishing phenomenon and allows us to process stimuli rather than merely respond to external stimuli. The information processing theory is also used by scientists to account for mental development and explain how the human brain matures with time.

“MULTISENS technology has attracted interest from an electrophysiology instrumentation company.”

Most breakthroughs in our understanding of the basic mechanisms of information processing in the brain have been obtained with local field

potentials and single neuron recordings. However, this approach has limitations mainly due to the rigid and non-biocompatible nature of the probes employed. With this in mind, the EU-funded MULTISENS (Multi-sensing polymer transistors for *in vivo* recording) project set out to screen alternative materials for probe functionalisation.

A series of conducting polymers were used to construct the probe. The probe was subsequently chemically functionalised with bio-active molecules such as enzymes or extracellular matrix components to promote cell growth. A novel lithographic process was established to essentially pattern microelectrode arrays and high-density organic electrochemical transistor arrays with

different materials. The ability of these devices to record neurophysiological activity was verified on brain slices and in cells in culture.

Project results were communicated through publications in peer-reviewed journals with a high-impact factor and to the general public through a scientific fair. Although still not at the commercialisation stage, MULTISENS technology has attracted interest from an electrophysiology instrumentation company.

MULTISENS

- ★ Coordinated by the *École nationale supérieure des mines de Saint-Étienne* in France.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/projects/rcn/99017_en.html

NEW DEVICE IMPROVES CELL ANALYSIS

The need to perform cost-effective, reliable cell analysis triggered European researchers to develop a new flow cytometry device. Cell shape discrimination in real-time could open up new avenues for exploiting flow cytometry as a diagnostics method.

Flow cytometry is a standard microfluidics-based technique for analysing cellular parameters such as size, surface, intracellular protein expression and cell cycle. The device works by passing a laser beam of different wavelengths through a cell stream and detecting the light bouncing off with an optical detector. The capacity to process thousands of events per second in real time and perform multi-parameter analysis has rendered flow cytometry an invaluable tool for diagnosis.

The key objective of the EU-funded DIMID (Development of an innovative microfluidic impedance-based device for multi-parametric cell analysis) project was to enhance the morphology-based discrimination capacity of flow cytometry. For this purpose, partners set out to develop a cytometer device that would take into account the geometric and dielectric properties of a cell, thereby revealing cell anisotropy. Such a device will prove extremely valuable in haematology and microbiology as well as for the identification of rare cells such as tumour or stem cells, all based on cell shape.

To this end, a new chip was designed alongside a probe that could detect the spatial orientation of cells. The device was designed to be portable so that its use can extend outside the laboratory. *In silico* modelling experiments were conducted to optimise the device building blocks based on the ability to discriminate cell shape, volume and morphology.

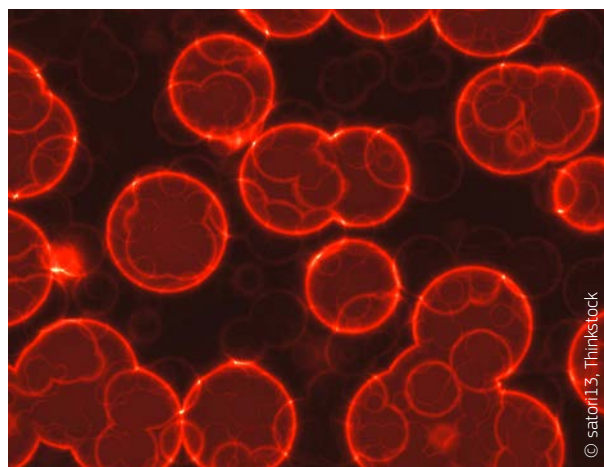
The consortium also explored the possibility of appropriately diluting whole blood for direct analysis, a method that could significantly speed up haematological diagnosis. Cell

shape discrimination could also extend to differentiating between dead and live cells.

Field tests showed encouraging results with respect to cost, accuracy and high-throughput performance of the prototype device. The potential of this work with respect to applications and commercialisation led to EU funding of the follow-up project DIMID plus. DIMID plus will bridge the gap between research and commercial application by bringing this new flow cytometer device to the market.

DIMID

- ★ Coordinated by Zurich Instruments in Switzerland.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/100888_en.html
- ★ Project website: <http://www.dimid-project.eu>
- ★  <http://bit.ly/1nPxPL>



NOVEL CORONARY STENT MATERIALS REDUCE HEART INFLAMMATION RISK

Tiny metal tubes called stents — which keep blood flowing through diseased coronary arteries by slowly releasing medication — have helped to save the lives of millions at risk of heart disease. Once inserted into arteries however, there is a small risk of a life-threatening complication called late ‘stent thrombosis’ (ST). This occurs when the stent fills with blood clot and disrupts the blood supply.



The main aim of the EU-funded PRESTIGE (PREvention of late Stent Thrombosis by an Interdisciplinary Global European effort) project, which began in December 2010, has therefore been to develop new strategies to prevent late ST, which kills around 25 000 patients in Europe every year. PRESTIGE began by identifying two key objectives: evaluating new stent designs that might better prevent the condition from occurring, and developing novel imaging technologies to enable early diagnosis.

In addition to the obvious health benefits, these innovations have the potential to provide a significant economic boost to Europe’s health industries sector. In 2010 more than 1.2 million stent implantation procedures were carried out in Europe. With an ageing population, demand for this type of operation is set to grow.

This project should also help to encourage cost reductions in European public and private health insurance systems, by reducing the need for emergency surgery and

helping patients with heart conditions to lead longer lives.

A key element of the project has been the development and evaluation of new stent materials. Drug eluting stents release medication that can help prevent potentially damaging scar tissue formation, which can occur in the initial months after implantation. However, these stents can occasionally cause an inflammatory reaction, which can lead to ST.

PRESTIGE has pioneered the development of new stent materials and coatings by achieving a better understanding of how stent surfaces interact with blood cells. This has enabled the team to focus on developing possible alternative medical coatings with a lower risk for inflammation after implantation. Tests in patients have been successfully carried out, with encouraging results.

A second approach has been to line stents with a thin layer of special antibodies — proteins produced by the body that identify and tackle foreign objects — which attract healthy

cells and anchor them to the surface of the stent. Initial lab tests of these antibody-modified stents have demonstrated a significant decrease in the risk of inflammation, as the body is less likely to react negatively to an object containing the body’s own healthy cells.

Another key aspect of the project has been the development of new imaging techniques. Partners in the PRESTIGE project have been able to use the Imaging Core Laboratory for Angiographic and Optical Coherence Tomography Analysis at the ISA Research Centre of the German Heart Centre in Munich, Germany. The lab provides state-of-the-art equipment and expertise.

“PRESTIGE has pioneered the development of new stent materials and coatings by achieving a better understanding of how stent surfaces interact with blood cells”

The project, which involves 14 European institutions, is scheduled for completion in November 2014. Coordinated by the German Heart Centre in Munich, the consortium has already made significant advances in treating this serious complication and addressing heart disease, the leading cause of death worldwide.

PRESTIGE

- ★ Coordinated by the German Heart Centre Munich in Germany.
- ★ Funded under FP7-HEALTH.
- ★ http://cordis.europa.eu/news/rcn/36593_en.html
- ★ Project website: <http://www.prestige-fp7.eu>

TOWARDS A FOOD PATHOGEN BIOSENSOR

Early detection of disease-causing organisms in food would save millions of lives and have huge social and economic impacts. Researchers have now developed sensors and methods to quickly detect pathogens during food production.

Viruses, bacteria and fungi in food are responsible for disease, loss of life and massive economic damage. New molecular biology tools offer the potential to

“PATHFINDER produced and collected a range of molecules able to bind to bacteria that cause food poisoning.”

quickly and easily identify these food-borne agents of disease.

The EU-funded PATHFINDER (Rapid and reliable detection of foodborne

pathogens by employing multiplexing biosensor technology) project aimed to develop a biosensor that could simultaneously detect a range of disease-causing bacteria.

PATHFINDER produced and collected a range of molecules able to bind to bacteria that cause food poisoning. The project manufactured antibodies against *Listeria*

monocytogenes, sourced an antibody against *Campylobacter jejuni* and *Campylobacter coli*, and screened libraries of molecules to find one that could bind to *Salmonella*.

Another aspect of the project focused on testing biosensor methods. A surface plasmon resonance biosensor is more sensitive than conventional laboratory detection methods, but could not detect *C. jejuni* when tested. A different sensor called MAGPIX was more successful, and a protocol was developed in PATHFINDER to detect *L. monocytogenes*, *C. jejuni* and *Salmonella sp.* simultaneously.

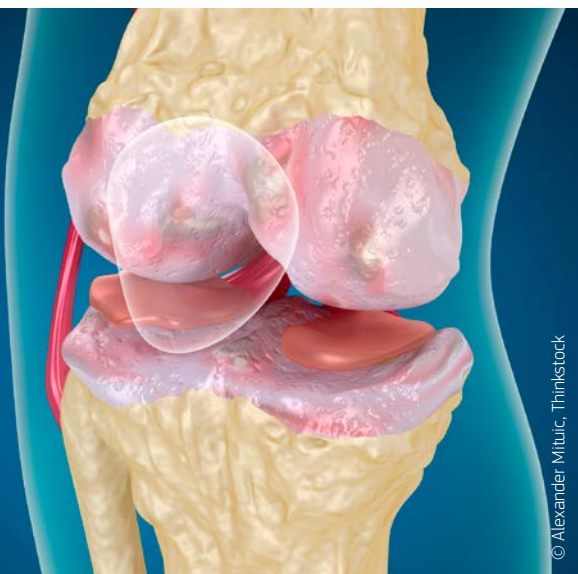
The MAGPIX biosensor protocol will be tested on commercial food samples in the next stage of the project. PATHFINDER has advanced the state of food-borne pathogen detection by developing new molecular binders and detection methods.

PATHFINDER

- ★ Coordinated by the National Science and Technology Development Agency in Thailand.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/projects/rcn/101693_en.html

A BIOMIMETIC IMPLANT TO TREAT OSTEOARTHRITIS

Exploiting the natural processes of tissue regeneration and repair could constitute a promising approach for reversing many degenerative disorders. However, reproducing exactly what happens in nature requires tight spatial and temporal control.



‘Osteoarthritis’ (OA) is a degenerative disorder of the joints and its incidence increases with age. It is estimated that 80% of the population will have radiographic evidence of OA by the age of 65.

The aetiology of OA remains unknown and existing disease management measures do not aim to regenerate the destroyed cartilage; instead they aim to

merely reduce the symptoms. For this purpose, painkillers or anti-inflammatory drugs are administered and in extreme cases surgical replacement of the joint is proposed as the only option.

Researchers in the EU-funded GAMBA (Gene activated matrices for bone and cartilage regeneration in arthritis) project envisioned a biomimetic implant system for bone and cartilage repair that mimics natural processes. To this end, they used a collection of innovative materials such as growth factor-encoding gene vectors, mesenchymal stem cells and a ceramic matrix for inducing bone and cartilage healing.

The GAMBA-generated toolkit was based on the use of mesenchymal stem cells and selective expression of certain growth factors that would ultimately drive these stem cells down a specific differentiation pathway. Temporal regulation of gene expression was achieved through heat-inducible promoters. By additionally coordinating spatial gene expression patterns, scientists hoped to design a system with components that could target inflammation while inducing cartilage and subchondral bone repair in OA.

The generated system consisted of three compartments, each of which expressed

one of three therapeutically relevant genes. These compartments were realised in the ‘Micro macroporous biphasic calcium phosphate’ (MBCP™) material and expressed an osteoinductive factor (BMP-2), a cartilage-inducing factor (TGF-beta) or an anti-inflammatory molecule (IL-10). Stem cells expressing these factors would differentiate to bone and cartilage cells while also being able to fight inflammation.

Overall, the design of the GAMBA system was intended to reproduce key elements of natural tissue formation as part of providing an implant for the treatment of OA. Coupled with an innovative programme of public outreach, actively linking patients and society, the consortium obtained invaluable insights into patient perspectives and expectations. Following successful validation in OA disease pre-clinical models, a clinical study is required to evaluate the potential of this novel system as a valid therapy for OA.

GAMBA

- ★ Coordinated by TUM in Germany.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/projects/rcn/95375_en.html
- ★ Project website: <http://www.gamba-project.eu>

“Outcomes highlighted the numerous pressures on contemporary media in Europe.”

SOCIAL SCIENCES AND HUMANITIES

POLICIES TO SUPPORT MEDIA INDEPENDENCE

Citizens rely on freedom of speech in the media to form opinions based on a variety of sources. EU-funded scientists have provided recommendations to policymakers at all levels to ensure that freedom is fostered and protected.

Maintaining the freedom and independence of the media is an important goal of democratic societies. EU-funded scientists initiated the project MEDIADEM (European Media Policies Revisited: Valuing and Reclaiming Free and Independent Media in Contemporary Democratic Systems) to evaluate the factors that affect development of policies with regard to media. Their objective is to ensure media independence through recommendations to policy stakeholders at national and European levels.

Scientists studied media policies and regulation in 12 EU Member States and two Candidate Countries. Country case findings were then used in a cross-country and cross-theme comparison. Results were the basis of policy guidelines to promote media freedom and independence targeted at state and other policy stakeholders, the EU and the Council of Europe.

Outcomes highlighted the numerous pressures on contemporary media in Europe despite the importance of freedom of speech in democratic societies

and existing safeguards. These forces include politics, market pressures, technological factors, and failures in regulation or in enforcement and compliance. The balance varies from country to country, as do the effects of these pressures. However, MEDIADEM analyses demonstrate important factors that undermine the freedom and independence of the media in Europe.

Detailed and country-specific recommendations regarding policy and regulation schemes have been provided to each of the 14 countries. In addition to specific guidelines, all countries must coordinate evidence-based and transparent media policy to ensure compliance with international guarantees of free speech. Policymakers must also address undue political influence on both public and private media and on monitoring and controlling media ownership in order to ensure independence. Similar recommendations have been presented to the Council of Europe, the EU and other stakeholders at the European level to complement and reinforce national policies.

Among these is to improve the enforcement of judgments passed by the European Court of Human Rights.

MEDIADEM has provided concrete media policy recommendations to foster media freedom based on evidence and scientific analyses. It has also engaged a large population of stakeholders from the media policy community, the media, academics and the public in an informed debate. By raising awareness of the fragility of media freedom in Europe, MEDIADEM has paved the way for widespread support of recommended policy reform.

MEDIADEM

- ★ Coordinated by the Hellenic Foundation for European and Foreign Policy in Greece.
- ★ Funded under FP7-SSH.
- ★ http://cordis.europa.eu/projects/rcn/94266_en.html
- ★ Project website: <http://www.mediadem.eliamep.gr/>

SURVEILLANCE AND SOCIETY

Whatever we think about it, it is clear that surveillance has increased — it is hard to ignore as the topic frequently hits the headlines. But does it matter? The EU-funded IRISS project is intent on finding out. The team is looking at whether surveillance changes our behaviour, and how it impacts our basic rights. The conclusions will be presented to policymakers, together with recommendations.



© coolkengzz, Thinkstock

‘Every day there is a new surveillance gadget, in addition to the numerous programmes already gathering data on us. We are sleepwalking into a surveillance society,’ claims IRISS (Increasing Resilience in Surveillance Societies) coordinator Reinhard Kreissl of Austria’s Institute for the Sociology of Law and Criminology. He wants to know what effect this surveillance has on how we live our lives, and levels of trust.

The IRISS team has been looking into the legal, social and technical aspects of surveillance, investigating awareness and reactions through case studies and interviews. And whereas talk of surveillance usually focuses on state security, the project is also looking at data collection by the private sector — for example by social media outlets, online vendors and search engines.

Does it matter?

In interviews, some people told researchers they have nothing against surveillance as they have nothing to hide. ‘When they started to think about what it means to be under constant surveillance, others vowed to change the way they live their lives,’ says Kreissl. Are they right to be concerned?

Kreissl gives two quite different examples of how surveillance can change behaviour. If everyone knows that a demonstration will be filmed, and that the images will be kept, some may decide not to attend. ‘This has an effect on political culture,’ he says. This is known as the “chilling effect”.

Meanwhile targeted marketing provides very tailored information, defined by the information already collected on the recipient, and has a manipulative effect on how someone sees the world and how they behave, says Kreissl.

Resilience

IRISS is using three case studies to investigate the impact of surveillance on democratic and open societies

— neighbourhood watch schemes, credit appraisals (checking a person’s or company’s credit record) and automatic number plate recognition.

Researchers are looking at how these schemes are organised in different countries, and how people feel about them. The results are not yet available, but patterns are discernable, says Kreissl.

The findings will be used to establish whether some people already have strategies for dealing with surveillance. They will also be used to identify how social, economic and institutional resilience can be increased. IRISS understands resilience primarily as citizens’ capability to develop strategies countering any negative impacts that mass surveillance has on their lives. Strategies may range from open resistance to specific technical measures of encryption, to avoidance.

Security and convenience trade-offs

Arguments in favour of surveillance often focus on security. CCTV, for example, ‘is often seen as a solution to all problems. But if you look at the research on it, you see that while it can have a positive effect, as a deterrent and in reducing crime, it is only effective in very specific situations. This is true for all forms of surveillance,’ says Kreissl, who is clearly passionate about the subject. The IRISS team has found very little independent evidence of the positive effects of surveillance, he adds.

The project has looked back over the history of surveillance, and found that while technologies are usually developed for a specific purpose for which they may be useful, the concepts are then sold to other sectors by marketing managers. ‘Once installed, the tools then take on a life of their own,’ says Kreissl.

It is not however the case that ordinary people are always passive bystanders in the collection of information — many of us give away data. ‘We could refrain — we could go to a travel agent to book our flight rather than booking online, for example. But people choose convenience over privacy,’ says Kreissl. His goal is to make people think twice before taking the easy option.

In addition to guidelines for the general public highlighting what to be aware of and when to be careful, IRISS is also formulating recommendations for policymakers at national and EU level. ‘It’s important to keep the discourse going — to keep the topic on the political agenda. I hope we can do this with IRISS,’ says the coordinator.

IRISS

- ★ Coordinated by the Institute for the Sociology of Law and Criminology in Austria.
- ★ Funded under FP7-SSH.
- ★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32241
- ★ Project website: <http://irissproject.eu>

A NEW LOOK AT ISLAM IN MEDIEVAL EUROPE

Novel techniques for studying Islamic pottery in Europe and the Mediterranean could help build stronger historical and cultural ties between the EU and the Muslim world.

When most of Europe was going through upheaval in the Middle Ages, Andalusia in southern Spain was flourishing academically, scientifically and artistically under Islamic rule. Sophisticated pottery emerged in the region, its design being influenced by the social events of that time. The EU-funded project ARANPOT (Archaeological research on Andalusian pottery (8th-11th centuries)) worked on identifying ceramic patterns and interpreting their significance in today's context.

From a technical perspective, the team studied the composition, glazing techniques, manufacture, chemical analysis and petrography of the ceramics, including the provenance of raw materials in glazing. It then extrapolated society's development in the Granada area based on the results of the pottery study, comparing it with other European and Mediterranean models of social development.

After intense petrographic analysis and neutron activation analysis, the emerging chemical data yielded

in-depth understanding of compositional variability, especially in the fine ware ceramics. The project led to the publication of papers in both English and Spanish that are opening new horizons in Andalusian archaeology, as well as in Islamic and Medieval archaeology.

The topic is being published in the Oxford Journal of Archaeology, revealing two distinct patterns of Islamisation and two separate social conceptions of Islam in early Medieval Vega de Granada. These intriguing results and their implications were presented at different archaeology-related events in Europe. The project team has also taken this kind of archaeological analysis to different parts of the Mediterranean and has worked on pottery retrieved from different sites in Palestine.

These new theoretical and methodological perspectives can have a strong socioeconomic impact, considering Islam from its material cycle of production, distribution and consumption, even beyond pottery. This helps academia study a cultural

division that was not so acutely perceived in the early Medieval period, bringing forth common origins and mutual influences of Europe and Islam.

The idea of Europe and Islam as interlinked historical entities is a strong one that citizens and policymakers can exploit. This is particu-

“The idea of Europe and Islam as interlinked historical entities is a strong one that citizens and policymakers can exploit.”

larly important as more Muslim citizens are becoming part of a greater Europe. Ultimately, it could give Europe a stronger role as a balancing power in the Mediterranean region, bringing closer cultural ties with Muslim nations.

Perceiving heritage as a common denominator will help undermine fundamentalism on both sides. At the end of the day, Europe with an Islamic past is not a lesser but a greater Europe. If history is portrayed in this light, conflict and radicalism could one day have less of a reason to exist, encouraging peace and coexistence instead.



ARANPOT

- ★ Coordinated by the University of Sheffield in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/projects/rcn/92185_en.html

HELPING TEACHERS TEACH SCIENCE

Students learn most effectively about science when the material is interesting and relevant. An EU project developed teaching modules to help teachers stimulate inquiry-based learning.



Current methods of teaching science do not necessarily meet this ideal. The ESTABLISH (European science and technology in action: Building links with industry, schools and home) project is attempting to turn this around.

The EU-funded 14-member consortium ran for four years to 2013. Its goal was to facilitate and implement an 'authentic' and inquiry-based approach for European secondary school science students. The approach would unite key stakeholders in science education.

First, the project attempted to define 'inquiry', and adopted a project educational framework on that basis, utilising key teaching concepts. Other project actions included identification and development of units, including the key concepts, and their eventual trial and evaluation. The project developed 18 suitable teaching and learning units, covering a wide range of sciences.

Following pilot testing, the units were revised. Later, they were implemented in the 11 participating countries: Czech Republic, Germany, Estonia, Ireland, Italy, Cyprus, Malta, the Netherlands, Poland, Slovakia and Sweden. Ongoing quality monitoring has been conducted by the internal Quality Assurance Committee.

ESTABLISH also promoted itself at various conferences and events, and made efforts to contribute to other Seventh Framework Programme (FP7) projects' objectives.

The outcome of ESTABLISH will be changes in classroom practice, reflecting improved concepts of science teaching. The project will also mean increased numbers of European teachers skilled in such innovative methods.

ESTABLISH

- ★ Coordinated by Dublin City University in Ireland.
- ★ Funded under FP7-SIS.
- ★ http://cordis.europa.eu/projects/rcn/93969_en.html
- ★ Project website: <http://www.establish-fp7.eu/>

PROTECTING EUROPEAN CONSUMER PRIVACY

Online service providers may be breaking European privacy laws, yet authorities are fairly powerless. An EU project illustrated the problem and solutions.

Much of modern life, and especially shopping, has moved online and become globalised. These rapid changes may undermine the EU's relatively strict protection concerning consumer information and informed consent.

The CONSENT (Consumer sentiment regarding privacy on user generated content services in the digital economy) project set out to investigate this. The 19-member consortium ran for three years to April 2013, during which time it received EUR 2.6 million in EU funding.

The project aimed to determine how consumer behaviour and commercial practices are changing the role of consent in the processing of personal data. Consent is a key concept of the European market, and separates this market from others. Nevertheless, a trend towards users of online services having little control of their personal information, especially regarding targeted personal advertising, apparently violates European principles.

The project also investigated how these social changes affect consumer choice and attitudes towards privacy.

CONSENT achieved its five objectives. In the project's first 18 months, it compiled three datasets, which were analysed in terms of current practices and legal frameworks. The project found that fair-processing practices of service providers are generally weak. For example, most do not provide a separate registration stage for providing consent. In general, it is difficult for consumers to find the provider's privacy policy, and some do not have one.

In most cases, consumers are unaware of which data are collected and how they are used. Furthermore, the current European legal framework is inadequate in several ways, laws are implemented inconsistently and authorities have insufficient powers. The lack of enforcement power means that providers have no incentive to comply with laws.

The second half of the project focused on the quantitative analysis of attitudes of individual users. The project also created a toolkit aimed at policymakers and summarised its findings in a policy brief. The project had an active dissemination schedule, mostly consisting of numerous workshops and events.

The CONSENT project provided an overview of the privacy practices and policies of current service providers, which identified numerous priorities for policymakers. This will mean more robust data protection for EU citizens.

CONSENT

- ★ Coordinated by the University of Groningen in the Netherlands.
- ★ Funded under FP7-SSH.
- ★ http://cordis.europa.eu/projects/rcn/94079_en.html
- ★ Project website: <http://consent.law.muni.cz/>

ENERGY AND TRANSPORT

GREENER FURNACES FOR ENERGY-INTENSIVE INDUSTRIES

Energy-intensive industries play a crucial role in boosting Europe's growth and employment, but strong climate-related policies can undermine their competitiveness. New, cleaner technologies are needed, and an EU project recently managed to achieve just that.

'Carbon leakage' is a well documented phenomenon in Europe, which sees businesses transfer their production to other regions in order to face competition from third countries without restrictions on greenhouse gas emissions. Since the EU cannot compromise on its sustainability targets for the sake of future generations, all hopes lie in new, affordable technologies enabling more sustainable production at a competitive cost.

The EDEFU (New Designs of Ecological Furnaces) project, which was partly funded under the EU's Seventh Framework Programme to the tune of EUR 8.5 million, has recently announced a major step forward in this

regard. The team, which held its final workshop on 22 May in Brussels, announced the successful design of a new type of ecological furnace boosting energy efficiency by 35 % and reducing CO₂ emissions by 27 % compared to traditional equipment.

The new technology integrates various heating systems such as plasma heating, high resistivity heating, radiant heat-microwave and biomass. It was developed for the aluminium, glass, cement and ceramic sectors, where industrial furnaces are used to provide heat in production processes. However, the team says it could be used by other related sectors as well.

“The new furnace is boosting energy efficiency by 35% and reducing CO₂ emissions by 27%.”

Other results from the project include waste heat reuse technologies, and new types of refractories (materials that retain their strength at high temperatures) with improved insulation characteristics thanks to the use of nanotechnology. The project discussed the commercialisation potential of these technologies at its workshop, saying there was a ‘high commercial potential expressed by end users, furnace manufacturers and auxiliary industry firms.’

Manufacturing industries are currently responsible for nearly one third of the world’s energy consumption and 36% of its CO₂ emissions. The project team expects its findings to contribute to reducing production costs and products’ carbon footprint.

EDEFU

- ★ Coordinated by Tecnalia in Spain.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/news/rcn/36598_en.html
- ★ Project website: <http://www.edefu.eu/>

REVOLUTIONARY AIRCRAFT DESIGN ON THE HORIZON

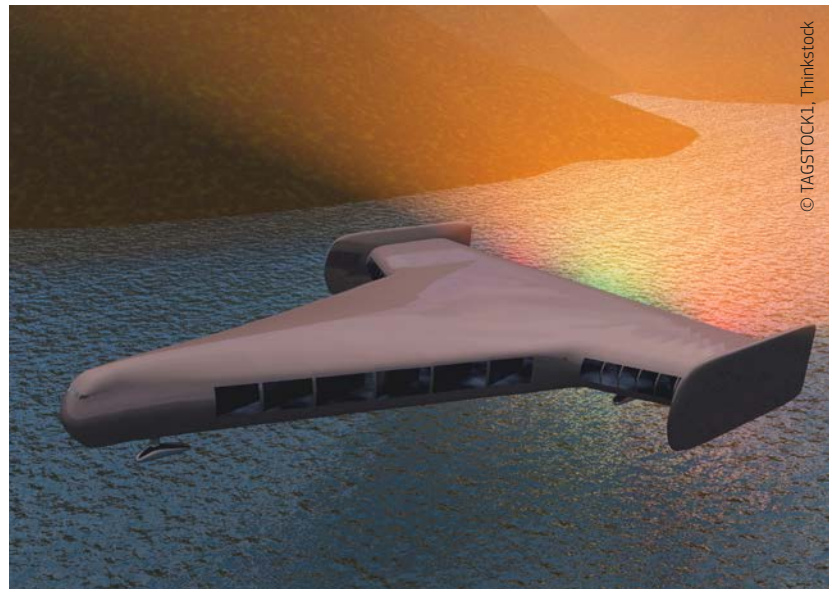
The idea of driverless pods for transporting passengers that could be moved from trains to aeroplanes is gaining ground and could redefine air transport as we know it.

Aircraft design has changed little since the 1960s, but radical new innovations are now on the horizon. One of these is the pod concept, which enables passengers to board a plane as if they were boarding a metro wagon. The EU-funded project FANTASSY (Future aircraft design following the carrier-pod concept as an enabler for co-modal seamless transport, passenger safety and environmental sustainability) is working on such a concept to bring about seamless air transport, coupled with enhanced passenger safety and environmental protection.

The project envisions a new aircraft design that combines a ‘passenger pod’ and a ‘carrier’ aircraft to receive it. While the concept and its constituents may not be technologically feasible at this point, it is important to work on it in order to achieve a reliable prototype in two or three decades. In this context, FANTASSY is evaluating the feasibility of the ‘carrier aircraft–passenger pod’ concept following a well-defined process.

More specifically, the project is outlining what the aircraft will look like and how it will function. It is defining the air transport system required for seamless mobility and door-to-door services. This involves in-depth investigation into technologies and materials currently under development that could be integrated into the modular aircraft design. Considerations under study include propulsion systems and energy storage.

So far, the project team has identified concepts and technologies that could be viable by 2050 or earlier. These



© TAGSTOCK1, Thinkstock

include concepts developed by NASA, Airbus and other key players in the industry. FANTASSY has also completed a study on future aircraft configurations and other concepts available today in line with the project’s vision.

In particular, the team proposed two preliminary pod and aircraft configurations: one that attaches the pods externally and one that accepts the pods internally. It is now outlining critical performance parameters that will enable selection of the most promising solution.

Benefits of such concepts include better intermodal passenger transport and cargo modules compatible with both rail and air transport modes. The same pods could be transferred from the aircraft to a rail vehicle

seamlessly, increasing passenger comfort and safety.

Such a system would also enable passengers to enjoy distributed airport facilities away from the runway, for example at a railway station, and then be transported directly to the carrier aircraft by rail. It would mean faster and easier passenger embarkation, increased flexibility in maintenance and easier evacuation in case of emergency. This radical new take on aircraft transport could redefine air travel and make it much more comfortable than ever before.

FANTASSY

- ★ Coordinated by the University of Patras in Greece.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/104570_en.html

LIGHTER-WEIGHT, MORE EFFICIENT HYBRID CARS

The hybrid car of the future could be more efficient by drawing power from the car body panels. EU researchers have developed prototype structural composite materials that can store and discharge electrical energy and that are also strong and lightweight enough to be used for car parts.

Besides a smaller, more efficient engine, today's hybrid cars can use lighter-weight materials to get better mileage. Current bulky batteries reduce the potential impact of hybrid technology. Thin materials that replace parts of the car body can serve as a battery, enabling drivers to cover longer distances before needing to recharge their cars.

The EU-funded research project STORAGE (Composite structural power storage for hybrid vehicles) focused on developing novel multifunctional materials that can simultaneously carry mechanical loads and store electrical energy, thus offering significant savings in vehicle system-level mass and volume, or performance benefits such as improved durability.

Initial work focused on two techniques for developing the constituents of the composite, namely reinforcing and grafting,

“The goal was to demonstrate an overall weight saving of 15%.”

as well as multifunctional resin. The team improved the material's mechanical properties by growing carbon nanotubes on the surface of the

carbon fibres. Carbon aerogel coating increased the surface area of the material, improving its capacity to store more energy. The matrix development was based on a mixture of existing epoxy resins and liquid electrolyte.

The constituents were then combined to form composite materials. Four multifunctional structural energy storage devices were manufactured, namely capacitors, batteries,

supercapacitors and hybrid capacitors. In the end, different techniques were used to test the electrical and mechanical properties of composite materials.

Key engineering and operational issues were addressed, beginning with the identification of a multifunctional design approach to carbon fibre laminates, and investigating how to package, integrate and connect the structural power composites within a vehicle structure.

Project activities resulted in three demonstrators: a small-scale radio-controlled car with a supercapacitor roof, a plenum cover with lithium-ion batteries and a trunk lid with supercapacitor laminates (saving more than 60% in weight).

Although STORAGE strove to achieve mechanical and electrical performances comparable to existing structural materials and electrical devices respectively, the goal was to demonstrate an overall weight saving of 15%. These revolutionary developments will help promote cleaner, more efficient and more competitive transport solutions.

STORAGE

- ★ Coordinated by the Imperial College of Science, Technology and Medicine in the United Kingdom.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/93371_en.html
- ★ Project website: <http://www3.imperial.ac.uk/structuralpowerstorage>



SILENT, ZERO-EMISSION DELIVERY FOR EUROPE

Fully-electric 'Light commercial vehicles' (LCVs) are scheduled for launch within the EU in 2020. In preparation, technology will soon be hitting the road in a demonstrator showcasing the best design concepts.

With minimal to no carbon dioxide and noise emissions, all-electric LCVs are poised for major impact on consumer and environmental health. EU-funded scientists working on the project DELIVER (Design of electric light vans for environment-impact reduction) are investigating the most promising design concepts for urban delivery trucks intended for large-scale production.

Work will lead to virtual assessment and a concept demonstrator as well as a detailed prototype. Participation of industrial partners should speed up commercialisation.

“Work will lead to virtual assessment and a concept demonstrator as well as a detailed prototype.”

The consortium made important progress on all fronts during the first reporting period. Following pre-selection of three design concepts based

on 2020 technologies and beyond, the team evaluated key performance indicators to choose one concept for further development.

All vehicle dimensions were specified and used to determine geometries and sizes of components and systems. Researchers have come up with an innovative door concept

and created the computer-aided design for the rolling chassis. The prototype frame was built. In addition, scientists have continued work on the architecture of the drivetrain and designed the electric motors that will be integrated with the wheels.

Work on the battery pack is nearly completed. Based on final vehicle dimensions and chassis mounting space, scientists were able to determine the energy capacity required. A prototype was successfully tested using a 'Battery management system' (BMS) supplied by the battery cell manufacturer, resulting in finalisation of the mechanical design and of BMS specifications. Scientists have procured the necessary components for assembly of the final version of the battery pack.

DELIVER activities will culminate in the production of a fully drivable demonstrator vehicle showcasing exciting innovation in the overall concept design, interior space and drivetrain. The virtual assessment will enable incorporation of even more advanced materials to highlight the full potential of project ideas. DELIVER innovation may soon be behind the surprisingly silent deliveries from your favourite store.

DELIVER

- ★ Coordinated by RWTH Aachen University in Germany.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/102010_en.html
- ★ Project website: <http://www.deliver-project.org/>

TRANSPORTATION INFORMATION SERVICE

Imagine a system combining all local transportation information in one place, and which also warns users and learns their preferences. An EU-funded project is making this possible and simple.

Most transportation service providers offer information about their services. However, to date, no interactive system exists that has linked all locally available public and private transportation services.

Such was the goal of the I-TOUR (Intelligent transport system optimized for urban trips) project. The 11-member consortium ran from February 2010 to July 2013, during which time it received EUR 3.5 million in EU funding. The project aimed to develop an open framework, to be used by providers and users, to build an adaptive transportation information service. The system would offer advice to travellers about routes and schedules for combined transportation modes.

In particular, the system offers alerts about schedule conflicts or

opportunities. In addition, the system learns from users' preferences and usage patterns, and gradually tailors its recommendations. Over time, the combined feedback from many users will help providers improve services.

I-TOUR achieved its aims, with a prototype system ready to be deployed. As a result, the project developed several innovative technologies. A mobile client shares local information for the community, and asks the community to validate the data; the client includes rules for identity protection. In addition, the project developed a modular infrastructure to ensure effective distribution of system data. To enable adaptation to user preferences, and for efficient routing, the project worked on developing models of multi-modal transport networks using hypernetworks. Other developments included user-friendly mobility clients



and identification of business models designed to at least recover costs.

Dissemination activities included a website, LinkedIn discussion groups, a YouTube channel, conference presentations and journal submissions, plus various workshops and meetings.

One expected impact will be increased democratisation of transport services, whereby service providers will respond to user feedback, thus giving users more control. Furthermore, the project will ultimately make public transportation safer, more efficient and more environmentally sustainable.

I-TOUR

- ★ Coordinated by Formit Servizi in Italy.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/93951_en.html
- ★ Project website: <http://www.itourproject.com>
- ★  <http://bit.ly/1ynbPKW>

A SENSIBLE SOLUTION FOR WIND TURBINE ELECTRICAL FAULTS

Wind turbine electrical system failures result in extended downtime, increasing operating costs and decreasing energy security. New on-board sensor technology and predictive tools will result in timely attention paid to potential problems.

Among renewable sources of energy, wind is one of the most commercially attractive for helping meet electricity needs and relieve dependence on fossil fuels. The technology is quite mature, with an average annual growth rate of more than 26% since 1990.

However, in order to meet the EU targets of covering 20% of electricity needs with wind energy within the next two decades, further improvements are required in terms of enhancing reliability and decreasing operating costs.

Reducing system faults can address both challenges for present and future wind turbines. EU-funded scientists are developing an intelligent sensor network for advanced diagnostics and predictive maintenance of electrical systems within the scope of the project WIND TURBARS (Online Intelligent Diagnostics and Predictive Maintenance Sensor System Integrated within the Wind Turbine Bus-Bar structure to aid Dynamic Maintenance Scheduling).

The consortium successfully developed a model of the electrical components of a wind turbine — generator, active rectifier, inverter and output filter. Data modelling of a normal operation has produced the starting point for an evaluation of initiation failure and of a simulation of key electrical faults identified based on a thorough literature review.

For signs of degradation regarding the faults being considered, partners have assessed a number of mathematical tools and their suitability. Progress has demonstrated that degradation can be detected weeks or even months before actually occurring.



© veeger, Thinkstock

Modelling and simulation work led to the identification of candidate sensors and initial component selection. In addition, based on the costs associated with electrical failures, the team has set a reasonable target price for the final sensor network system.

WIND TURBARS' diagnostic and predictive technology will address wind turbine electrical faults before they affect operations. The sensor network is expected to have a huge impact on the development of offshore farms given the extreme difficulties associated with inspection and repair. The benefits for onshore and retrofit

markets are also significant. Overall, the project stands to make a major contribution to the EU's renewable energy goals by increasing the energy security afforded by sustainable and eco-friendly wind power.

WIND TURBARS

- ★ Coordinated by HV Wooding in the United Kingdom.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/106156_en.html
- ★ Project website: <http://www.windturbars.eu/>

THE FUTURE OF BUSES

Bus systems have great potential to improve urban transport. A new system has redesigned everything about buses so that they can finally realise it.



Traffic is becoming slower and more congested. Urban buses represent very attractive solutions to many of the transportation problems affecting cities, yet bus systems have, to date, typically not been well managed.

Hoping to change that was the EBSF (European bus system of the future) project. The 49-member project ran from September 2008 to February 2013, during which time it received EUR 15.8 million in EU funding. The project's goal was to develop an integrated bus management system,

“The result of EBSF’s work will be urban bus systems that work and which passengers enjoy using.”

combining new vehicle technologies with new infrastructures and improved operations management. The objectives were to develop an intelligent operations system, develop innovative vehicle infrastructure and integrate

these two into European urban scenarios.

When defining the system, the project consulted transportation experts and stakeholders to determine their needs. This produced a list of more than 500 items. These were formalised and condensed into a wish list of 342 system requirements and then grouped into 17 functional requirements. The requirements represent necessary improvements to three project sub-systems: vehicle, infrastructure and operations. The analysis also compared trade-offs and conflicts.

The project's development of key technologies focused on new system designs affecting 12 areas. The driver station was redesigned with respect to driver comfort and vehicle operations. Passenger accessibility was assessed via simulated usage by various demographic groups, focusing on reduced bus stop waiting time. Other new systems included information technologies, a handling support system, modularity, energy management and efficiency, transport and traffic policies, passenger information, and

intermodal and transport hubs. The project also investigated the electrification of urban bus systems. Furthermore, the project reinvented the bus stop as a friendly gathering place; the concept received two French design awards.

EBSF's new integrated system has been tested in seven European cities (Budapest, Bremerhaven, Brunoy, Gothenburg, Madrid, Rome and Rouen). The tests successfully demonstrated the concepts and led to further refinements.

The result of EBSF's work will be urban bus systems that work and which passengers enjoy using. This will mean more efficient and effective city transportation.

EBSF

- ★ Coordinated by UITP in Belgium.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/89933_en.html
- ★ Project website: <http://ebsf.eu/>
- ★ <http://bit.ly/1plZysP>



ENVIRONMENT AND SOCIETY

CLIMATE CHANGE, MEET CYBORG PLANTS

We tend to think of plants as being the first victims of pollution and climate change. But thanks to an FP7 research project, crops, forests and even the plants in your back garden could be fighting back.

While we know what the impacts of climate change and pollution are likely to be, collecting detailed measurements is challenging. Putting sensors in every field or forest is expensive and time-consuming, and while these sensors can measure the state of the environment they can't tell us what is happening to the plants themselves. But now the SME-led PLEASSED project (PLants Employed As SEnsing Devices) is hoping to change that, by using plants themselves as environmental monitors.

Dr Vitaletti, project coordinator and Chief Technology Officer at WLAB

— an Italian SME which emphasises a culture of innovation and technical excellence in the area of wireless technologies and mobile/pervasive computing — says, 'Plants will be "the sentinel" of the environment. To this end, we are trying to classify the electrical signals generated by plants in reaction to external stimuli like pollutants.'

Talking plants

By using the same sort of technology that measures brain and muscle movements in human beings, Dr Vitaletti and his team think we can better understand what is happening

in the environment, and in plant-life as a result. He calls this blend of living tissue and digital sensors 'cyborg plants'. Once within the plant, the microsensors developed by the PLEASSED team can collect the signals generated by the plant, analyse them, combine them with those of other plants nearby, and produce a clear analysis of the environment. In other words, the cyborg plant will tell you how it feels and why it feels that way.

Dr Vitaletti and his team have been creating their prototypes from cheap, readily-available components in the hopes that everyone, from hobbyists to farmers, will be able to make their

own plant sensors. Anyone would then be able, for instance, to determine if a plant needs more or less sun and water, or how a specific fertiliser affects its health. Added to that, since the solution is Wi-Fi-based, monitoring your garden from your living room would technically be possible.

“The cyborg plant will tell you how it feels and why it feels that way.”

Open designs and open data

‘The whole PLEASSED architecture is open. The main purpose of this is to create a community of people interested in developing such technology,’ says Dr Vitaletti, adding, ‘we really hope that the PLEASSED open community will grow and help us to achieve better and more general results. We

are developing the PLEASSED kit, namely an open system that allows users to perform their own experiments and improve the design.’

The PLEASSED project is also making the data it collects freely available. ‘The availability of a large, high quality dataset is necessary for our project to develop. To use plants as sensing devices we need to develop classification algorithms capable of understanding the signals generated by plants,’ says Dr Vitaletti. ‘In particular, we hope that researchers will [be able to test their own] classification algorithms on the dataset.’

PLEASSED to help make things better

Plant-based monitoring opens up a whole range of opportunities for understanding the effect of pollution and climate change as never before. But Dr Vitaletti stresses that collecting data is only a first step in protecting

our environment for future generations. ‘If understanding is the first necessary step to change, plants can contribute by providing us with a valuable tool to better understand and monitor our environment,’ he says, ‘but then change is up to us.’

PLEASSED is a EUR 1.45 million project, with EUR 1.07 million funded by the European Union’s Seventh Framework Programme (FP7), as part of the Future and Emerging Technologies initiative. The project started in January 2012 and will end in May 2015.

PLEASSED

- ★ Coordinated by WLAB in Italy.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/story/rcn/13072_en.html
- ★ Project website: <http://pleased-fp7.eu/>
- ★  <https://www.youtube.com/watch?v=2tgdCB3v7mE>

EU RESEARCH ‘CLEARS’ THE WAY FOR HIGH QUALITY LAKES AND RESERVOIRS

The growth of blue-green algae in our lakes, large ponds, water reservoirs and public waters constitutes a problem for our environment and for our health. But their growth can now be prevented thanks to ultrasound-based technology.



© LG Sound

Traditional algae controlling methods (e.g. aeration, chemical or biological additives, and others) are not sufficiently effective when it comes to larger waters. They may also be associated with high labour costs and potentially negative environmental impacts, especially when chemicals are used. In order to address these problems, the EU-funded CLEARWATERPMPC (Development of an efficient environmentally-friendly Algae Control System, based on ultrasound technology, designed for use in bigger ponds and lakes) project has successfully developed and commercialised an environmentally-friendly technology. Known as the MPC-Buoy, the CLEARWATERPMPC solution uses ultrasound technology to prevent the growth of blue-green algae.

The MPC-Buoy is equipped with three ultrasonic transmitters with a diameter reach of at least 500 metres. Underneath the buoy, sensors also monitor the water quality in real-time. The sensors communicate the information to a web server.

As part of the project research, two MPC-Buoys were installed in Skrzyneckie Male Lake in Poznan, Poland. The buoys provided a complete overview of the water quality by collecting the following parameters every 10 minutes: chlorophyll (green algae), phycocyanin (blue-green algae), pH, TSS, dissolved oxygen and the temperature.

The project showed that the ultrasound treatment needs to be adjusted according to the type of algae and other parameters in the water, in order to perform at maximum efficiency.

Monitoring also showed a difference in the algae levels between the lake with the MPC-Buoys set up and several

Blue-green algae often result in a deterioration of water quality and emit a distinctly unpleasant odour. They consume a lot of oxygen in the water, leaving little for other animals like fish. They also produce toxins which can cause skin irritations and are suspected to be involved in the occurrence of liver cancer.

other similar lakes in the surrounding area. For example, the level of cyanobacteria (blue-green algae) cells in Kórnickie Lake, which is located in the same area as Skrzyneckie Male Lake, was nine times higher compared to the lake where the MPC-Buoys were set up.

“Locals have said that the water in the lake has become cleaner and that no algae scum appeared after deployment of the two MPC-Buoys.”

Local inhabitants also noticed a visual improvement in water quality. The CLEARWATERPMPC project team reports that locals have said that the water in the lake has become cleaner and that no algae scum appeared after deployment of the two MPC-Buoys.

Although ultrasound was already a well-known and proven technology for the treatment of algae, the CLEARWATERPMPC buoy is said to be unique for several reasons. In contrast to the currently available ultrasound based systems, the MPC-Buoy is more cost-effective due to its low operation and installation

costs. It also has an online lake monitoring system implemented and the possibility of remotely controlling specific control parameters. Additionally, the system is independent of power supply from the shore, since efficient solar panels are used to provide power all year round in any country.

The MPC-Buoy is patented by Dutch company LG Sound, the project coordinator. The project concluded in December 2013, and the MPC-Buoy has already been installed in lakes in Poland, the UK, the USA, Japan and Ireland. It has proven to be effective in lakes, ponds, dams and elsewhere.

CLEARWATERPMPC

- ★ Coordinated by LG Sound in the Netherlands.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/news/rcn/36583_en.html
- ★ Project website: <http://clearwater-pmpc.com/>

NEW SMART IRRIGATION MANAGEMENT SYSTEM

Sustainable agriculture is increasingly important in helping to mitigate the growing effects of climate change. New research has created a smart irrigation management system to help farmers use water more sustainably.

The EU has put strict new water use and sustainable agriculture policies in place. These aim to minimise the impact of farming on water resources, while maximising economic returns from commercial agriculture.

Funded by the EU, the ENORASIS (ENvironmental Optimization of IRrigAtion Management with the Combined uSe and Integration of High Precision Satellite Data, Advanced Modeling, Process Control and Business Innovation) project was set up to build and market a decision support system

that would optimise water use in irrigation. The system will provide irrigation management tools and services to help farmers use water more effectively.

The ENORASIS software platform has already been built, consisting of a geographic information system-based decision support system and irrigation management system. Researchers have completed web and mobile user interfaces, and the platform is designed to incorporate satellite data as well as data from wireless sensor networks.

Four pilot sites were selected in Cyprus, Poland, Serbia and Turkey, and pilot systems have been installed there. These pilots will run for two years to thoroughly test the systems and to gather data. The project is also developing a Meteo Analysis Tool for weather forecasting, which will be tested and validated within the next year.

“The project is also developing a Meteo Analysis Tool for weather forecasting.”



Once complete, the ENORASIS platform will be commercially available to farmers in the EU. It will save farmers money by optimising irrigation, bringing EU agriculture in line with new water and sustainability policies while reducing the environmental impact of irrigation in Europe.

ENORASIS

- ★ Coordinated by Draxis Environmental in Greece.
- ★ Funded under FP7-ENVIRONMENT.
- ★ http://cordis.europa.eu/projects/rcn/102038_en.html
- ★ Project website: <http://www.enoras.eu>
- ★  <http://bit.ly/1l65Hlz>

AN ENVIRONMENTAL STANDARDS INFORMATION PORTAL FOR EUROPE

In Europe, we have a vast wealth of research results that support standards in relation to environmental aspects such as air, water, soil and waste. SIPE, an EU-funded project, brings all these results together and combines them with information on standards and policies in a single dedicated web-based portal.

The project, which began in September 2012, is now in its final few months and the first version of the SIPE-RTD web portal is available for testing. The portal contains up to 190 policies (split up in 3600 policy articles), 950 Standards and about 600 EU-funded projects or research results.

The aim of the SIPE (An environmental Standards Information Portal for Europe) project is to promote and increase the use of research results in support of standards (related to air, water, soil and waste) among stakeholders involved in research, standardisation bodies, policy and enterprises/SMEs.

The portal, which offers a unique interface for information from the standards, policies and research communities, is a tool used to help achieve this aim. It allows users to browse in a number of different ways: using the four compartments ('Water and Marine', 'Air', 'Waste and Sludge', 'Soil and Sediment'), clicking on the keywords in the cloud or just using the free search.

The interlinking of information is based on keyword fingerprints that are developed for each item in the web portal. Easy transfer of information is facilitated by an input module and a document repository.

At the outset, information on EU-funded research projects in support of standards and their results was collected. European Commission Directives in these areas and their policy tasks were also collated. The same set of keywords was used to describe all data sets. This pool of (standards-related) keywords was interlinked by algorithms into a categorisation scheme of keywords.

The portal is also the result of a long and ongoing process of consultation and feedback. An Interfacing Group, consisting of invited stakeholders' representatives, commented on the initial concept and continues to guide the development and implementation of the portal. It is instrumental in ensuring that SIPE-RTD develops into a fit-for-use and sustainable entity. Public participation has also been organised via a Stakeholder Network.

Led by HydroScan in Belgium, the consortium comprises in total six partners from four countries: Mermayde in the Netherlands, WISE-RTD Association and Hydraulics Laboratory, both in Belgium, IVL Svenska Miljöinstitutet in Sweden and Quality Consult in Italy. These partners, along with all interested parties, will all gather in Brussels in June for the project's final conference, 'Research Innovation and Policy Implementation based on Standards Knowledge'.

Stakeholders are still encouraged to contribute to the SIPE-RTD Web Portal by creating their own profile and uploading research projects and results in regard to the environment and standards. The SIPE team is eager for users to test the portal and offer feedback.

SIPE

- ★ Coordinated by HydroScan in Belgium.
- ★ Funded under FP7-ENVIRONMENT.
- ★ http://cordis.europa.eu/news/rcn/36588_en.html
- ★ Project website: <http://www.sipe-rtd.eu/>



IMPROVING TECHNOLOGY TRANSFER TO FARMERS

An EU-funded project has established online platforms to improve technology transfer to pig farmers.

Academic and industrial research generates large amounts of 'knowledge and technology' (K&T) that often does not reach end users. This is particularly true in the case of agricultural sciences.

The RTD2FARM (Enhancing collaboration in research for livestock) initiative brought farmers and farmers' associations together with the scientific community to improve

K&T transfer. The project focused on pig farming, Europe's largest livestock sector, in Belgium, Italy and Austria.

"The project focused on pig farming, Europe's largest livestock sector, in Belgium, Italy and Austria."

Initially, information was gathered and collated from both researchers and farmers. A farmer's survey served to identify the needs of farmers in terms of technology transfer.

Based on these assessments, researchers designed the virtual European Centre for Excellence in Pig Sciences

(EUCEPS — <http://www.euceps.eu>). It consists of two online platforms: Wikipigs and PigSci.

Wikipigs is an innovation platform that provides an overview of current research and allows direct interaction between researchers and farmers. PigSci is a learning platform that provides farmers with access to the knowledge, translated into a range of languages, collected by RTD2FARM.

RTD2FARM has shown that K&T transfer to farmers is fragmented and generally occurs on an ad hoc basis. But its solution, the EUCEPS initiative, should ensure that research extends to all stakeholders.

RTD2FARM

- ★ Coordinated by the University of Veterinary Medicine Vienna in Austria.
- ★ Funded under FP7-KBBE.
- ★ http://cordis.europa.eu/projects/rcn/99236_en.html
- ★ Project website: <http://www.rtd2farm.eu>

A NEW BIOSENSOR FOR FUNGAL TOXINS

Mycotoxins are a family of chemicals produced by fungi that contaminate a wide range of human and animal food crops. Researchers have now developed a highly sensitive, automated detection system for a common mycotoxin known as 'deoxyvalenol' (DON).

There is currently no automated mycotoxin detection system for the cereal industry. However, mycotoxin contamination of cereal crops such as wheat and maize causes major economic losses through food damage and associated health problems.

As such, the EU-funded MYCOHUNT (Rapid biosensor for the detection of mycotoxin in wheat) project was established to develop a rapid and sensitive biosensor for detection of the DON mycotoxin.

Researchers first showed that wheat dust had higher concentrations of DON than wheat grains, making it the most suitable substrate to sample for mycotoxins. They then developed a DON-specific antibody in mice to use as an immunosensor — a biological detector.

After extensive market research, researchers built a prototype that could detect DON in air at concentrations as

low as 50 parts per billion. The prototype was tested and validated in both laboratory and factory conditions.

A business plan has since been drawn up for the commercialisation of this novel technology. Further refinement of the design is necessary, but it is estimated that the MYCOHUNT device will become commercially available within the next two years.

MYCOHUNT

- ★ Coordinated by Ateknea Solutions in Hungary.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/95606_en.html
- ★ Project website: <http://www.mycohunt.eu>
- ★  <http://bit.ly/1qvH4b7>



© ygrek, Thinkstock

"Researchers built a prototype that could detect DON in air at concentrations as low as 50 parts per billion."

WATER TREATMENT MEMBRANES ACTIVATED BY THE SUN

Access to water fit to drink is threatened by increasing contamination and water scarcity. New water treatment technology requiring minimal electricity and infrastructure could provide important relief.



“Several novel coating techniques developed within the scope of the NATIOMEM project show promise for future use in hydrogen production plants and third-generation solar cells.”

Increasing population growth and human activities are putting severe pressure on our planet’s sustainability. Availability of clean water has long been a major challenge in the Middle East and South Africa, and is a growing concern in Western countries. Around the globe, technology to reclaim contaminated surface water and wastewater will have an important impact on the quality of life of all citizens.

EU-funded scientists developed new membranes for water treatment technologies within the scope of the project NATIOMEM (Nano-structured TiON photo-catalytic membranes for water treatment). The porous substrate combining ceramic and metal membrane filters out particles and microorganisms larger than the pore size. A photo-catalytic coating based on titanium oxide is activated by sunlight to kill microorganisms, decompose and

mineralise organic pollutants, and oxidise dissolved metals.

The NATIOMEM project is focused on production of safe drinking water in rural areas of South Africa, and on remediation of grey wastewater for toilet flushing and irrigation to be implemented on rooftops in Jordan’s urban areas. Laboratory test results were quite promising and three pilot plants were used to evaluate the membranes’ performance.

Scientists provided updated recommendations regarding the design and application of the photo-catalytic membranes. Realistic use scenarios requiring efficient pre-filtration and recirculation of water for multiple passes and anti-fouling activity were included. The technology is now poised to provide simple, effective and economical water treatment in regions of extreme water scarcity.

In addition to applications in water treatment, several novel coating techniques developed within the scope of the NATIOMEM project show promise for future use in hydrogen production plants and third-generation solar cells. Results have been published in seven peer-reviewed scientific publications as well as communicated at numerous conferences and workshops.

The NATIOMEM project has produced filtration membranes that have the potential to significantly increase the commercial competitiveness of partners. Exploitation of the proposed water treatment process could also have an important impact on the availability of clean drinking water in challenged regions such as the Middle East and South Africa. With both rural and urban applications, opportunities abound for exploitation.

NATIOMEM

- ★ Coordinated by DHI in Denmark.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/projects/rcn/96170_en.html
- ★ Project website: <http://www.natiomem.eu/>



IT AND TELECOMMUNICATIONS

SECURITY AND PRIVACY? NOW THEY CAN GO HAND IN HAND

Disclosing more personal information than needed online when, say, you log in to your bank website may simplify the bank's security at the cost of your privacy. Now, thanks to research by an EU-funded project, there is a new approach that keeps systems secure and protects your identity.

The ABC4TRUST project (Attribute-based Credentials for Trust) research team is piloting this technology with young people, often thought to be less careful about their online security. But 'that's not the case,' says Prof. Dr Kai Rannenberg, coordinator of the ABC4TRUST project. 'The participants were very interested in learning which personal data they reveal and how they can control this. The university students especially feel that Attribute-based Credentials (ABCs) can help them manage their e-identities and enable them to use internet services in a privacy-preserving way.'

For example, at Norrtullskolan secondary school in Söderhamn, Sweden, pupils can access counselling services online. However, until recently the pupils couldn't access these services using a pseudonym — they had to identify themselves by name so the school could check whether they were allowed to use them.

But in the ABC4TRUST pilot scheme, each child is issued with a 'deck' of digital certificates that validate information like their enrolment status, their date of birth and so on. This allows the school pupils to enjoy both privacy and security. Instead of having to reveal their whole identity when using the counselling service they can simply use one of the certificates in their deck that pseudonymously verifies they are enrolled at the school.

Another pilot developed at the Computer Technology Institute and Press 'Diophantus' and trialled at the University of Patras, Greece, allows students to give anonymous feedback on their courses and lecturers, while ensuring that only registered students can take part in the polls.

Prof. Rannenberg says, 'Our user studies showed that the school children, parents and university students are happy that they are giving less of their private information when they access the services and leave feedback. Also, the respective authorities are happy with the pilots and the feedback; in the

not too distant future we expect more European public services and other organisations will switch to Privacy-ABCs.'

Users want privacy, organisations want security

According to recent research by the market research organisation Ovum, 68% of us in the EU would like to opt out of having our personal data tracked. In a speech in May, Commissioner Neelie Kroes stressed that it is essential for EU business 'to show the citizen that going online is not just convenient, but trustworthy... With resilient and secure networks and systems I think we can build that trust.'

New ways of managing online identities that increase privacy while maintaining security are now a high priority for businesses and citizens alike. ABC4TRUST makes this as easy as ABC.

ABC4TRUST is a EUR 13.05 million project, with EUR 8.85 million funded by the European Union's Seventh Framework Programme (FP7). The international and multidisciplinary ABC4TRUST consortium is led by Johann Wolfgang Goethe-Universität Frankfurt am Main, Germany and involves 11 partners from seven countries. ABC4TRUST started in November 2010 and will run for 4.25 years.

ABC4TRUST

- ★ Coordinated by the Goethe University Frankfurt in Germany.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/story/rcn/13071_en.html
- ★ Project website: <https://abc4trust.eu/>

WARMING UP TO MULTIMEDIA

New services to store, search and present multimedia will help businesses optimally harness their multimedia assets.

Multimedia is playing an ever-growing role in the way we communicate and share information, from education and training to entertainment and social media. The EU-funded project IM3I+ (IM3I+ pushing multimedia research into practice) is working on taking multimedia into the industrial arena. It is building on its predecessor, IM3I, which successfully developed a new framework for importing, analysing, annotating, searching and publishing multimedia documents and collections.

called ON:meedi:a. The latter represents a flexible, easy-to-handle management and publishing system for an organisation's media assets with a powerful media indexing back-end.

Besides centralised system administration and configuration, this solution is the easiest way to efficiently provide different instances for a business's potential clients and interested customers. Customisation and adaptation for special needs and purposes can be accomplished remotely more rapidly, resulting in the ability to set up more projects at the same time.

Efforts are ongoing to spread the word about the IM3I+ project in order

to reach the identified target creative content industries through online means, newsletters and social media. By organising their multimedia more efficiently, organisations can streamline their services and increase their efficiency, supporting a more vibrant and vigorous European economy.

IM3I+

- ★ Coordinated by IN2 Search Interfaces Development in the United Kingdom.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/101518_en.html

"The project team has already analysed the creative content market and built offerings for each segment after consulting with potential users."

More specifically, IM3I+ is introducing IM3I application scenarios in industrial showcases for creative content industries. It is consulting with stakeholders to validate these showcases and supporting their implementation through better market deployment strategies for creative content industries. The project team has already analysed the creative content market and built offerings for each segment after consulting with potential users.

Overall, the project is set to build a solid commercial offer as a software-as-a-service for mixing and mastering content on a platform



COMPLETE CRISIS MANAGEMENT

A crisis training and crisis management system has been developed to enable public authorities to better plan and train organisations and crisis managers for emergency situations.



Fast and effective emergency planning can save lives when disasters strike in the form of fires, flooding, industrial accidents and terrorist attacks. Urban and industrial areas are most vulnerable because of their high population density, built-up environment and presence of major infrastructures.

The EU-funded INDIGO (Innovative training & decision support for emergency operations) project built on the work of earlier initiatives to revolutionise the way in which such threats are managed. This was achieved through the training of security organisations, the design of suitable emergency plans and the efficient handling of crisis management procedures.

INDIGO developed an innovative system based on state-of-the-art virtual reality, simulation and artificial intelligence that improved the operational preparedness and management of complex crisis situations. The system can provide 3D interactive visualisation of the disaster scene, including

information from the field, simulation results and the interiors of buildings.

The system also enables different scenarios to be created for planning, training and anticipating future conditions and impending developments during the operation. It can also be used for conducting post-event analysis. Furthermore, INDIGO allows the simultaneous training of decision makers, crisis managers and first responders using simulated scenarios to communicate and share complex information between different organisations.

Project partners also released the Emergency Symbology Set, following a detailed analysis of the needs of crisis managers. The set is for use with 2D and 3D maps to improve decision-making across organisational boundaries by facilitating immediate understanding of crisis situations.

Consortium members tested the operational and training capability of the system in two real-life situations. During Veteran's Day in the Netherlands, police used the INDIGO operational system to monitor and report information between the mobile and stationary control centres, in parallel with their monitoring system. French firefighters in La Haye will trial the system for operational purposes and for training purposes within their organisation and for international organisation training.

The INDIGO system offers an essential and integrated tool for training personnel, planning operations, and facilitating crisis management and cooperation across organisations and nations. It will therefore play a vital role in protecting and aiding EU citizens in emergencies.

INDIGO

- ★ Coordinated by Diginext in France.
- ★ Funded under FP7-SECURITY.
- ★ http://cordis.europa.eu/projects/rcn/94424_en.html
- ★ Project website:
<http://indigo.diginext.fr/>
- ★ <http://bit.ly/1yF0aOt>

AIRPORT SECURITY TRAINING REDEFINED

State-of-the-art simulation and gaming technology is being used to create the ultimate airport security training application. This will help managers and airport staff to prepare for crises.

Airport security has become one of the biggest concerns of the travel industry. The EU-funded project CRISIS (Critical incident management training system using an interactive simulation environment) worked on a cutting-edge critical incident management solution to train security and emergency personnel in airports. It developed a prototype of an interactive simulation environment that trains crisis managers and relevant staff at different levels of the organisation, avoiding predictable

simulation exercises with pre-set drill-oriented choices.

Bringing together a consortium of partners in the fields of software engineering, modelling, gaming, security, decision sciences and technology, the project worked on creating a train-on-demand security solution. Against this backdrop, the project team developed software to simulate complex group behaviours in exercise scenarios. It conducted field studies in collaboration with police officers and

fire-fighters, as well as a live exercise at Keflavik Airport, Iceland. Work also involved research into advanced decision technologies, creating sophisticated exercise templates and enabling

“The system will be able to automatically update the instructor on trainee performance in real time.”

exercise planners to configure sophisticated scenarios and situations for training.

The system will be able to automatically update the instructor on trainee performance in real time. It will also feature a mobile or tablet application that can be used by instructors to monitor performance. Interestingly, airport staff will be able to 'play' against the system, as a team within an organisation, or even against other organisations.

In a nutshell, the project has successfully designed a prototype that features all the key software components to facilitate training and simulation.

In addition to enhancing security over the long run, the project is set to help small and medium-sized businesses in the field explore new opportunities. Airports, travellers and the economy are set to benefit from this endeavour.

CRISIS

- ★ Coordinated by the Middlesex University Higher Education Corporation in the United Kingdom.
- ★ Funded under FP7-SECURITY.
- ★ http://cordis.europa.eu/projects/rcn/94447_en.html
- ★ Project website: <http://idc.mdx.ac.uk/projects/crisis/>
- ★  <http://bit.ly/1LmzW7>



© Stocktrek Images, Thinkstock

ENVIRONMENT-FRIENDLY HI-TECH FASHION

Europe's garment industry is searching for new ways to involve customers. Consumers will be able to select eco-friendly 'e-smart' outfits as required.



© Alliance, Thinkstock

The MICRO-DRESS (Customised Wearable Functionality and Eco-Materials Extending the limits of Apparel Mass customisation) project combined fashion with technology to create stylish, functional garments manufactured according to the principles of sustainability. The consortium comprised small and medium-sized enterprises (SMEs), prominent EU institutes, and leading textile and clothing groups.

Work was based on two distinct business models: the extension of an existing customisation model of an international brand, and the expansion of an innovative mass

customisation model targeted at SMEs, known as 'micro-factories'. The benefits of mass customisation are that it combines the personalisation of custom-made products with the flexibility and cost efficiency of mass production.

Project partners developed rapid manufacturing techniques that enabled microelectronic components to be printed directly onto selected environment-friendly fabric. This involved the integration of solar cells, electronically conductive layers and light-emitting diodes into the garment.

A 'kinetic' jacket containing motion-tracking sensors was developed together with medical partners to allow the remote monitoring by physiotherapists of elderly people with rehabilitation needs. MICRO-DRESS partners also developed a removable smart card system that allows messages to be sent to recipients, such as notification of phone calls and texts, while they were in a secure area.

Logistics-related algorithms and web tools were developed to enable customers to choose the devices and the degree of environmental friendliness of production processes along the supply chain (referred to as 'yarn to garment'). Consortium members also developed and designed an 'e-supply chain management platform' to model the sourcing of e-devices.

Addressing health and safety issues associated with the manufacturing process, partners developed new cost-effective biosensor-based screening. The tests are expected to revolutionise the detection of potentially toxic compounds found in azo dyes and pigments.

MICRO-DRESS represents a significant step forward in the application of mass customisation and in the integration of microelectronics into fabric, while reducing the garment industry's environmental impacts.

MICRO-DRESS

- ★ Coordinated by the Athens Technology Center in Greece.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/projects/rcn/96356_en.html
- ★ Project website: <http://www.micro-dress.eu/>

SOCIALLY NETWORKED BUSINESSES

Having a web page is no longer enough — today, customers want to interact with organisations in a social media-style. An EU-funded project is helping organisations provide that interaction.



© violetkaipa, Thinkstock

Businesses and organisations quickly embraced the World Wide Web once it became established in 1989. However, customers and service users have come to expect to be able to interact with organisations in a participatory social media-style.

Enabling businesses to offer and develop systems in that style was the aim of the BPM4PEOPLE (Business Process Modelling for Participatory Enterprises, Organizations, and Public Administration Bodies) project. The six-member consortium ran for two years up to August 2013, with almost EUR 1 million in EU funding. The project aimed to design and market innovative software tools and methodologies that enable social business processes. The project's 'Business process management' (BPM) software products would integrate the design and analysis of business processes with social networking functions. These would allow flexible exploitation of the opportunities arising from social networking. The tools developed would be implemented on top of existing social networking platforms.

The project commenced with a study of the BPM platform field. Following this, BPM4PEOPLE specified the concept and requirements of social BPM. In addition, the project detailed its proposed SocialBPM extension to business process management,

notation and a new standard for Interaction Flow Modelling Language.

The project then successfully implemented business logic components as extensions of WebRatio, and designed implementation tools as a component of the designs. The resulting designs were tested and proven as a set of business case studies. Furthermore, the project designed and implemented a crowd computer able to run crowd-sourced business processes. The project created an implementation methodology, including a continuous improvement process, plus a methodology for market penetration.

Dissemination activities included various technical and popular publications, plus presentations about the project at numerous workshops, conferences and other gatherings. In addition, the project created a relevant online community, and in general raised awareness about its work.

The main beneficiaries of BPM4PEOPLE's work will be European small and medium-sized enterprises. They will now find it easier to adopt and use social BPM, and thus more readily reap

"The tools developed would be implemented on top of existing social networking platforms."

the benefits of such systems. The project's work will also benefit European public authorities wishing to offer services complying with legislative requirements for customer feedback.

BPM4PEOPLE

- ★ Coordinated by WebRatio in Italy.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/100350_en.html
- ★ Project website: <http://www.bpm4people.org>



INDUSTRIAL TECHNOLOGIES

WIBRATE: PICKING UP ON BAD VIBRATIONS

We've all dreaded the moment, as we're driving along, when the car starts to shake or rumble for no apparent reason. Or wondered nervously at the shuddering of an aeroplane as it takes off or lands. But what causes such vibrations? An EU-funded project set up to develop sensor systems that collect vibration information is yielding potentially game-changing results.

Vibration is a daily occurrence in a vast range of machinery, not to mention in buildings and infrastructures as well. The phenomenon causes wear and tear and often leads to equipment or structural failure. But can it be prevented? The WIBRATE (Wireless, Self-Powered Vibration Monitoring and Control for Complex Industrial Systems) partners certainly think so, provided that vibration characteristics are monitored and their underlying causes are understood.

WIBRATE engineers have come up with an innovative new technology

to detect and analyse vibrations in a wide range of applications. It consists of a self-powered, wireless vibration control and monitoring platform that can be fitted to trains, civil engineering structures, energy installations such as petrochemical plants, and factory-floor machinery, in a matter of minutes. What's more, the technology promises to dramatically reduce the cost of maintenance and accidents in many of our day-to-day activities.

WIBRATE is a three-year, EUR 2.85 million FP7 project which developed

and tested these detectors. Powered solely by energy harvested from the vibrations themselves, the sensor system is the brainchild of a consortium of European SMEs and research centres, led by the University of Twente in the Netherlands. Less than two years into the project and the WIBRATE consortium has been rewarded with one of its first industrial contracts for the sensor system, from Southeastern Railways in the United Kingdom; this has allowed the project to further enhance the prototype and convert it into a product.

Cutting down disruption for rail travellers

Southeastern Railways installed the sensors on a number of its trains and found they worked impressively by delivering significant reductions in operational and maintenance costs, as well as improving safety in helping identify premature failures. Now, Southeastern says it is optimising the use of its assets better, as well as reducing service disruptions for passengers.

The sensor systems monitor wear and tear of bearings, wheels and axles on trains, and their use could also be extended to train tracks, say the project partners. Since they are wireless and self-powered, the sensors can be fitted quickly without the need for complex retrofit wiring or batteries. The smart sensors collect vibration data while a train is in motion. Software algorithms on the smart sensors look for signs of wear and send their detections wirelessly to the central database. The train operators

get real-time information on the health status of the trains.

'The technology has attracted attention from European train operators in a number of countries including Germany, Ireland, Spain, Italy and Sweden,' said project coordinator Prof. Paul Havinga, of the University of Twente. Other partners in WIBRATE are the Swiss Università Della Svizzera italiana, Fiat's research centre in Italy, IT giant Honeywell (India), mechatronics leader LMS International (Belgium), and the project's SMEs: Inertia Technology (The Netherlands) and Perpetuum (UK), winner of the Southeastern contract.

Huge monitoring and control market

The technology appears to have a breathtaking range of applications. 'Imagine for example a factory where machines are equipped with intelligent sensors that detect impending failures by monitoring vibrations,' explained Prof. Havinga. 'The sensors can be installed with minimum effort and cost. They create an ad-hoc intelligent network that can supervise the machinery

on a continuous basis and eliminate the labour-intensive process of periodic monitoring.'

"The sensor systems monitor wear and tear of bearings, wheels and axles on trains."

The project partners are moving fast to take their results to the global monitoring and control market, which is a surprisingly big economic concern, representing 750 000 jobs in the EU. By 2020, monitoring and control revenues are forecast to grow to EUR 143 billion, twice the amount mobile phones bring in.

WIBRATE

- ★ Coordinated by the University of Twente in the Netherlands.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/story/rcn/13069_en.html
- ★ Project website: <http://wibrate.eu/>
- ★  <http://bit.ly/1q17X6U>

NEW AUTOMATED SEWER CLEANING SYSTEM

Keeping a sewerage system clean and functional is crucially important for public health and proper functioning of a city's infrastructure. Researchers have developed an automated sewerage inspection and cleaning device that will save time and money.

It costs more than EUR 6 billion annually to clean and maintain the 2.25 million kilometres of sewerage networks in the EU. But current cleaning systems are extremely inefficient as they require massive amounts of water.

Funded by the EU, the PIPEGUARD (A novel technology for sewerage mapping, inspection and cleaning with integrated

"The approach would result in a 35% reduction in cleaning costs through targeted cleaning."

real-time self-audit capability) project has come up with a potential solution: a device to inspect, clean and map sewerage systems. The

approach would result in a 35% reduction in cleaning costs through targeted cleaning.

The prototype consists of a commercially available tractor-like platform, an ultrasound device for detecting dirt in the sewers, and video and still cameras. It is linked via a cable to a ground station where data processing and user interaction through a simple interface take place.

In addition to locating dirt and damage in sewers, and cleaning the detected dirt, the overall system can provide a 3D map of the sewerage network in real time. This will allow users to identify areas where sedimentation is high.

The device can fit into tunnels as small as 100 mm in diameter, and has a cleaning and inspection rate of 60 metres per minute.



With field testing of the prototype yielding highly positive results, further development could see it brought to market in the near future.

PIPEGUARD

- ★ Coordinated by Fraunhofer in Germany.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/100964_en.html
- ★ Project website: <http://www.pipeguard.eu>

ENVIRONMENTALLY FRIENDLY PLUMBING PIPES

To minimise environmental impact, EU scientists set out to develop 100% recyclable eco-friendly thermoplastic pipes with enhanced properties.



© M.Lonelywalker, Thinkstock

Plastic pipes are widely used in the plumbing sector but most are not fully recyclable and the recyclable ones produce high levels of toxic by-products. Nearly 3 500 tonnes of scrap plastic pipes are landfilled in European waste disposal sites due to use of non-recyclable plastics. Almost 50% of plastic pipes are made using cross-linked polyethylene (PEX). Due to their cross-link bonds, PEX pipes are impossible to recycle. Furthermore, the recycling of multi-layer pipes containing encapsulated aluminium leaves highly toxic by-products in the environment.

The NANOFLEX (A Universal Flexible Low-cost Plumbing and Heating pipe system fully Environment-compatible by using innovative Nanoparticle technology) project will help producers and

small and medium-sized enterprise distributors of pipe systems overcome the challenges of meeting the objectives of the EU Landfill Directive and the revised 'Water framework directive' (WFD). Its aim is to develop novel thermoplastic pipes without PEX, suitable for underfloor heating, radiator heating and drinking water distribution systems. By replacing aluminium or expensive ethylene vinyl alcohol with novel nanocomposites based on clay, oxygen permeability into pipes will be reduced.

To meet the project objectives, the team worked on establishing an extrusion process capable of producing an un-bonded flexible pipe from chosen materials together with the necessary process technologies.

During the first reporting period, the focus was on reinforcing a polymer matrix with proper nanoparticles. This included compounding and exfoliation trials, using a variety of polymers and nanoclays.

Exfoliation and compounding processes were further developed in the second reporting period. To optimise oxygen barrier properties, scientists sought to improve nanoparticle dispersion in the polymer matrix. Furthermore, they fully developed a process for producing a self-reinforced polymer tape that will wrap an extruded inner pipe. They then worked on identifying a suitable method for covering the tape with nanoparticle coating.

The team's efforts resulted in a pre-prototype multi-layer pipe. The recyclable thermoplastic pipe was tested, with results providing valuable information for verifying and further improving the developed processes. At present, an integrated process line for NANOFLEX pipes remains to be developed.

NANOFLEX

- ★ Coordinated by NRL in Norway.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/projects/rcn/96677_en.html
- ★ Project website: <http://www.greenflextube.org/>

CAT'S EYES THAT SEE THE BIG TRAFFIC PICTURE

'Light-emitting diodes' (LEDs) powered by the Sun could soon be guiding drivers. With sensors and wireless communication, they may also help control centres manage traffic patterns on a larger scale for enhanced safety.

Almost every driver at some point has come across the lines of small, reflective spheres marking lanes or shoulders when lit up by vehicle headlights. These road studs, also known as cat's eyes, have entered a new era. Incorporation of LEDs increases visibility as compared with reflection, provides lighting at angles not illuminated by headlights and enables use of colours to indicate different conditions.

EU-funded scientists are pushing the frontiers of new technology with the development of 'Intelligent road studs' (IRSs). Work on the project INROADS (Intelligent renewable

optical advisory system) is focused on integration of LEDs with sensor and communication systems to enhance traffic management and driver information. In addition, the team is investigating the use of renewable energy such as small solar cells or piezoelectric devices to provide autonomy in areas without grid access and to reduce carbon dioxide emissions.

Following a series of consortium meetings with the Project Advisory Group and industry representatives, partners chose to develop the technology for active lane delineation and smart pedestrian crossings. A cost-benefit analysis of

the two applications was conducted. Scientists defined the requirements of each system, including power and lighting demands, operating temperature range, communication protocols, chemical resistance and compliance with relevant standards.

To date, the team has developed recommendations for potential wireless communication technologies suitable for

“Real-time traffic data could be used to provide advance warning of queues and minimise stop/start at traffic lights.”

each application. In addition, following testing of various sensors, one was chosen and incorporated into the sensor board design. Careful consideration of human safety factors will provide

critical information regarding the spacing, intensity and operation of the lights.

Potential applications are numerous and have important implications for safety and the environment. With wireless communication to a control centre, real-time traffic data could be used to provide advance warning of queues and minimise stop/start at traffic lights. INROADS IRSs are also seen as a low-cost and low-carbon way to provide guidance and increase safety compared to conventional street

lighting. In addition to foreseen traffic applications, the individual technologies for LEDs, wireless communications and renewable energy should provide partners with commercial products in their own industry sectors.

INROADS

- ★ Coordinated by TRL in the United Kingdom.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/102011_en.html
- ★ Project website: <http://www.fehrl.org/inroads>
- ★ <http://bit.ly/T3db3v>



© moodboard, Thinkstock

MITIGATING ELECTROMAGNETIC DISTURBANCES

‘Electromagnetic’ (EM) interference can wreak havoc with critical systems and radios aboard aircraft. An EU-funded project focused on minimising the risk of interference, whether it originates from outside or within the aircraft.

In the current air vehicle life cycle, experimental verification is set at the end of the development phase, when air vehicles are already built and just before being released to the market. However, if equipment and sub-systems are affected by mutual EM interactions or cannot correctly operate when subjected to external EM disturbances, re-work costs may be high and the delivery time scale may considerably increase in the event of redesign or retesting.

To help with this, the EU-funded project HIRF SE (HIRF synthetic environment) elaborated the methodology to develop a technology that should mitigate EM interference at the early stages of aircraft development. In addition, it would provide a considerable reduction in the certification/qualification tests required on air vehicles.

To deal with the increased use of composite materials and structures by the aeronautics industry, the HIRF SE framework included the most advanced computational models for the numerical simulation of EM characteristics and performance. Furthermore, it was able to simulate a widespread typology and number of EM (internal and external) interference sources.

Advanced computational tools were also used to calculate the internal and external fields of EM interference in low- and high-frequency scenarios (from 10 kHz to 3 GHz and from 3 to 40 GHz). With the open and evolutionary architecture of the framework, many specialised programmes

were able to work together to study the EM behaviour.

The correct operation of the framework was verified and validated by comparing data from real tests on small and medium air vehicles and pre-existing data for large air vehicles. Furthermore, all tools that were integrated inside the HIRF SE framework were assessed through comparisons with results from measurements.

HIRF SE helps reduce the delivery time scales of future air vehicles and systems by decreasing the time required for physical testing, possible redesign and re-testing. Developing and validating virtual models are key issues in reducing the number of development tests required to obtain air vehicle certification and to get improved results.

HIRF SE

- ★ Coordinated by Alenia Aermacchi in Italy.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/projects/rcn/89387_en.html



© Digital Vision, Thinkstock

UNIQUE PRODUCTS FOR UNIQUE CUSTOMERS

Today's consumers are increasingly seeking custom-made products rather than mass produced ones. With the emergence of new technologies that facilitate design and manufacture, industry is differentiating itself by delivering tailored products to a more demanding market.

The EU-funded project E-CUSTOM (A web-based collaboration system for mass customization) sought to engage customers in designing personalised products and to enhance decentralised manufacturing.

To bridge the gap between mass production and mass customisation, the project envisioned a web-based system that customises products with regard to features such as materials, shape and appearance. It worked on a tool to encourage manufacturing and/or assembly of selected parts outside the central manufacturing site — i.e. by associated suppliers, service providers or local

distributors — thus supporting a smart, decentralised approach.

In parallel, E-CUSTOM worked on measuring the environmental footprint of possible manufacturing solutions to home in on the most appropriate one. Such an efficient and eco-friendly approach can help overcome the challenges that European manufacturers are faced with, adding value to products and spurring innovation on a large scale. It aligns production with actual consumer demand more effectively, and shortens the design time for personalised products by up to 15%.

More specifically, the project team worked on developing a user-adaptive design system representing user-friendly design tools that enable customers to effect unique design changes in their order. E-CUSTOM then developed a decentralised production concept and an environmental assessment module in order to help select the most appropriate supply and/or manufacturing schemes. The last part of the project involved creating the required infrastructures in terms of network and information and communication technologies to standardise data exchange. This would facilitate communication among individuals and user groups.

In essence, the project team introduced radical changes to the organisational and operational structures of today's manufacturing sector with a focus on assembly-intensive production such as the auto industry. This could lead to savings in energy consumption by as much as 10% and in transport costs by as much as 20%. The cost of raw materials will also decline, as will time to market and delivery. The new E-CUSTOM tools are expected to lead to an increase in market share of up to 10% for European manufacturing, rendering it more competitive than ever before.

“The E-CUSTOM concept shortens the design time for personalised products by up to 15%.”

E-CUSTOM

- ★ Coordinated by the University of Patras in Greece.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/projects/rcn/94642_en.html
- ★ Project website: <http://www.ecustom-project.eu/>





SPACE

ON A MISSION TO MARS

Now that the Curiosity Rover of the National Aeronautics and Space Administration (NASA) is settled in on the surface of Mars taking pictures and gathering samples, the European Space Agency (ESA) is building the next robot it plans to send to probe the mysteries of the 'Red Planet'. An EU-funded project was established to re-design ESA's ExoMars.

Expected to launch in 2018, ExoMars will be tasked with finding whether life ever existed or is still active today on Mars. It will host a suite of scientific instruments dedicated to searching for life-related signatures, such as isotopes or molecules that can be interpreted as having been produced by a living organism.

To achieve this, the six-wheeled robotic rover will have the capability to travel up to 70 metres each day searching for signs of past and present life. It will be able to collect and analyse samples from within rocky outcrops and from the sub-surface, down to a depth of 2 metres.

The ROV-E (Lightweight technologies for exploration rovers) project identified the need to reduce the mission cost. Cutting-edge composite materials will be used to reduce the weight of the rover. However, concentrating solely on reducing the weight of each equipment structure does not lead to further reducing the mass of the overall payload.

The solution that the ROV-E project envisioned was to design shielding, health monitoring, data handling, power generation and other components that integrate multiple functions. It considered revolutionary 'multi-functional structure' (MFS) technology that eliminates chassis, electronic boxes and cabling by integrating electronics, thermal control and structure into a single element.

"Just the power storage of the MFS developed can provide up to 2% savings in the system mass."

First proposed in the 1990s, this concept for spacecraft architecture consists of placing the majority of electronics on the load-bearing structure. Printed circuits can also be laminated into the structures' face sheets. This approach, coupled with low-density polymer composites made of high-strength fibres, substantially reduces the overall weight.

SPACE

Specifically, the first phase of the project was devoted to tailoring thermal, mechanical and electrical properties of composites to fit functionalities added to MFSs. A series of tests on different materials were conducted and a numerical model was developed to calculate mass, volume and energy savings achieved with selected materials.

ROV-E's next phase involved the review of basic design parameters in computer simulations recreating conditions that will be encountered on the Red Planet. Particular emphasis was placed on the mobility sub-systems as the robot will face complex shaped obstacles (rocks), rough terrain with pebbles and sand. Based on the findings, directions for improvement were proposed for all-terrain navigation.

The MFS technology developed is very versatile and can be useful in applications where mass and volume are a concern, as in telecommunications and navigation microsattelites. Just the power storage of the MFS developed can provide up to 2% savings in the system mass and, ultimately, contribute to reduced fuel consumption and mission cost.

ROV-E

- ★ Coordinated by Tecnalia in Spain.
- ★ Funded under FP7-SPACE.
- ★ http://cordis.europa.eu/projects/rcn/97204_en.html
- ★ Project website: <http://www.rove-project.eu>

GETTING INTO GEAR FOR SPACE TRAVEL

To reduce size, weight and backlash in motion control systems, harmonic-drive gearing is ideal for power transmission. For space exploration, an EU-funded project is addressing a major drawback — the need for liquid lubricants.

Harmonic-drive gearing depends on multiple teeth being engaged at the major axes of a thin ring inside a slightly larger ring and then their disengagement at the minor axes. The challenge for the HARMLES (Dry lubricated harmonic drives for space applications) project was to come up with solid lubricants that minimise tooth wear and increase resistance to fatigue.

Due to the low pressure and temperature in space, liquid lubricants incur the risk of outgassing and evaporation. This leads to loss of lubrication efficiency as well as outgassed products deposited on the sensitive surface of optical components.

For space applications, the most commonly used solid lubricants are based on 'molybdenum disulphide' (MoS_2). Besides MoS_2 , 'tungsten disulphide' (WS_2) is very similar in structure. This type of lubricant is different in its preparation but offers only a very thin coating — no thicker than 0.5 micrometres — with limited lifetime.

HARMLES researchers conducted a series of tests (pin-on-disc and fretting tests) and validated the tribological behaviour of harmonic-drive gears coated with 'Diamond-like carbon' (DLC) and 'tungsten carbide' (WC). A wide variety of coatings were also tested and benchmarked for their suitability.

The next challenge was to find a design that increases lifetime. To achieve this, the HARMLES engineers used a complex 3D simulation of tooth engagement so that the tooth profile is modified in a

way that eliminates improper tooth engagement and reduces tooth wear and sliding friction.

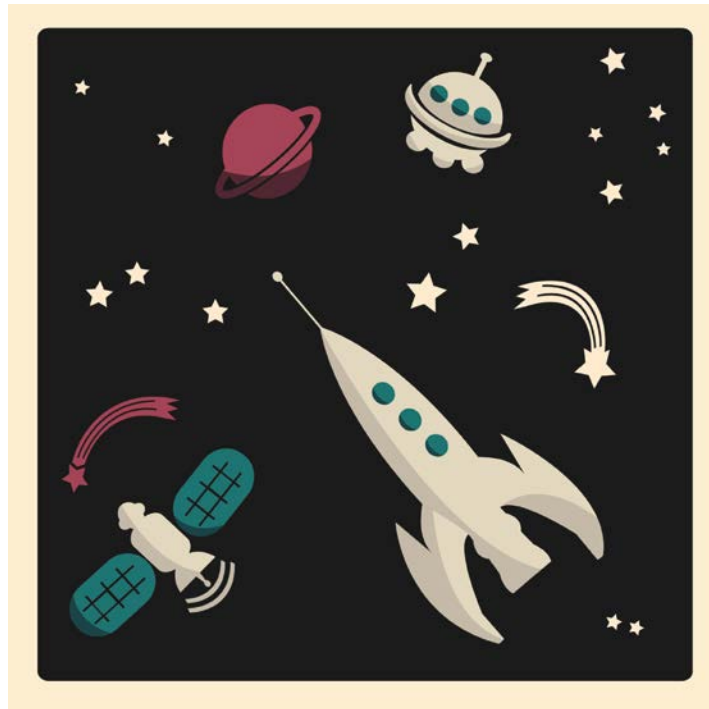
Furthermore, detailed finite element analysis of the toothbed pinpointed areas of high stress and fatigue due to bending. Even though by design more teeth could be engaged, the rolling efficiency depended on bending loads, speed and lubrication.

The first steps towards an optimised design for a dry lubricated harmonic-drive gear have been taken. In particular, the geometric adaptation has increased the gear's operation time by a factor of 20. However, improvements

are still necessary regarding the targeted lifetime. The development of solid lubricants for a new harmonic-drive gearing system will decrease spacecraft mass and, as a result, fuel requirements. This will help keep the European space programme on course.

HARMLES

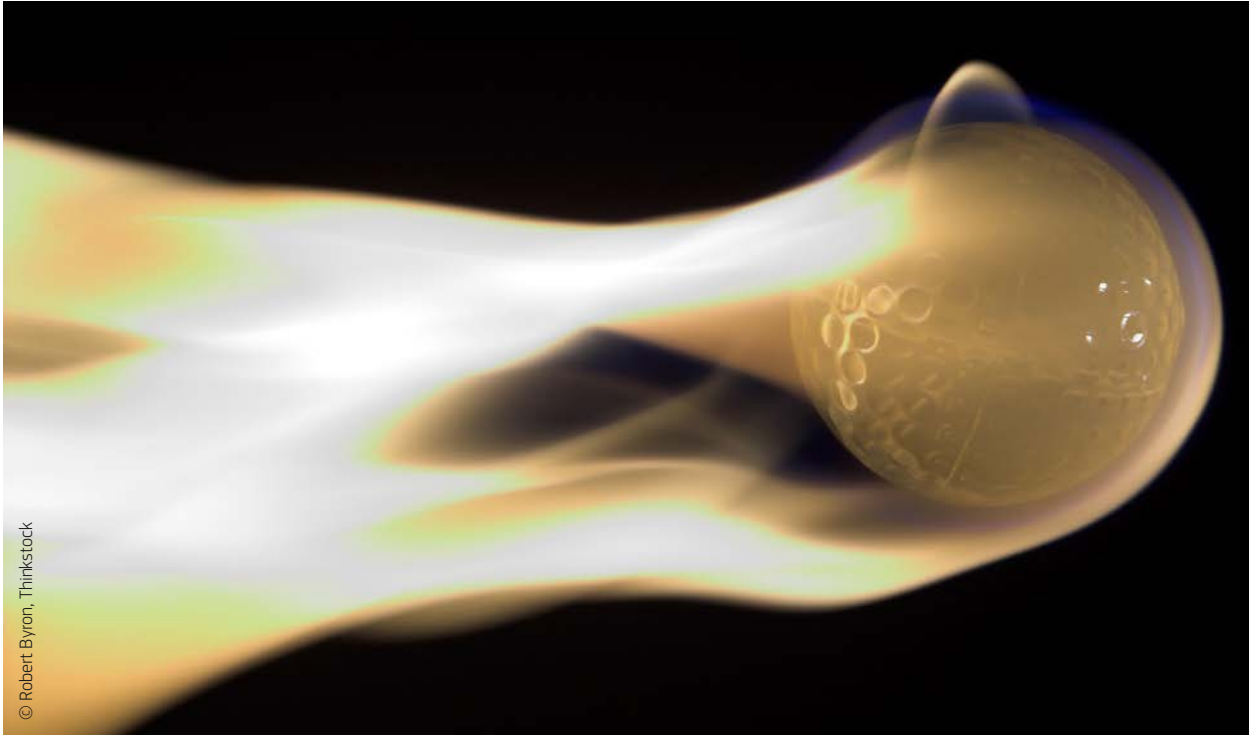
- ★ Coordinated by AC2T Research in Austria.
- ★ Funded under FP7-SPACE.
- ★ http://cordis.europa.eu/projects/rcn/99096_en.html
- ★ Project website: <http://www.harmles.eu/>



© toniashilova, Thinkstock

NOVEL SHIELDS THAT CAN TAKE THE HEAT

Spacecraft require advanced 'Thermal protection systems' (TPSs) for atmospheric re-entry. EU-funded scientists are developing a concept with reduced weight and enhanced performance that will also relieve dependence on foreign space technologies.



© Robert Byron, Thinkstock

Ablative materials designed to slowly burn away in a controlled manner are a promising solution for atmospheric re-entry vehicles based on conventional capsule designs that are now being revisited. Europe has conducted minimal research into ablative materials since the 1980s but development is now seen as an important component of reducing dependence on other countries for critical space technology.

EU-funded scientists are developing innovative TPSs for superior performance compared to traditional carbon phenolic materials within the project HYDRA (Hybrid ablative development for re-entry in planetary atmospheric thermal protection).

The HYDRA concept combines an ablative outer shield with higher heat resistance together with low-mass, lightweight thermostructural frames from 'Ceramic matrix composites' (CMCs) to provide structural support. The hybrid design will improve thermal protection and corrosion resistance as well as enhance shock absorption and damage tolerance. Joining technologies will be key to project success.

Following comprehensive analysis of current and planned space missions, scientists chose Earth re-entry missions as a starting point and developed associated specifications for the hybrid TPS. A matrix of state-of-the-art ablative materials was constructed, including performance criteria as well as availability, with particular attention paid to

'International traffic in arms regulations' (ITAR) of the United States government.

The team chose two different materials for the protection shield, the first a rigid carbon graphite felt impregnated with a phenolic resin and the second a cork-based composite. Two CMCs have also been selected. Following a preliminary screening of seven adhesives, three were selected for detailed testing during the upcoming project phase. In addition, researchers have developed theoretical models from which a complete coupled 3D model and simulation will be derived.

HYDRA expects to deliver a novel TPS concept combining a low-density ablator with a high-performance CMC structural component. The hybrid system will enable an important reduction in mass and a simultaneous increase in temperature limits.

Researchers plan to meet the challenges of future space missions while relieving dependence on foreign-sourced space technologies for enhanced competitiveness of the EU space industry and the EU itself.

HYDRA

- ★ Coordinated by Tecnalia in Spain.
- ★ Funded under FP7-SPACE.
- ★ http://cordis.europa.eu/projects/rcn/100907_en.html
- ★ Project website: <http://www.hydra-space.eu/>

EVENTS

AUGUST
04 ▶ 05

Berlin, GERMANY

CONFERENCE

INTERNATIONAL CONFERENCE EUROPE IN CRISIS

The International Conference 'Europe in Crisis' will be held from 4 to 5 August 2014 in Berlin, Germany.

When looking at the present situation in Europe, the economic crisis is a constant focus of the debate, and will be covered as such during the conference. However, growing tension towards migrants, anti-semitism and fostering a unique European identity are all further issues that will be considered by participants within the context of this theme. Scholars, NGO activists, Master and PhD students, and independent researchers will all be invited to attend and contribute to the discussions which will take place over two days.

For further information, please visit:
<http://socialsciencesandhumanities.com/upcoming-conferences-call-for-papers/call-for-papers-europe-in-crisis.html>

AUGUST
17 ▶ 22

Krakow, POLAND

CONFERENCE

SHEDDING NEW LIGHT ON DISEASE

A conference entitled 'Shedding New Light on Disease' will be held from 17 to 22 August 2014 in Krakow, Poland.

Recent advances in the biological sciences and medicine have led to an increasing demand for real time and minimally invasive chemical and structural information on biological materials.

The conference sets out to bring together clinicians and scientists who have joined forces in the quest for novel biomedical applications of Infrared and Raman spectroscopy to improve patient care.

For further information, please visit:
<http://www.spec2014.com/gb/d-29/welcome.html>

AUGUST
24 ▶ 27

Frankfurt, GERMANY

CONGRESS

20TH WORLD CONGRESS ON SAFETY AND HEALTH AT WORK 2014

The 20th World Congress on Safety and Health at Work 2014 will be held from 24 to 27 August 2014 in Frankfurt, Germany.

The importance of health and safety is second to none. Every year countless lives are lost as a result of neglecting appropriate procedures and lack of awareness or necessary training on the job.

This congress will provide a platform for the exchange of information and opinion to experts in health and safety, representatives of companies and employees and public authorities. It will provide an opportunity to pool experience, cooperate on specific issues and present best-practice examples.

For further information, please visit:
<http://www.safety2014germany.com/>

AUGUST
20 ▶ 23

Heidelberg, GERMANY

CONFERENCE

CHEMICAL BIOLOGY 2014

A conference entitled 'Chemical Biology 2014' will be held from 20 to 23 August 2014 in Heidelberg, Germany.

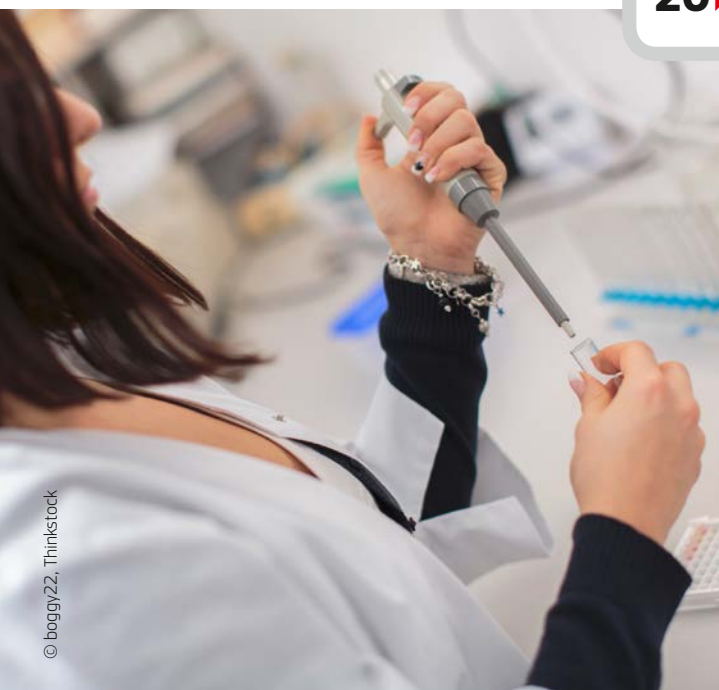
This conference will cover a broad scope of approaches and methods used in chemical biology including innovations in drug discovery, computational methods, protein engineering and controlling and engineering with light.

It will provide participants with an opportunity to meet and discuss the latest research findings and activities in areas ranging from tool development to biological applications and from computational drug design to synthetic chemistry.

For further information, please visit:
<http://www.embl.de/training/events/2014/CHB14-01/>

EVENTS

For more forthcoming events:
<http://cordis.europa.eu/events>



AUGUST
27▶29

Berlin, GERMANY

SYMPOSIUM

10TH INTERNATIONAL SYMPOSIUM ON OPEN COLLABORATION

The 10th International Symposium on Open Collaboration (OPENSYM 2014) will be held from 27 to 29 August 2014 in Berlin, Germany.

The conference will focus on collaboration research including wiki and social media, Wikipedia, open source software, open data, open access and IT-driven open innovation research.

The event seeks to foster collaboration and exchange between scientists from different areas of expertise including computer science, social science and law. It is also open to all those with an interest in open collaboration and its impact.

For further information, please visit:
<http://www.opensym.org/os2014/>

SEPT.
03▶05

Vienna, AUSTRIA

CONFERENCE

NINTH INTERNATIONAL JOINT CONFERENCE ON SOFTWARE TECHNOLOGIES

The Ninth International Joint Conference on Software Technologies (ICSOFT 2014) will be held from 3 to 5 September 2014 in Vienna, Austria.

Software technologies are essential for developing any enterprise information system encompassing a large number of research topics and applications. These range from programming issues to the more abstract theoretical aspects of software engineering.

This conference aims to bring together researchers, engineers and practitioners working in areas that are related to new software paradigm trends and mainstream software applications.

For further information, please visit:
<http://www.icsoft-ea.org/>

SEPT.
07▶10

Copenhagen, DENMARK

CONFERENCE

EUROSENSE 2014: A SENSE OF LIFE

A conference entitled 'EuroSense 2014: A Sense of Life' will be held from 7 to 10 September 2014 in Copenhagen, Denmark.

Consumer research has advanced a great deal over the years. Although there are still tick-box style questionnaires being passed around testing rooms, today's research digs deeper into the science behind our choices.

This conference will focus on sensory science in consumer research. It will address the complex intertwined areas related to consumer choice and discuss approaches towards gaining a better understanding of consumer psychology.

For further information, please visit:
<http://www.eurosense.elsevier.com/index.html>

SEPT.
20▶27

Venice, ITALY

CONFERENCE

NINTH CONFERENCE ON SUSTAINABLE DEVELOPMENT OF ENERGY, WATER AND ENVIRONMENTAL SYSTEMS

The Ninth Conference on Sustainable Development of Energy, Water and Environmental Systems will be held from 20 to 27 September 2014 in Venice, Italy.

The conference is dedicated to the improvement and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development.

It will focus on energy, water and environment systems including wastewater treatment, integration of local energy resources and their application to the sustainable development of Mediterranean cities and surrounding regions.

For further information, please visit:
<http://www.mediterranean2014.sdewes.org/index.php>



A comprehensive overview of European energy research at your fingertips!

<http://setis.ec.europa.eu/energy-research/>

Aiming to support cutting-edge projects, the Energy Research Knowledge Centre (ERKC) is a community portal that allows energy researchers and policymakers across Europe to share ideas and findings and identify potential partners and resources.

The ERKC web portal collects and organises validated, referenced information on energy research programmes and projects being currently undertaken in Europe and beyond. It is also a source of news on innovative work being carried out in the EU.

ERKC publications analyse the policy implications of energy research results and provide an overview of innovative research across the spectrum of energy technologies. One such overview - a Thematic Research Summary on Bioenergy - will be available on the portal in the near future.

The ERKC was set up under the umbrella of the European Commission's Strategic Energy Technologies Information System (SETIS). A recent publication of SETIS also deals with bioenergy and is available here: <http://setis.ec.europa.eu/setis-magazine/bioenergy>



Free subscriptions, orders and downloads



The *research*eu* magazines are free of charge.

To subscribe to either *research*eu results magazine* or *research*eu focus*, please go to:
<http://cordis.europa.eu/research-eu>




To order a single issue of a *research*eu results magazine*, please go to:
http://bookshop.europa.eu/research_eu



For an issue of *research*eu focus magazine*, please go to:
http://bookshop.europa.eu/research_eu_focus



Publications Office

-  eur-lex.europa.eu • EU law
-  bookshop.europa.eu • EU publications
-  ted.europa.eu • Public procurement
-  cordis.europa.eu • Research and development



Follow us on Facebook and Twitter:
facebook.com/EULawandPublications
twitter.com/myCORDIS
twitter.com/CORDISfunding