

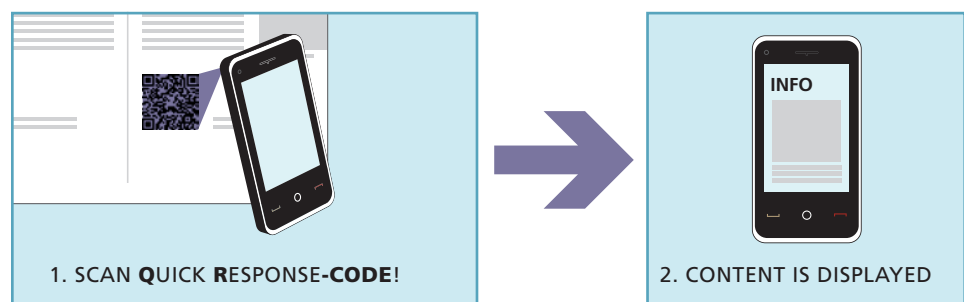
ANNUAL REPORT 2012 | 2013

A REPORT FOR YOU ABOUT
US, OUR PRODUCTS,
OUR SERVICES AND OUR
RESPONSIBILITY FOR THE
FUTURE.



ADDITIONAL INFORMATION

For some of our contributions, we have stored additional information that is accessible to you by smartphone via a QR code. If you are working at your computer, please use the shortened URL.



SUSTAINABILITY AS A RECURRING THEME

The shift in sustainable energy and raw materials supply is the focus of our work. We would like to show you what contribution our products and services make to sustainable development. A symbol helps to find this information quickly. It pulls like a consistent thread through the report and – following the three pillars of sustainability – it structures the topics into the categories Ecology, Economy and Society.

SUSTAINABILITY: TALK TO US

The aspects of sustainability in this report are to be understood as highlights. In case of questions regarding the topic, please contact the institute's sustainability manager (contact cf. pg. 39) or the respective scientific contact.

MORE ABOUT SUSTAINABILITY AT FRAUNHOFER UMSICHT
www.umsicht.fraunhofer.de/en/sustainability.html



We are looking forward to your feedback!



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EVERYTHING AT A GLANCE.

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*Prof. Dr.-Ing. Eckhard Weidner,
Director of the Institute.*



*Prof. Dr.-Ing. Görgen Deerberg,
Deputy Director of the Institute.*

PREFACE



We dedicate the award
as "Place of Progress"
to our employees.



Dear readers

We received an award as "Place of Progress" in North Rhine-Westphalia. Building on this, we have made our institute's structure more flexible and developed it further, plus we integrated an Institute Branch. Because growth clearly requires space and new heads. As such, we will continue to be a constantly progressive partner for research and development also in the future.

FRAUNHOFER-WIDE EMPLOYEE SURVEY

2012 started with the analysis and discussion of the positive results of the Fraunhofer-wide employee survey: our employees do identify with the institute and enjoy their work. They feel well integrated into the institute's strategy, appreciate the flat hierarchies and a working environment that provides for professional leeway, openness to ideas and the reconcilability of work and family. Nevertheless, there is potential for optimization: more efficient work processes, clearer cut responsibilities, more opportunities for advancement, and structured growth.

NEW STRUCTURE AS A RESULT

With the key areas of "Production without raw materials" and "Energy with UMSICHT" (UMSICHT = prudence in German), we are positioning ourselves as pioneers of the shift in energy and raw materials supply. Through the structuring of the institute into the divisions "Energy", "Processes", "Products" and "Organization", which are sub-divided into departments and groups, we are creating more personal development opportunities. The concurrently established "Think Tanks" help to obtain the necessary creative input.

NEW INSTITUTE BRANCH COMPLEMENTS EXPERTISE

Since July 1, 2012, we have a branch of the institute in Sulzbach-Rosenberg, in the Nuremberg metropolitan area. With the help of the 70 new employees acquired this way and thanks to the financial commitment of the German state of Bavaria, we can bring new integration projects on the way in the next years. The Center for Energy Storage (pg. 22) is one of them. On the next pages, you will find out with which projects we are contributing to the shift in energy and raw materials supply above and beyond that. We are keeping additional information available on the Internet and are also looking forward to providing you with respective explanations in a personal discussion.

Please enjoy this exciting read!

Many greetings,



Eckhard Weidner



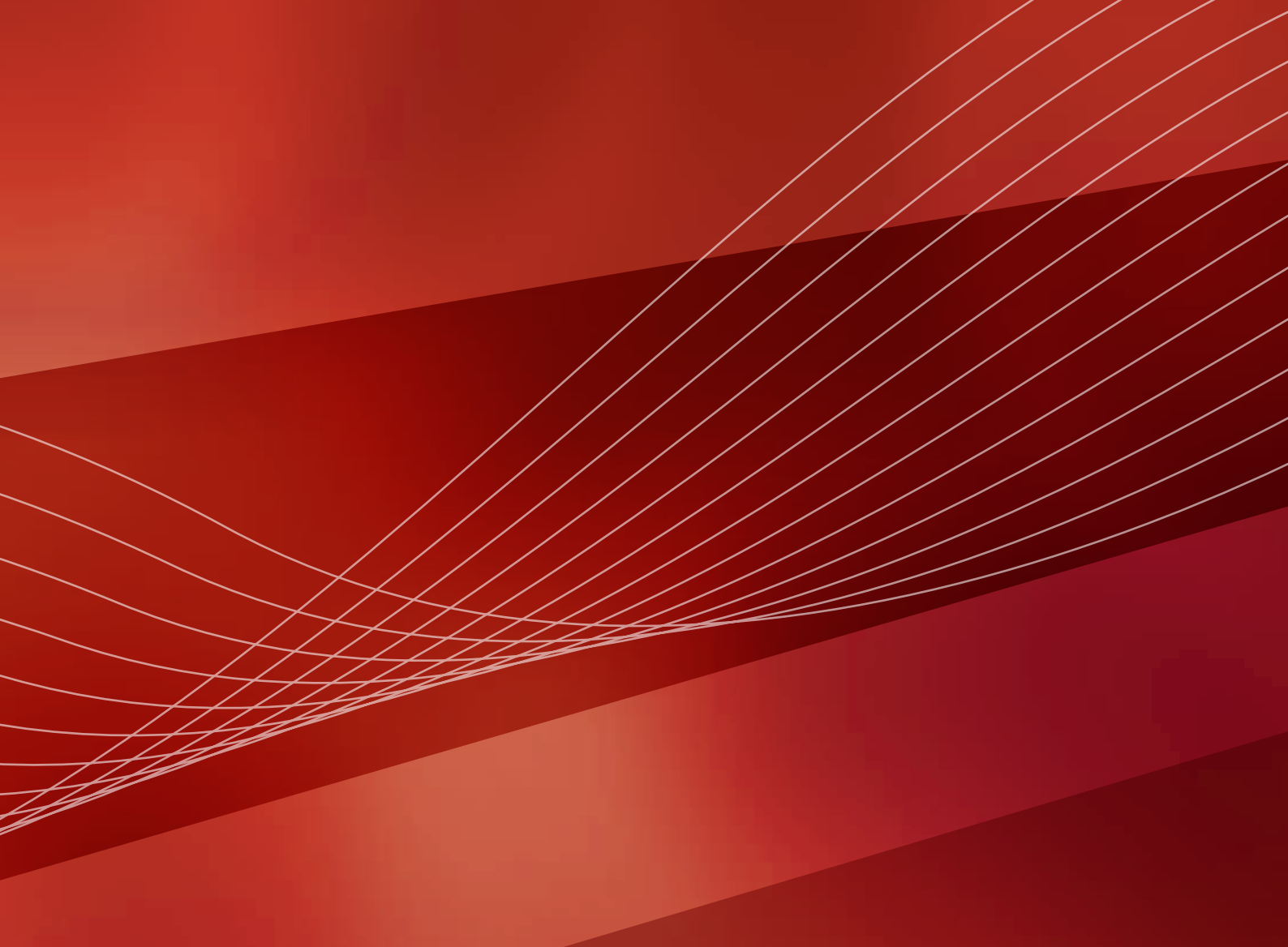
Görgo Deerberg



INSTITUTE

THE BASIC DATA OF FRAUNHOFER UMSICHT.

Profile, Key Performance
Indicators, Organizational Chart,
Strategy, Awards.



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- 10 Organizational chart
- 12 Questions on the strategy
- 14 Awarded!

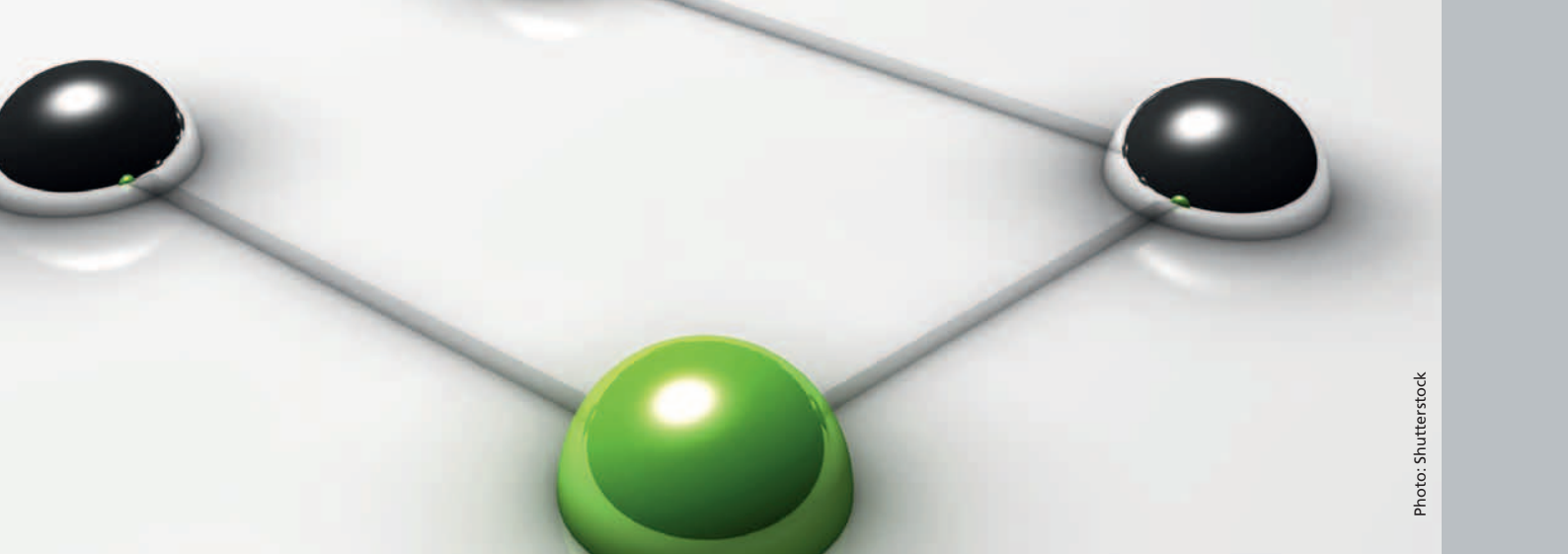


Photo: Shutterstock

PROFILE OF FRAUNHOFER UMSICHT

Fraunhofer UMSICHT actively participates in the shift in energy and raw materials supply. As a pioneer for technical innovations in the divisions "Energy", "Processes" and "Products", Fraunhofer UMSICHT wants to encourage sustainable business practices and environmentally friendly technologies as well as innovative behavior to improve the quality of life for people and to support the innovation capacity of the domestic economy. As one of 66 institutes and entities with separate legal status of the Fraunhofer-Gesellschaft, we are networked world-wide and promote international cooperation. Fraunhofer is the largest organization for applied research in Europe.

KEYNOTES

<i>Founded:</i>	<i>June 1990</i>
<i>Main site:</i>	<i>Oberhausen, NRW (Germany)</i>
<i>Branch office:</i>	<i>Willich, NRW (development of plastics made of renewable resources, manufacturing in pilot series and small batches)</i>
<i>Institute Branch:</i>	<i>Sulzbach-Rosenberg (in the Nuremberg metropolitan region of Bavaria) (power generation from biomass and waste, waste management/resources management, materials for energy technology, system analysis and energy storage at the "Center for Energy Storage CES")</i>
<i>Total staff*:</i>	<i>463 employees, of which 393 are located in Oberhausen and Willich as well as 70 in Sulzbach-Rosenberg</i>
<i>Total budget:</i>	<i>30.5 million Euro (2012), of which 26.4 million Euro are allocated to Oberhausen and 4.1 million Euro to Sulzbach-Rosenberg</i>
<i>Customers:</i>	<i>Small or medium-sized enterprises, major enterprises, public institutions</i>
<i>International markets:</i>	<i>Europe (primarily), Africa, Asia, South America</i>

*As of December 31, 2012



Institute's complex in Oberhausen.



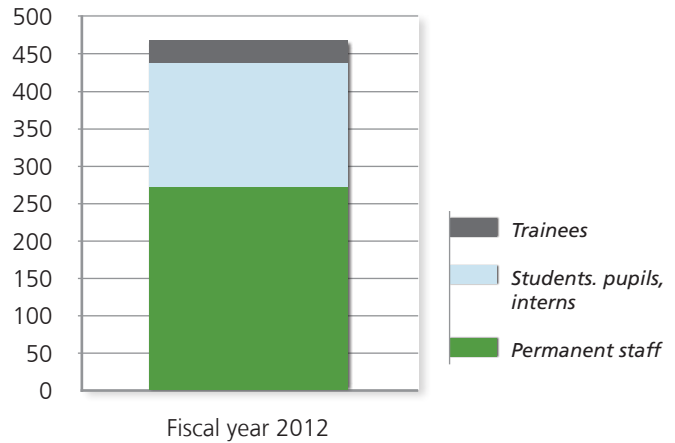
Institute's complex in Sulzbach-Rosenberg.

FACTS AND FIGURES

STAFFING STATISTICS 2012

	OB	SURO *
Permanent staff	225	54
Scientific ♂ 166 ♀ 45	170	41
Administrative	55	13
Other staff	168	16
Trainees	15	3
Students, pupils, interns	153	13
Total staff	393	70

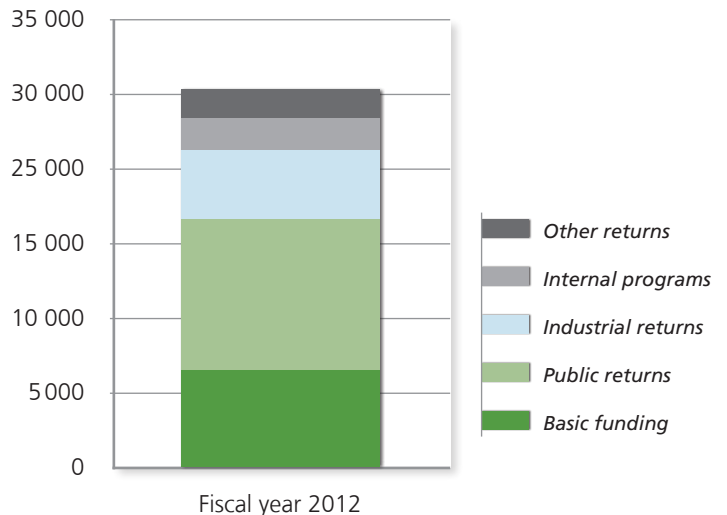
[Number of employees]



FINANCIAL STATISTICS 2012

	[thousand Euro]	
	OB	SURO *
Operating budget	24 050	3 649
Other costs	11 646	820
Staff costs	12 404	2 829
Investment budget	2 328	404
External project investments	1 163	337
Internal investments	1 165	67
Total returns	26 378	4 052
Industrial returns	8 893	722
Public returns	7 203	2 870
Other returns	1 875	40
Internal programs	2 078	0
Basic funding	6 329	420

[thousand Euro]



DIRECTORATE

Director | **Prof. Dr.-Ing. Eckhard Weidner** Deputy Director | **Prof. Dr.-Ing. Görgе Deerberg**

ENERGY

Division Director | Dr.-Ing. C. Doetsch
Deputy Division Director | Dr. T. Marzi

ENERGY SYSTEMS ENGINEERING

Head | Dr.-Ing. Wilhelm Althaus

- Waste Heat to Power
- Compressed Air Energy Storage

ENERGY SYSTEMS

Head | Carsten Beier

- Energy Supply Systems
- Energy System Optimization

CHEMICAL ENERGY STORAGE

Head | Dr. Thomas Marzi
Dr.-Ing. Barbara Zeidler-Fandrich

- Thermochemical Storage
- Catalytic Processes
- Biogas

ELECTRICAL, THERMAL ENERGY STORAGE

Head | Dr.-Ing. Christian Doetsch

- Electrochemical Storage
- Thermal Energy Storage and Systems

THINK TANK ENERGY

Head | Dr.-Ing. Anna Grevé

PROCESSES

Division Director | Prof. Dr.-Ing. G. Deerberg

BIOREFINERY/BIOFUELS

Head | Dr.-Ing. Axel Kraft

- Bio-based Chemicals
- Biofuels, Hydrocarbons
- Thermochemical Conversion
- Speciality Chemicals, Formulations

PROCESS INTENSIFICATION

Head | Dr.-Ing. Ilka Gehrke

- Water Processes
- Adsorption Processes
- Active Surfaces

INFORMATION TECHNOLOGY

Head | Thorsten Wack

- IT-Infrastructure
- IT-Services
- Application Development
- Modelling and Simulation

PROCESS ENGINEERING

Head | Josef Robert
Hans-Jürgen Körner

- Environmental Biotechnology
- Bioprocess Engineering and Fluid Separation
- Biomass and Residue Utilization
- Membrane and Food Technology

THINK TANK

Head | Prof. Dr.-Ing. Görgе Deerberg

- International Projects
- Urban Production
- Group Environmental and Process Technology (RUB*)

PRODUCTS

Division Director | Prof. Dr.-Ing. E. Weidner

MATERIAL SYSTEMS

Head | Jürgen Bertling

- Synthesis and Functionalization
- Processing and Testing
- Prototype, Design, Interaction

BIO-BASED PLASTICS

Head | Dr.-Ing. Stephan Kabasci

- Polymer Chemistry
- Material Development
- Processing and Applications
- Production Scale-Up and Testing

LEATHER AND HIGH PRESSURE TECHNOLOGY

Head | Manfred Renner

- Leather Technology
- High Pressure Impregnation
- Product Design by Pressure (RUB*)

RESOURCES AND INNOVATION MANAGEMENT

Head | Dr.-Ing. Hartmut Pflaum

- Sustainability Assessment and Management
- Material Flow Systems
- EU, IPR, Strategy

THINK TANK FUTURE PRODUCTS

Head | Jürgen Bertling

- Additive Manufacturing, FabLab
- Sustainable Polymer Products

ORGANIZATION

Division Director | A. Weber

ADMINISTRATION

Head | Nina Junen

- Projects
- Controlling
- Human Resources Administration
- Travel and Central Services

PUBLIC RELATIONS

Head | Iris Kumpmann

Press and Media Relations,
Events,
Internal Communications

UMSICHT ACADEMY

Head | Anja Gerstenmeier

- Further Academic Education
- Human Resources Development

ANALYTICS

Head | Dr.-Ing. Edda Möhle

TECHNICS

Head | Richard Sprick

- R&D-Workshop
- Construction and
Facility Management

OCCUPATIONAL SAFETY AND ENVIRONMENTAL PROTECTION

Head | Dr.-Ing. Ulrich Seifert

LIBRARY

Head | Kerstin Hölscher

INSTITUTE BRANCH SULZBACH-ROSENBERG

Director | Prof. Dr. A. Hornung

Deputy Director | G. Dimaczek

RENEWABLE ENERGY

Head | Samir Binder

- Energy from Biomass
- Thermochemical and
Chemical Storages
- Thermal Storages
- Energy Efficiency and
System Analysis

RECYCLING MANAGEMENT

Head | Dr.-Ing. Matthias Franke

- Biogas, Waste Water, Phosphorus
- System Analysis
- Raw Materials and Waste

NEW MATERIALS

Head | Dr. HDR Patrick J. Masset

- Corrosion and Wear Protection
- Surface Engineering
- Metallurgical Processes

INFRASTRUCTURE

Head | Gerold Dimaczek

- Administration
- Public Relations and Marketing
- Central Technical Services



Prof. Dr.-Ing. Eckhard Weidner



Prof. Dr.-Ing. Görgе Deerberg



Andreas Weber

QUESTIONS ON THE STRATEGY

Fraunhofer UMSICHT now has 463 employees, an Institute Branch in Sulzbach-Rosenberg, new key areas, and has restructured itself. The shift in energy and raw materials supply are the foundations for the focal points of research. The institute's and divisions' directors explain why.

KEY AREAS

With which strategy does UMSICHT remain fit for the future?

"Production without raw materials" and "Energy with UMSICHT". These two – somewhat provokingly phrased – key areas embrace our new structure with the operational divisions "Energy", "Processes", "Products". With knowledge, expertise and innovative technical solutions along the process and utilization chains, we contribute to the design of the shift in energy and raw materials. We develop technologies, innovative products and cycles that sustainably cover the basic needs of the people at minimal resource consumption. Very important strategic elements are the good cooperation with our partners and, of course, the dedicated and committed UMSICHT team.

Prof. Dr.-Ing. Eckhard Weidner, Director of Fraunhofer UMSICHT

DIALOG WITH SOCIETY – PARTICIPATION

How is the dialog with society mastered, especially in times of increasingly complex technologies?

Our goal is to make our work more accessible to both the scientist and the interested lay person. We offer tours to everybody and want to thereby provide encouragement to join the discussion.

Our Friends and Patrons Group has been awarding the UMSICHT Science Award since 2009. The Prize is intended to promote the dialog between science and society. We have to approach society comprehensibly and present our thoughts to the consumers and strive to motivate them to actively engage themselves.

Prof. Dr.-Ing. Görgе Deerberg, Deputy Director of Fraunhofer UMSICHT

RESTRUCTURING – NEW IDEAS

With the restructuring, Think Tanks were introduced at the institute. What are you hoping for from this?

Even at a research institute, there is the risk of losing sight of new chances and opportunities due to the ongoing day-to-day business. But for the long-term success of UMSICHT, it is imperative that we generate new ideas and derive research activities from them. It is only with our own research results that we remain an attractive research partner. What we are hoping for from the idea factories is that they will provide space and time for creativity and thereby contribute to the sustainable success of UMSICHT.

Andreas Weber, Director of the Organization Division, Fraunhofer UMSICHT

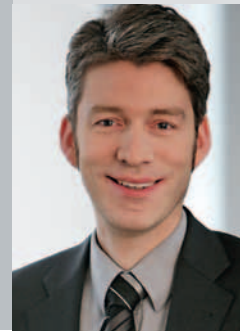


Gerold Dimaczek



Photo: Aston University

Prof. Dr. Andreas Hornung



Dr.-Ing. Christian Doetsch

INSTITUTE BRANCH SULZBACH-ROSENBERG

Since July 2012, the former ATZ has been an Institute Branch of Fraunhofer UMSICHT and as such part of Europe's largest society of applied research. How did the objectives change due to this?

Our histories are similar. We, too, were in the past a heavily application-oriented institute. For us, the focus is on the needs of the SMEs and industry. We do, of course, notice that Fraunhofer has a lot of clout. With UMSICHT in Oberhausen as a strong partner, a lot of opportunities and synergies result. We see our main task in developing powerful storage technologies and ensuring the raw material availability for a powerful economy.
Gerold Dimaczek, Deputy Director of the institute branch in Sulzbach-Rosenberg

FRAUNHOFER CENTER FOR ENERGY STORAGE

Where do you see the opportunities and challenges in the creation of a Center for Energy Storage (CES)?

As quickly as possible, we now have to offer practicable solutions for decentralized energy conversion and storage. At present, the markets are extremely dynamical – Germany wants the shift in energy and we should contribute to making it possible. In the context of the Center for Energy Storage (CES), we want

to convert the first demo plants into continuous operation in the year ahead. We will convert biogenous residues into storable energy using electricity from excess wind and solar energy. This, in turn, can then be fed back into the grid as needed.

Prof. Dr. Andreas Hornung, Director of the Sulzbach-Rosenberg branch of the institute

SHIFT IN ENERGY: DOMESTICALLY/INTERNATIONALLY

How important are international cooperations in the "Energy" division?

Energy and energy grids are a cross-border topic. This can be very specifically observed in the European power grids which connect Germany with its nine neighbors and further beyond with the other countries. Even though at present energy policy still quite often has a rather domestic focus, the technical/scientific cooperation is European. The International Energy Agency (IEA) or also the European Association for Storage of Energy (EASE), in which Fraunhofer UMSICHT is actively participating, are designing future strategies and research cooperations. This way, technologies are created with which the shift in energy is advanced.

Dr.-Ing. Christian Doetsch, Director of the Energy Division, Fraunhofer UMSICHT



AWARDED!

In 2012, Fraunhofer UMSICHT and its employees won a total of four prizes. Whether it was for the whole institute, the scientific performance of an individual employee, or for a particularly successful spin-off – the four awards are proof of the high scientific level and the societal claim of the institute, especially in the shift in energy and raw materials supply.

PLACE OF PROGRESS

Fraunhofer UMSICHT received the "Place of Progress 2012" award from the Ministry of Science of the German state of North Rhine-Westphalia (NRW) for its activities in the area of the shift in energy and protection of resources. The institute is pursuing sustainable research, which means that especially in the shift in energy and raw materials supply social aspects are integrated into the development process in addition to technological and ecological aspects.

NRW's Minister of Science, Mrs. Svenja Schulze, emphasized at the award ceremony: "UMSICHT does not close itself off, but rather seeks exchanges with society at large through 'discussion events' such as the Global Young Faculty, the Fraunhofer Environmental Talent School for senior grade students, or the UMSICHT Science Award for journalists." This way, UMSICHT helps to bundle competencies, promote the exchange of communication, and develop holistic technological innovations and establish them on the market. The honorary title "Place of Progress" recognizes special contributions of scientific pioneers to progress in the German state of North Rhine-Westphalia (NRW).

RUHR COMPOUNDS SPIN-OFF

An important objective in the dialog between science and society is the technology transfer. This is made possible via the institute's spin-offs. Employees of Fraunhofer institutes can risk diving into independence with an idea that is ready for market

and make the technology directly available to the market. The Ruhr Compounds GmbH spin-off of Fraunhofer UMSICHT even received two awards: Ruhr Compounds convinced in the founders' contest start2grow with its 5-year business plan and, in addition, won the special award "New Technologies". With this, the founders' team received a total prize money of 35,000 euros.

The newly founded company processes rubber residues into high quality plastics. Previously, rubber as production waste was quite often only reusable for secondary products. Comminuted into a powder or granulate, it was found in modern playground surfaces and padded mats. Now, it is possible to produce high quality products such as hub caps and splash guard caps, handles or transport rollers from recycled rubber. The new plastics are called elastomer powder modified thermoplastics – in short: EPMT®. They provide raw material cost savings and enable customers to increase their material efficiency.

Ruhr Compounds started its business operations in January 2012. The company produces and sells EPMT® materials. In addition, the spin-off offers a service package for customized evaluation of EPMT® utilization potentials and guarantees the optimal technological and economic utilization of the EPMT® materials to customers.

Additional information: pg. 50



EXCELLENT MASTER'S THESIS AND VOLUNTEER WORK COMMITMENT AND INVOLVEMENT

For her great commitment and involvement for women in engineers' professions and for her excellent Master's thesis, Katja Buß, a student working on a doctoral thesis at Fraunhofer UMSICHT, Department of Electrical, Thermal Energy Storage, received the award of the international organization Soroptimist, awarded for the very first time, which is accompanied by a prize money of 1000 euros. In particular, the choice of the especially relevant topic of energy efficiency was also a deciding factor for the jury.

The Soroptimist organization is a world-wide active service organization of working women. Katja Buß joined it to actively lobby for women to increasingly work in engineers' professions. She has already organized the Summer University SUNI as well as the Girls' Day several times, and participates in the mentoring program of the Duisburg-Essen University.

1 Minister Svenja Schulze with Prof. Eckhard Weidner at the award ceremony for the "Place of Progress".

2 Nina Kloster and Damian Hintemann accepted the prize on behalf of the whole Ruhr Compounds team.

3 Katja Buß received the prize of the Soroptimist organization.

4 The prize for Manfred Renner: the statue of St. Jordi, patron saint of tanners.

In her Master's thesis, she placed an emphasis on the subject area of electromobility and researched test cycles for energy storage in this field. In 2011, she completed her studies with a Master's degree and is now writing her dissertation on standardized performance tests for lithium ion batteries in the application with regenerative energies.

Additional information: pg. 40

MOST IMPORTANT AND BEST PRESENTATION IN MEXICO

At the International Tanners' Convention in Mexico, Manfred Renner, Head of the Leather and High Pressure Technology Department, Fraunhofer UMSICHT, received an award for the best and most important presentation. The topic: "Cleantan® – Tanning without generating wastewater by utilizing compressed carbon dioxide." Manfred Renner received the statue of St. Jordi, patron saint of tanners.

With the newly developed process, leather can be tanned virtually wastewater-free by using compressed carbon dioxide. In addition, the duration of tanning is considerably reduced and fewer chemicals are being used. At the Oberhausen site, a tanning system on a pre-industrial scale has already been set up, in which up to 500 kilograms of hide can be tanned in a single step.

Mexico is one of the largest producers of leather for the automotive industry. Approx. 150 representatives of the tanning industry and from groups of chemical companies participated in the international congress in Puerto Vallarta.



PROJECTS

THIS IS WHAT WE DO FOR YOU.

Fraunhofer UMSICHT has been providing guaranteed crisp ideas since 1990.
In the annual report, we are presenting an excerpt of the projects worked on.



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- 19 Efficiently utilizing mine gas as primary energy
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- 21 More green gas Europe-wide
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INTELLIGENTLY COOLED BATTERIES FOR ELECTRIC CARS

1 The CryoSol^{®plus} dispersion can absorb three times as much heat as water.



SUSTAINABLE

Ecology/Economy: Depending on the energy source, electric cars can offer environmental advantages. They could become the vehicles of the future. For this, important aspects need to be optimized: the range, the battery performance, and their weight. The CryoSol^{®plus} coolant allows for an efficient temperature control of the battery through which space and weight can be saved and the range of electric cars can be increased.

To keep batteries in electric cars functional for a long period of time, they may not over-heat nor be exposed to extreme cold. Their comfortable temperature is between 20 and 35 degrees Celsius. Today, water and ambient air are used for cooling. However, cooling systems so far are not yet fully mature. A new, efficient method is provided by CryoSol^{®plus}, a coolant consisting of a dispersion of paraffin in water. It can absorb three times as much heat as pure water, within a certain temperature range. This produces additional advantages: a smaller reservoir storage tank in the car saves space and weight.

INCREASED RANGE OF ELECTRIC CARS

Batteries for electric cars are very expensive – the price can amount to half of the vehicle's price. Therefore, a good temperature control is essential in order to ensure a long useful life. Especially trips in the middle of summer severely heat up the batteries. Nowadays, they are cooled with ambient air, even though air can only absorb little heat and does not conduct it well. While water-cooling systems feature a better heat capacity and are better at transporting heat off, the water storage in the car is limited.

With the CryoSol^{®plus} dispersion, the researchers of Fraunhofer UMSICHT have developed a coolant that is more efficient than water and air, saves space and weight in the car and thereby increases the range of electric cars.

PHASE CHANGE MATERIAL FOR THE SUITABLE TEMPERATURE

CryoSol^{®plus} is a dispersion that can absorb three times as much heat as water and it conducts heat well from the battery cells into the coolant. The costs are only marginally higher than the costs of a water-cooling system. When CryoSol^{®plus} absorbs heat, the solid paraffin particles melt into paraffin droplets and store the heat this way. When the solution cools down, the droplets solidify again – an efficient phase change material. The next step will be tests with a test prototype vehicle.

MORE INFO

s.fhg.de/en-cryosol-plus



CONTACT

Dipl.-Ing. Tobias Kappels | Phone +49 208 8598-1347 | tobias.kappels@umsicht.fraunhofer.de



EFFICIENTLY UTILIZING MINE GAS AS PRIMARY ENERGY

In active coal mines gas is released. One of its main ingredients is methane, which can be utilized as fuel. Not only does its energetic utilization expand the portfolio of primary energies, but it also reduces, at the same time, greenhouse gas emissions. In the research and development project CoMeth, "Coal Mine Methane (CMM) – New Solutions for Use of CMM – Reduction of GHG Emissions", Fraunhofer UMSICHT and partners realized two demonstration installations for the processing of mine gas in Poland and Russia.

CMM is generated during the natural process of carbonization. While digging coal, the gas is released. The problem: mine gas essentially consists of methane, which – in addition to carbon dioxide, nitrous oxide and CFCs – is among the long-lasting greenhouse gases. Sponsored by the Seventh Research Framework Program, eight partners from six different countries researched in the past three and a half years innovative methods for the energetic utilization of mine gas in the EU project CoMeth. As a result, it was possible to build two demonstration installations for the processing of CMM.

DEMONSTRATION INSTALLATIONS IN POLAND AND RUSSIA

In the demonstration installation in Poland, CMM featuring a high methane content is processed into liquid methane. As opposed to conventional methane utilization options in burners of combined heat and power plants, with this process, a valuable energetic product can be manufactured at sites with an insufficient infrastructure. In Siberia, mine gas with a low content of methane is used as substitute for combustion air in gas engines for power generation. This way, gases can also be sensibly utilized if their methane content is too low for conventional utilization options (< 4% CH₄) and which are typically released into the atmosphere.

COMETH-WIKI

The recommended actions for the utilization of the gas as energy source worked out in the project were published in a Wiki. The Wiki will be helpful in mastering the challenges in CMM projects and, in addition to methods of gas prognostication, is dedicated to financial, legal and technical aspects.

CONTACT

Dipl.-Ing. Clemens Backhaus | Group Manager Compressed Air Energy Storage | Phone +49 208 8598-1188 | clemens.backhaus@umsicht.fraunhofer.de

1 The colorless and odorless methane (CH₄) occurs in large quantities in subterranean natural gas deposits.



SUSTAINABLE

Ecology: Both demonstration projects want to initiate follow-up projects in order to utilize the methane sources not utilized in many countries to date. Per ton of methane, 2.75 tons of carbon dioxide are generated upon its incineration. Accordingly, greenhouse gases can be reduced by 22.25 tons per ton of methane, as opposed to 25 tons that would be effective in case of a release into the atmosphere. At the same time, the use of fossil fuels is reduced by the same amount. The potential for the energetic utilization of mine gas is quite considerable in a lot of coal producing countries.



Photo: JuweiTop/pixelio.de

ACCEPTANCE OF BIOGAS PLANTS

1 The brochure (available in German) provides recommendations to all involved parties for the construction of biogas plants.



SUSTAINABLE

Society: New technologies can only be as successful as the degree to which they are accepted by society. In particular in the course of the shift in energy, the dialog with stakeholder groups is very important.

Biogas is one of the most successful renewable energy sources. But a new construction of plants is not always free of conflicts. Neighbors fear changes of the appearance of the landscape, an increased amount of traffic, nuisances through noise and smell. Fraunhofer UMSICHT and the Research Group Environmental Psychology of the Saarland University have interviewed neighbors, plant operators and experts regarding the image and acceptance of biogas technology. The results are available in a brochure for download, free of charge.

Good communications and public information which have to start already in the planning phase, a plant concept that is adjusted to the site and a responsible management of operations – these recommendations are the foundations that are necessary for a smooth implementation of biogas projects. The population's acceptance of renewable energies is high, however, quite often the contribution is underestimated that biomass utilization makes towards the energy supply overall. Most of the time, wind power and solar power are associated with renewable energies. Furthermore, it is important that all acting parties involved – regional policy, government agencies, planners and plant operators – cooperate with one another early on. It would be ideal if municipalities were to develop regional energy concepts.

BROCHURE PROVIDES RECOMMENDATIONS FOR COURSES OF ACTION

In surveys, interviews and workshops, researchers in the project funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) captured sociological and technological aspects that have an impact on the acceptance of biogas plants. From June 2010 to April 2011, they interviewed people in six different regions who live near biogas plants. In addition, operators of biogas plants as well as experts were included in the survey. The results of the study were condensed into the brochure "Acceptance of biogas plants – background, analysis and recommendations for practice". It provides an overview of the levels of action at which measures for conflict avoidance can take effect. The recommendations are directed at political decision makers, the regional planning officials, professional and trade associations, planners, manufacturers and operators of biogas plants, the neighbors of biogas plants and the population in general.

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MORE GREEN GAS EUROPE-WIDE

Biomethane can replace fossil natural gas – e. g. in transportation or in the supply of electricity and heat. However, at present, biomethane is only produced and utilized in very few EU countries. Furthermore, uniform European standards regarding the requirements for the feeding of gas into the grid are missing. In the EU Project "Green-GasGrids", Fraunhofer UMSICHT is working with twelve international partners on strengthening the market for biomethane and providing better framework conditions for feeding biomethane into the natural gas grid via EU-wide standards.

Biogas is produced through anaerobic fermentation of organic biomass. To feed it into the natural gas grid, the gas has to be prepared. Europe-wide, more than 200 treatment plants are already in operation, approx. 150 of them feed into the public gas grid. In Germany, the Netherlands, Switzerland, Sweden and Austria, biomethane has already been used for a few years. But despite the high willingness on behalf of the political decision makers and market actors, the market development lags behind the existing potentials across all of Europe. This is caused, in particular, by information deficits, insufficient domestic legislation, lack of technical standards and lack of grid building between the involved actors as well as barriers to the cross-country trade of biomethane. In view of this background, thirteen international partners have brought to life the "GreenGasGrids" project, supported by the Intelligent Energy for Europe (IEE) financing program.

SUCCESSFUL BIOMETHANE PROJECTS THROUGH BEST PRACTICE

Fraunhofer UMSICHT is coordinating the creation of a comprehensive data collection regarding the production, treatment and feeding of biogas into the natural gas grid. In this, domestic legal framework conditions, technical aspects of biomethane production, treatment and feeding, sustainability aspects as well as ongoing political programs are taken into consideration. In the data collection, a lot of country-specific information all around biomethane is being made available free of charge. In a best practice analysis, an overview of the existing production mechanisms for biomethane is also provided. All information is available at the "www.greengasgrids.eu" website and is also communicated in workshops.

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1 In biogas plants, biomass is fermented into biogas. In order to gain biomethane – green gas – interfering gas contaminants need to be separated out.



SUSTAINABLE

Ecology: The project helps in strengthening the market for biomethane and expanding it EU-wide. Faced with the background that, by 2020, the share of renewable energies in the EU is intended to be 20 percent, this is an important step toward stabilizing the energy system. Biogas has an important advantage: it is more plannable than the fluctuating energy sources such as sun and wind.



CENTER FOR ENERGY STORAGE

1 In a pilot project, the tractor trailer is transporting excess heat in a container from a remote biogas plant to a central consumer.



SUSTAINABLE

Ecology/Economy: Energy is the driving force of our industrial society. A sustainable energy supply has to be economical, environmentally friendly and secure. Energy conservation, renewable energy solutions and increasing energy efficiency in connection with a modern infrastructure are the key to achieve the necessary shift. Only with powerful energy storage systems can the secured availability of energy for all be ensured.

With the decision to shift to renewable energies, the political switches in Germany have been set for a new era in energy. From a technological perspective, several hurdles still need to be overcome to be able to complete the transformation to a fully renewable energy system. As renewable energies such as wind and sun are subject to natural fluctuations, energy storage solutions on a large scale are required to secure a continuous energy supply. Furthermore, new energy conversion technologies are needed to make best possible use of renewable resources.

ENERGY STORAGE ON INDUSTRIAL SCALE

The Center for Energy Storage develops systems for energy conversion and storage, starting from a first schematic. These concepts are tested at pilot scale and refined to market maturity. The objective is to offer concrete storage solutions for direct market implementation in a short timeframe. The research is subdivided into four work groups with the following foci: (1) Systems Analysis, (2) Chemical Energy Storage – Catalysis and Process, (3) Chemical Energy Storage – Process and Technical Implementation, and (4) Heat Storage. Furthermore, spanning these work groups, integrated biomass-based concepts for energy conversion are being developed, which enable the use of surplus electricity to produce solid and fluid fuels for engines and incineration purposes.

ENERGY CONCEPTS IN A EUROPEAN CONTEXT

What is good for Bavaria and Germany cannot be bad for Europe. The researchers in Sulzbach-Rosenberg are connected with other scientists and industrial partners through international networks with the aim to export their technologies, to e. g. Italy and the UK. The center was launched on May 1, 2012 with the help of an initial 20 million EUR funding by the Free State of Bavaria over the next five years. The work groups Systems Analysis, Chemical Energy Storage – Processes and Technical Implementation and Heat Storage are located at Fraunhofer UMSICHT's Institute Branch in Sulzbach-Rosenberg. The work group Chemical Energy Storage – Catalysis and Process is situated in Straubing within the BioCat project group of Fraunhofer.

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ENERGETIC UTILIZATION OF BREWER'S GRAINS

Germany-wide, approx. 2 million tons of brewer's spent grain is generated per year. To date, a large share of it is utilized as feed stuff – but the biological stability and the high water content considerably limit the shelf life of the brewer's spent grain. After two to three days already, and in the summertime even faster, the brewer's spent grain is spoiled and no longer usable as feed. Yet, due to its high organic content, it could even be energetically utilized directly at the brewery's site. This conversion can be an incentive to completely cover a brewery's heat needs with biomass.

ECONOMICAL AND CLIMATE-FRIENDLY

Brewer's spent grain is a typical waste product of food production. In the past, concepts for the energetic utilization of brewer's spent grain limited itself to the anaerobic fermentation into biogas or the direct thermal utilization. Therefore, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety as part of its climate protection initiative sponsored the project "Optimized energetic utilization of a wet waste (brewer's spent grain) through combination of biological, mechanical and thermal processes" (funding code: 03KB038). In the first part of the project, it was proven on a technical shop scale that the concept represents an alternative. In addition, the researchers in Sulzbach-Rosenberg performed initial calculations regarding the economic feasibility and the possible greenhouse gas savings. At present, this approach is being tested in practice under industrial scale conditions at a brewery.

BIOGAS AND THERMAL ENERGY

The high share of cellulose, hemicellulose and lignin on the one hand and the high water content on the other have, in the past, made the optimal utilization of brewer's spent grain more difficult. Thereupon, the researchers of UMSICHT developed a concept to mechanically dehydrate the brewer's spent grain with a screw press. Via differences in pressure, a solid and a liquid phase are generated. Then, the press water with the components that degrade well biologically (especially fats and proteins) can be utilized for biogas fermentation. Given the right prerequisites, the press residues can then be energetically utilized with wood chips without further drying, i. e., the fuel mix is incinerated and provides heat for the brewing process.

1 After separation via the screw press, the dry brewer's spent grain can be utilized energetically together with wood chips.



SUSTAINABLE

Ecology/Economy: Brewer's spent grain is a valuable residue which – with its high organic share – is, in principle, well suited for energetic utilization in addition to the utilization as feed. If the brewer's spent grain is separated into a solid and a liquid phase, both fractions are optimally utilizable. The biogas generated can be converted into electricity and heat; the thermally generated energy, in turn, is needed for brewing beer. This achieves an increase in efficiency, lowers the costs and ultimately protects the climate.

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Photo: Fraunhofer UMSICHT/Anja Becker

NEW UTILIZATION CONCEPTS FOR BIOMASS

1 (f.l.t.r.) Prof. Eckhard Weidner (Director of Fraunhofer UMSICHT), Mrs. Svenja Schulze (Minister of Science of the German state of North Rhine-Westphalia), Dr. Hermann Garbers (Executive Board of CLAAS) and Prof. Ulrich Buller (Board member responsible for research at Fraunhofer-Gesellschaft) are opening the new biomass technical shop.

The corn or grain on the field has been harvested, the straw remains. An agricultural machine collects it, and it is further processed directly at or on the field. Shortly after harvesting, valuable intermediate products are created such as bio crude (pyrolysis) oil or press juice containing protein. This is one of the visions of the future of the Fraunhofer Innovation Cluster "Bioenergy", which was officially opened at Fraunhofer UMSICHT in September 2012 together with a newly created biomass technical shop. The objective is to develop conversion technologies with which wet biomass can be utilized both materially as well as energetically – without utilization competition to food and feed production.

Worldwide, enormous amounts of grass and green waste, harvesting residues, residues from agricultural production or biowastes from private households are generated: wet biomass that is mostly containing lignocellulose. To date, it is not yet intensely utilized due to its high water content and therefore its low calorific value, since transport and storage is also expensive. It is the objective of the Fraunhofer Innovation Cluster "Bioenergy" to develop efficient production systems to increase the available and utilizable amount of biomass. This is particularly possible with wet, stalk-like biomass and helps to bring the food and feed production and biomass utilization into unison.



SUSTAINABLE

Ecology/Economy/Society:

New concepts are needed for the utilization of biomass without competing with food and feed production. Here, the material utilization is linked with the energetic utilization of biomass containing lignocellulose. Processing concepts in proximity to the harvesting enable farmers to find new distribution channels.

MOBILE AND DECENTRALIZED UTILIZABLE PROCESSES

With suitable technical processes – mobile or decentralized – such stalk-like harvesting residues or residues from food production can be converted into carbon-rich intermediate products for the raw materials and energy supply. An important prerequisite is that the interim products are transportable and stable when stored. Processes to be further developed are, in addition to the pretreatment via drying and fractioning, the fast pyrolysis and the hydro-thermal carbonization (HTC). In the pre-treatment, e.g. press juice is created which can be fractioned into valuable components such as proteins, carbohydrates or organic acids as input materials for the chemical industry. From straw, e.g. a pyrolysis oil can be obtained via fast pyrolysis. Through HTC, wet biomass becomes a product similar to lignite which can be utilized as fuel or as soil conditioner.

MORE INFO

s.fhg.de/en-innovation-cluster-bioenergy



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SAFELY USING PERFLUORINATED SURFACTANTS

Perfluorinated compounds (PFCs) are water and fat-repellant at the same time. This makes them a seemingly absolute necessity in many industrial areas. Unusually long-lasting, they get into organs via the food chain and have a toxic effect. Therefore, the use of PFCs in larger quantities is only allowed in a few areas. Exceptions apply to electroplating and fire fighting foams. Here, PFCs are for the most part without alternative. But the application safety offers room for optimization. Five measures already help considerably.

The objective of the user seminar offered by Fraunhofer UMSICHT initially was to provide practical knowledge such as information regarding occupational safety or regarding the treatment of media containing PFCs as well as to explain about potential ecological and economic consequences of contaminations in soil and water. This joint level of knowledge formed the basis to subsequently discuss the issues comprehensively that are specific to the discipline and to make important derivations for practice.

FIVE MEASURES INCREASE APPLICATION SAFETY

1. Standardization of process monitoring
2. Standardization of statutory threshold values
3. Provision of analytical field methods
4. Provision of substance-specific adsorbents for PFCs
5. Improved communications

ADSORBENT PERFLUOR_AD

At present, Fraunhofer UMSICHT is, in cooperation with Cornelsen Umwelttechnologie GmbH, researching the development of novel adsorption materials based on natural resources. In the future, they should allow for an easy and cost-optimized separation of PFCs from contaminated waters. The new adsorbent "Perfluor_Ad" is based on biomaterials. Through its high specialization on difficult to adsorb short chain PFCs, it can – in the form of a supplemental purification stage – optimize the purification performance as well as the operating costs of (activate charcoal) treatment plants.

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1 Perfluorinated chemicals (PFCs) are used in electroplating and in fire fighting foams as a necessary auxiliary process agent.



SUSTAINABLE

Ecology/Product responsibility: Practice-focused events such as the PFT user seminar help to start the dialog about PFCs and to interdisciplinarily develop the topic. As such, the application safety of processes for which there are no material alternatives to PFCs available to date, can be optimized market-oriented.



IT'S NOT POSSIBLE TO HAVE IT ANY FRESHER: AGRICULTURE IN CITIES

1 Education and training site at the Manhattan School for Children (NY, USA).



SUSTAINABLE

Ecology/Economy, Product responsibility: The project improves the efficiency of processes with respect to ecological effects. The integration of agriculture into urban spaces leads to a frugal and efficient use of resources, protects the climate and contributes to a healthy lifestyle since plants are growing directly at the consumer's.

Worldwide, more than half of all people live in cities. Why not produce fruit and vegetables where most consumers live? The flat roofs of a lot of buildings are suitable as areas for agricultural use. Greenhouses installed there can also utilize the waste heat and the cleaned wastewater of the building. "inFARMING®" is the name of the concept that integrates agriculture into urban spaces and for which Fraunhofer UMSICHT developed concepts, materials and cultivation processes. At the Fraunhofer inHouse Center in Duisburg, furthermore, a prototype for this is to be created.

It is not possible to have it any fresher. On the way home from the office, the computer specialist harvests tomatoes in the greenhouse on the roof of this company. The plants there live of the cleaned wastewater and waste heat of the building. In Germany, such plantation systems do not yet exist. But maybe soon: in the inFarming® project – shorthand for integrated farming – Fraunhofer UMSICHT is developing solutions for urban agriculture that can be implemented quickly. The objective is to use existing building for the cultivation of vegetables. Fundamentally, many types of plants are suitable for the cultivation in such city farms. In addition to vegetables and fruits, the cultivation of plants containing active substances is being investigated.

ADVANTAGES OF URBAN AGRICULTURE

The advantages: lower space consumption for agriculture, hardly any transportation costs, thereby fewer emissions and fresher products, since the plants grow directly at the consumer's. The waste heat of the house and solar modules should be sufficient to provide the greenhouses with energy. The water consumption is also minimal, since wastewater is cleaned in a cycle and reused for watering. In Germany, there are approx. 1200 million square meters of flat roofs of non-residential buildings. On approx. a quarter of them herbs and vegetables could grow. The plants would bind approx. 3.5 million tons of CO₂ per year. This is the equivalent of 10 percent of the CO₂ emissions of industrial operations in Germany. The cooperation partner, the American company Bright-Farms, has already realized projects in New York. In Germany, an application laboratory will be built at the inHouse Center Duisburg, the Fraunhofer Innovation Workshop for intelligent room and building systems.

MORE INFO

s.fhg.de/en-infarming



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TUNNEL DIALOG: INVOLVING CITIZENS IN LARGE PROJECTS

The times since large infrastructure projects were planned ignoring the citizens are a thing of the past, the latest since Stuttgart 21. Yet, until now, the blueprint has been missing for a process that efficiently lets citizens have a word and participate in the design. What this could look like has been illustrated by the "Tunnel Dialog" project. Under the leadership of Fraunhofer UMSICHT, a dispute that had been smoldering for many years regarding the additional installation of an air filter in a tunnel in Schwäbisch Gmünd (Federal State of Baden-Wuerttemberg) was solved in mere six months.

Large infrastructure projects are often the subject of bitter fights because the technical and scientific foundations of planning are quite often difficult to understand for those affected and allow quite often only for limited influence. The key issue in Schwäbisch Gmünd was the discussion regarding the installation of an exhaust air filter into the 2.2 km long Einhorn (unicorn) tunnel which is intended to relieve the city of road noise. It was planned to ventilate the tunnel via a central venting chimney. Increased imissions above the permissible level for residential areas located nearby due to the tunnel air burdened with dust and pollutant gasses were not to be expected. But the neighbors feared for the health and ecological consequences and suggested the installation of a tunnel filter.

VIVID PARTICIPATION, CLEAR RESULT

A consortium around Fraunhofer UMSICHT developed a transparent citizen's dialog process in which initially all those affected agreed on joint principles for technical expert opinions. This created a foundation for the technical, ecological, health and economic assessment of the tunnel filter as well as the preparation of solution suggestions. In total, representatives of the citizens' action groups, affected companies, planning government offices, experts and municipal administration met four times and discussed the results worked out. In the end, there was a clear result: a filter is not needed. Instead, additional potentials for improving the air quality were suggested, such as the expansion of the local environmental zone, the improvement of public transportation and research projects for air pollution control.

The final report regarding the tunnel dialog is available for download at: www.tunneldialog.de. The project was sponsored by the German Federal Ministry of Education and Research.

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1 Presentation of the final report for the tunnel dialog which can be viewed at "www.tunneldialog.de".



SUSTAINABLE

Society: The tunnel dialog was accompanied by the Essen Institute of Cultural Sciences to investigate its suitability as a role model for the future. The process developed and applied can help, in the future, to integrate citizens in ecologically relevant investment decisions early on and scientifically founded.



BIO-BASED CHEMICALS FOR CONSUMER CARE PRODUCTS

1 Concentrated final product with high viscosity.



SUSTAINABLE

Product responsibility:

Sustainability as well as the securing and expansion of the raw materials base is one of the objectives the chemical industry is pursuing with bio-based production processes. As long as fossil raw material sources are still available and affordable, the switch to bio-based chemicals is primarily a question of cost. Efficient and cost-efficient processes in which bio-based raw materials and residues are at the beginning of the value-added chain are therefore important areas of development at Fraunhofer UMSICHT.

Bio-based chemicals play an increasingly important role in the most diverse consumer care markets. No matter whether it is in the cosmetics industry, for cleaning agents, in medical care or for industrial applications – sustainably and at the same time cost-efficiently produced primary products promise high sales. At present, Fraunhofer UMSICHT is researching the catalytic manufacturing of lactic acid and its salts. The economic application in as many market segments as possible is intended.

PRIMARY PRODUCTS AS KEY COMPONENTS

Starting with bio-based raw materials, via catalytic processes, Fraunhofer UMSICHT is developing primary products that can be utilized in a broad range of applications. As such, alcohols, lipids or sugars are, for example, converted into higher alcohols, acids, esters or organic salts. While especially in the health and personal care sector, high-price products are used in small quantities, in the home care and industrial and institutional cleaning sector, high volumes are requested.

APPLICATION DIVERSITY OF LACTIC ACID DERIVATIVES

One example for the versatile usability in end products is lactic acid with its salts, the lactates. With a chemical-catalytic synthesis process developed by Fraunhofer UMSICHT, polyalcohols or sugars are converted to lactates. Pure hydrogen is produced as a byproduct. The formulation obtained this way can be used as a de-icing agent without expensive treatment. Separated and cleaned lactic acid can be used in cosmetics, as preservative and for pH adjustment in the food industry or for disinfection in diverse areas. In the chemical industry, lactic acid is used as a synthesis component; it can be converted into polylactic acid (PLA), a biocompatible, deformable plastics material. In the form of its esters, it can also be broadly applied as a solvent.

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1

SELECTIVE LASER SINTERING: ONE COMPONENT, TWO MATERIALS

Selective laser sintering (SLS) allows for the manufacturing of components of any geometry and with a high degree of functionality from a powdered starting material. Layer by layer, the component is created directly from digital data. At present, an SLS component can always just consist of a single material. Fraunhofer UMSICHT is working on a process in which, for the first time, two different powders can be stored in the construction space and be sintered by the laser. The challenge consists in finding plastics that are compatible with one another.

1 *Cantilever chair made of thermoplastic plastics.*

PROMISING EXPERIMENTS

Currently, Fraunhofer UMSICHT is testing materials in a specially designed mini laser sinter system with a volumetric capacity of 200 milliliters of material and 190 degrees Celsius process temperature. Furthermore, promising powder combination can be tested in a 10 liter system.

Important challenges: the powders applied via a print head must not become sticky at high temperatures, must not lose shape and must not display any hysteresis losses. The depositing of two powders at present is only working with differently colored samples of the same material. A multi-component dosing requires a lot of effort but appears to be feasible. Via compounding, cryogenic grinding, sinter tests and characterization, Fraunhofer UMSICHT is ensuring a complete process chain.

"BIONIC MANUFACTURING"

Background of the contract research is the completed project "Bionic Manufacturing". Based on the construction of a cantilever chair via SLS it was possible to demonstrate in a BMBF (Federal Ministry of Education and Research) project a manufacturing technology for biologically inspired components. The cantilever chair follows both in its exterior design as well as in the internal material structure bionic principles such as load-appropriate geometry and finely structured, locally varying composition of the material.

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CONCEPTS FOR BIOFUELS IN AVIATION

1 Air traffic has to considerably reduce its CO₂ footprint in the future.



SUSTAINABLE

Ecology/Economy:

To ensure the environmental compatibility of biofuels, the German Federal Government has enacted the Biofuels Sustainability Act. According to the Act, biofuels will only be considered produced sustainably if, in comparison to fossil fuels, there are greenhouse gas savings of at least 35 percent. This minimum requirement will increase to 50 percent in 2017 and for new systems to 60 percent in 2018. The project helps in achieving the objective.

Since 2012, airlines that want to take off and land in the EU have to present certificates for their air pollution. One option to reduce the carbon dioxide emission of aviation is to use bio-jetfuels. European standards for the quality assurance of biofuels in aviation do not yet exist. Building upon the American guidelines for fossil aviation fuels, a standard for aviation fuel was developed that allows for a biofuel share of up to 50 percent. Sponsored by the German Federal Ministry of Economics and Technology, this is where the group project QuaNaBioL comes into play: framework conditions for quality standards, sustainability criteria of bio-jetfuels as well as creating incentives for their application.

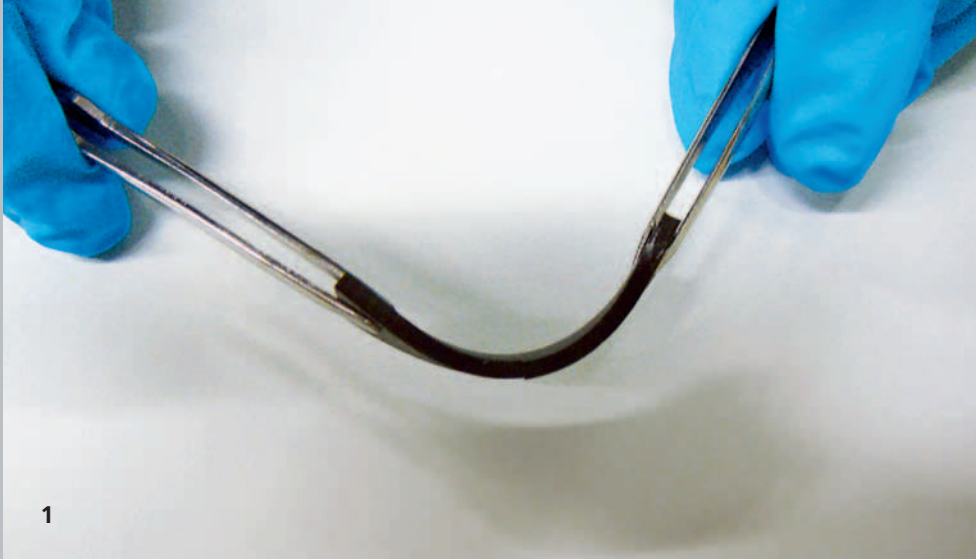
With the QuaNaBioL project ("Quality Assurance and Sustainability in the Provision of Biofuels for Aviation"), Fraunhofer UMSICHT wants to create the prerequisites for the German aviation industry, with the help of which biofuels with exactly defined properties can be used in the near future. Despite fulfilling the political mandates, the aviation industry is to neither lose profitability nor competitiveness. After a project duration of two years, the results flow into an integrated concept for action for all actors of the value-added chain "Bio-Jetfuels" to this way later implement all relevant parameters in an operational quality management system and in relevant business processes.

POTENTIAL RAW MATERIALS FOR BIO-JETFUELS

An important issue will be the taking inventory of potential raw materials and the inspection as well as assessment of the various conversion processes. Based on the standardization project, in a first analysis step the currently relevant process routes of bio-jetfuels from the provision of the raw materials to the refueling of the aircraft were investigated. Beyond that, structures and means of transportation for conventional kerosene as well as storage facilities were reviewed based on oil companies selected as examples. As the immediate next steps, the process routes as well as the quality assurance concept and the development of potential production structures for bio-jetfuels will be revised. This serves for the preparation of the concluding risk and systems analysis.

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1

SCIENTISTS WITH IDEAS FOR SELF-HEALING MATERIALS

Since January 2012, Fraunhofer UMSICHT has been coordinating the "Training Network for Self-Healing Materials: from Concepts to Market – SHeMat". Funded by the Seventh Research Framework Program "Marie Curie Actions" of the European Commission, the project team is developing and implementing innovative self-healing concepts for different classes of materials with the objective of bringing them to market-readiness. In addition, promising young scientists are supported and networked within the European context. Fifteen young scientists were recruited within the network SHeMat, two of them conduct research at Fraunhofer UMSICHT.

Within four years, the European training and research network SHeMat will promote the topic of self-healing materials. The objective is to develop self-healing materials from different classes of material and reach market readiness in suitable applications. Furthermore, standardized methods for the healing effectiveness should be applied. This issue is decisive for the broader acceptance and commercial utilization of self-healing materials and is so far lacking in all worldwide activities. The investigation focuses on the following classes of materials: polymers, composite materials, concrete and ceramics. Beyond that, biological self-healing processes in plants are being analyzed to identify additional ideas for self-healing technical materials.

GLOBAL EXCHANGE OF KNOWLEDGE

Fifteen young scientists from all over the world were accepted as part of the SHeMat network. The network provides its participants with continuing education in the areas of expansion of scientific skills, general qualification measures (communication training, project management, etc.) as well as in the areas of sustainability assessment and entrepreneurship. Fraunhofer UMSICHT is employing a Portuguese postdoctoral researcher who has dedicated herself to the topic of "Quantification and assessment of self-healing capabilities". A graduate student from India focusses his research activities on self-healing thermoplastics. Whether the network will ultimately deal with the development of self-healing pipes made of polyethylene, with self-repairing concrete for construction applications or with a self-healing ceramic heat protection coating for aircraft turbines will be written up in one of the coming annual reports.

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1 The capability for self-healing and/or for regeneration is intended to be transferred to different classes of materials.



SUSTAINABLE

Product responsibility/

Society: Self-healing materials intend to prolong the lifetime of a technical part, the surface of pavements or building material to minimize material input and costs for replacement. Besides, catastrophic damages due to sudden material failure leading to demolition or damage to persons can be avoided. Biological systems reveal suitable strategies adaptable for technical materials.

MORE INFO

www.shemat.eu





Photo: Heike Schollmeyer, Westphalian Institute of Higher Learning, Recklinghausen site

NATURALLY ADHESIVE

1 This adhesive is based on the renewable resource polylactic acid.



SUSTAINABLE

Ecology/Economy: More than 820,000 tons of adhesive were produced in Germany in 2010 according to the Adhesives Industry Association. So far, a large share is manufactured based on crude oil. The industry is also offering adhesives made from renewable resources such as starch, cellulose, dextrans and proteins, but only slowly. First products are e.g. wallpaper paste and glue sticks. The project helps to expand the raw material basis for adhesives made from renewable resources.

To date, adhesives are, for the most part, manufactured based on crude oil. But they also can be created from renewable resources – for example from proteins, natural rubber, starch or cellulose. Fraunhofer UMSICHT is developing new adhesive recipes based on renewable resources. Pressure-sensitive adhesives, like those used on adhesive bandages, self-adhesive labels or adhesive tapes are on the development plan, just like adhesive systems that both conform to the high quality requirements of laminated articles and are also compostable.

ADHERING WITH POLYLACTIC ACID

Jointly with the Westphalian Institute of Higher Learning, Recklinghausen site, and the companies Jowat, Logo tape and Novamelt, Fraunhofer UMSICHT is developing a pressure-sensitive adhesive for industrial applications. The German Federal Ministry of Food, Agriculture and Consumer Protection finances the research project.

The basis of the pressure-sensitive adhesives will be backbone polymers. They provide the adhesives with the internal strength (cohesion). The task of the UMSICHT researchers now is to develop a backbone polymer made of the raw material polylactic acid. The biological material has a decisive advantage: since lactic acid is produced at industrial scale, it can be manufactured cheaply.

PACKAGING WITH COMPOSTABLE FILMS

Laminated films protect food from dirt, humidity and chemicals. Here, printed packaging and print articles made of paper are coated, on one or both sides, with a transparent, glossy, matte or embossed plastic film. In a group project with the companies Achilles Papierveredelung Bielefeld, Jowat and Consult IM Managementberatung, UMSICHT scientists are developing novel adhesive systems for laminated films. For this, the researchers mostly rely on water-based dispersion adhesives. In these materials, the adhesive components are very finely distributed in water. They are applied on one side and joined while still wet.

CONTACT

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Photo: Shutterstock

1

PLASTIC SURFACES FREE OF BACTERIA

It is no secret that bacteria virtually romp around on places such as door handles, light switches and remote controls in hotel rooms. However, that such surfaces can retroactively be equipped with nano silver close to the surface and thereby become resistant against bacteria, is not widely known. At present, Fraunhofer UMSICHT is researching a process that allows for the impregnation of polymer surfaces with the help of supercritical carbon dioxide. Supercritical carbon dioxide is ideally suited for impregnation since it can, on the one hand, be blended like a gas, and on the other behave like a liquid at the same time. In addition, carbon dioxide is neither flammable nor toxic, readily available and cheap.

To achieve the best properties for a given application, plastics are typically colored, equipped with additives and functionalized. Furthermore, in a lot of cases a coating of the surface is necessary. Funded by the German Federal Ministry of Economics and Technology, Fraunhofer UMSICHT combined the advantages of both processes with the intention of impregnating plastics via supercritical carbon dioxide. This way, nano or micro scale silver particles can be introduced into surfaces such as those of door handles, light switches, etc., through which the multiplication of bacteria is stopped. In comparison to the use of additives and colorants by means of compounding, impregnates such as pigments, UV stabilizers, etc. can be saved on and non-heat-resistant substances such as pharmaceuticals can be introduced. Scratches do not diminish the coatings.

SUPERCritical CARBON DIOXIDE

During the impregnation, the supercritical carbon dioxide has two tasks: first, it opens the polymer structure and enables the transport of a substance into the surface. Second, it can contain already dissolved additives and deposit them at the point of time of pressure release into the polymer surface. The application of colorants, additives or coatings of plastics components is often a relevant process step at medium-sized companies. The new process to be developed will in particular provide for these companies the opportunity to adjust components in a manner that makes efficient use of the materials and is environmentally friendly to their customers' needs.

CONTACT

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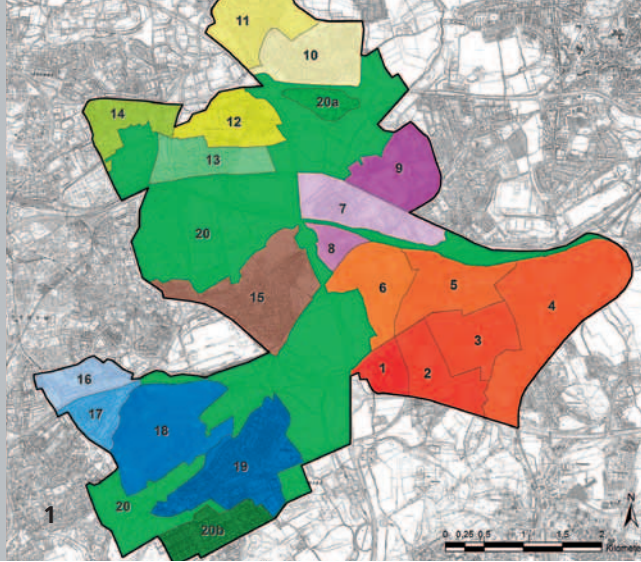
1 Due to the nano scale silver particles in the surface, bacteria do not stand a chance.



SUSTAINABLE

Ecology/Economy/Product responsibility: Comprehensive experience was already gathered in the area of high pressure impregnation. The success of the process was illustrated both in components such as contact lenses as well as in sinter powder, plastics profiles, etc. It holds great potential since carbon dioxide is neither flammable nor toxic, and it is cheap. The impregnation for the improved manufacturing of leather is summarized in a patent by Weidner and Geihlsler¹.

¹ Weidner, E.; Geihlsler, H., 1996, Process for preparing animal hides or pelts, patent specification: EP 0813611



BOCHUM: REDUCING CO₂ WITH NEW ENERGY CONCEPTS

1 Building cluster Bochum East.



SUSTAINABLE

Ecology/Economy: A lot of industrial processes generate waste heat. Its utilization is a good opportunity to reduce energy costs. Jointly with other project partners, Fraunhofer UMSICHT is investigating small commercial/industrial areas to test out local heat grids. The identification of suitable sources of waste heat and heat sinks and their networking provides a contribution towards climate protection. The concept can serve as a model for additional commercial/industrial areas in Germany.

The Ruhr district city of Bochum wants to reduce its carbon dioxide emissions by 36 percent – an objective of the "Energy and Climate Protection Concept Bochum 2020". By 2030, the savings are to be expanded even to 50 percent. In this, a central area of action is represented by the topic of sustainable heat generation and utilization with the energetic city restructuring. Within one project year, Fraunhofer UMSICHT is developing an integrated heat utilization concept for the Bochum East part of the town. With the objective of optimizing the energy supply, the heat supply in this area was reviewed under ecological, technical and economic perspectives.

Especially in densely populated areas, the existing buildings and their heat consumption represent an important factor for the overall energetic situation. In the heat utilization concept Bochum East, Fraunhofer UMSICHT worked out solutions for a climate-friendly heat supply for the part of town with approx. 68,900 inhabitants. Funded by the German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, the concept took into consideration both the demographic development of the parts of town as well as the current technical measures, and serves for the systematic and planned consideration of the energetic aspect of the planning of new construction areas as well as renovation of existing buildings.

ENERGETIC CITY RESTRUCTURING

For a better review and bundling of measures, the Bochum East part of town, 23.4 square kilometers in size, was structured into twenty clusters plus two special zones. For each cluster, the potential for renewable energies and the different centralized and decentralized approaches for the heat supply were analyzed. The energy supply options worked out were inspected for costs, acceptance, environmental friendliness and implementability, and discussed with the actors on-site. In a roadmap, the suggested recommended actions were prioritized. A visual representation and an ongoing controlling instrument support the heat utilization concept over the long term. Among the centralized solution suggestions is e. g. the expansion of the district heating grid. The construction of small combined heat and power plants and the utilization of heat pumps, especially within clusters that cannot utilize any other options, are decentralized solutions.

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Photo: Fraunhofer UMSICHT/Kurt Fuchs

METAL-COATED FABRICS AS PASSIVE FIRE PROTECTION

For numerous applications and industrial processes, high temperatures are a decisive factor and at the same time a huge challenge for both materials and operators. The fire-proof fabric Mtex® protects against intense heat and is at the same time flexible in its use. The metal-coated fabric provides sufficient heat protection even at temperatures of 600 degrees Celsius and above. Due to an innovative thermal coating process, no adhesives, which previously were used in the manufacturing of comparable textiles, are required.

MULTIPLE APPLICATIONS THANKS TO THERMAL COATING

Fiber-reinforced composites with special characteristics are needed in numerous industries. Whether in automotive construction, in the steel industry or in mechanical engineering, depending on requirements, different base and coating materials can be used and combined. In addition to default aluminum coatings, coatings of copper or zinc are also possible. The connection between metal and textile is realized via an innovative thermal coating process. In this process, the metal is directly applied to the base material fibers. The metal forms a coating around the single fibers and bonds to resulting in a very robust thermal resistant material. This key to this toughness is that no chemical bonding agents are necessary in the process, which usually represent a potential weak spot in comparable materials.

FROM THE BAVARIAN HIGH-TECH OFFENSIVE TO SERIES PRODUCTION

The development of this material dates back to a project within the Bavarian High Tech Offensive sponsorship program which ran from 2000 to 2009. The program aimed at creating new developments to secure Bavaria as a technology development region. After initial pilot production in Sulzbach-Rosenberg, serial production was transferred to a plant in Upper Franconia, belonging to sealing and materials specialist Frenzelit Werke GmbH. Well-known customers such as Siemens or the VW group are already successfully using Mtex® as a protection from high temperatures in high-tech applications. Apart from serial produced high-end products, application-specific solutions can also be realized.

CONTACT

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1 Two coating variants of Mtex®: with copper (left), with aluminum brass (right), and non-coated in the middle.



SUSTAINABLE

Ecology/Product responsibility: In Mtex®, the metal is applied to the textile via a thermal coating process. Bonding chemicals as used in similar functional materials can be omitted. Therefore, even at high temperatures, no toxic substances are generated.



PEOPLE IN RESEARCH

RESEARCH INVOLVES LOTS OF PEOPLE.

Behind our work, there are people; we would like to introduce some of them to you, since without them we would be nothing.



³⁸ PROF. DR. ANDREAS HORNUNG

New Director at the Institute Branch in Sulzbach-Rosenberg

³⁹ DR.-ING. MARKUS HIEBEL M.SC.

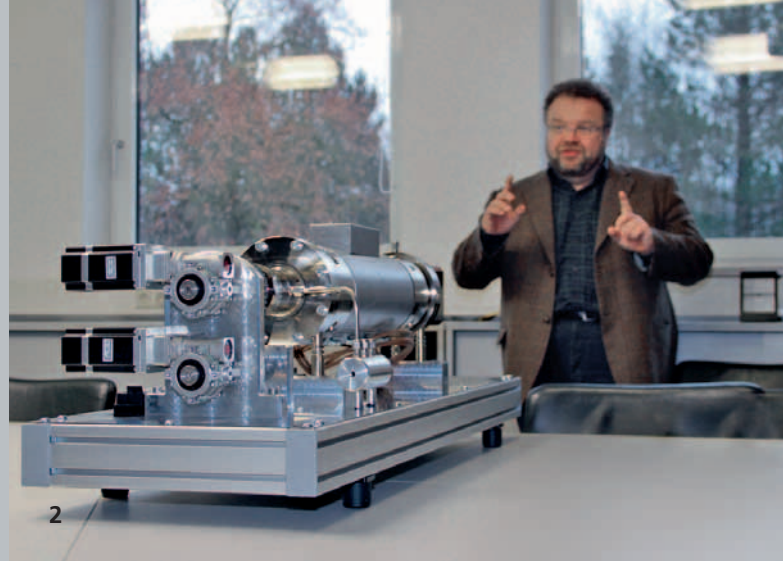
The first sustainability manager at the Fraunhofer-Gesellschaft

⁴⁰ KATJA BUSS M.SC.

The engineer's profession is only something for men? Think again!

⁴¹ DIPL.-WIRT.-ING. MICHAEL METZ

Energy supply – Residential areas as virtual storage



NEW DIRECTOR AT THE INSTITUTE BRANCH IN SULZBACH-ROSENBERG

Effective January 1, 2013, Professor Dr. Andreas Hornung took over the management of the Institute Branch of Fraunhofer UMSICHT in Sulzbach-Rosenberg. Furthermore, he is Director at the European Bioenergy Research Institute (EBRI) of the Aston University in Birmingham (UK). The engineer is researching biomass-based systems for energy conversion and storage. In addition to the development of the Fraunhofer site, he will increasingly work on the creation of the Fraunhofer Center for Energy Storage CES in Sulzbach-Rosenberg (pg. 22) as a strong pillar of the Bavarian and German innovation landscape.

What did you do on your first day at work at the Fraunhofer UMSICHT, Institute Branch Sulzbach-Rosenberg?

We have brought a non-planned order for 5 million euros on its way. Jointly with the local Amberg-Weiden Institute of Higher Learning, we are creating a demonstration platform for the transformation of decentralized excess electricity from photovoltaics and wind power systems in chemical interim storage such as storable gasses or oils which are used motorically and can be fed back into the grid. The concept serves as a regional model for SMEs, municipalities and farmers which pioneeringly demonstrates one component for a decentralized, demand-oriented conversion of energy and thereby for relieving the grid. This was a very nice start.

What do you see as your first big challenge in your new position?

To show to Fraunhofer and the region around Sulzbach-Rosenberg that we can place applied technology on very short notice.

What exactly do you deal with as the Director at the European Bioenergy Research Institute EBRI?

In the UK, it is about developing bioenergy systems and technologies that tolerate non-wood-like biomass in pyrolysis gasification systems as input material. Here in Sulzbach-Rosenberg, we are also concentrating on the pyrolysis which we want to combine with the biogas technology that is already widely available in Germany. At present, we have the opportunity to setup a demonstrator based on this technology on very short

notice with various cooperating firms from Northern Italy and Germany.

How often do you commute between Germany and the UK and how do you like to spend your time while doing so?

I commute between Birmingham and Sulzbach-Rosenberg on a weekly basis, each time via Karlsruhe. In general, I use all the electronic gadgets available these days while doing so to render my flights reasonably bearable. My favorite for this is my iPhone.

What are your hobbies?

I like to drive in my camper with my family, and I play the trumpet.

CONTACT

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1 *Prof. Andreas Hornung has been Director of the Institute Branch Sulzbach-Rosenberg since January 2013.*

2 *The Pyrofab reactor can pyrolyse the most diverse forms of biomass.*

MORE INFO

www.umsicht-suro.fraunhofer.de



1



2

THE FIRST SUSTAINABILITY MANAGER AT THE FRAUNHOFER-GESELLSCHAFT

Since September 1, 2012, Dr. Markus Hiebel has been the sustainability manager at Fraunhofer UMSICHT, the first at the Fraunhofer-Gesellschaft. His responsibilities include the support and implementation of concrete improvement measures with respect to sustainability at the institute, the coordination and conceptional continuation of the sustainability report and the participation in panels. Furthermore, he leads the sustainability working group at the institute in which employees are active out of their own volition.

Ever since the institute was founded, UMSICHT has had the objective to develop sustainable technologies. What is different now?

By now, the topic of sustainability has reached a considerably higher importance in society so that our conventional approach to business is reaching its ecological and societal limits. In recent years, science has made large advances with respect to insights into the capturing of the interdependencies between products and environmental impacts (e. g. climate change) and between societal impacts (e. g. acceptance of systems/plants for renewable energies). The issues require improvements in our innovation processes from us.

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1 *Dr. Markus Hiebel, Sustainability Officer.*

2 *As the first research institute, Fraunhofer UMSICHT created its sustainability report in accordance with the GRI standard.*

MORE INFO

www.umsicht.fraunhofer.de/en/sustainability.html



What were the first important objectives that were achieved since you started your job?

We show more of an external presence with our sustainability topics. With our sustainability report, which in 2012 was for the first time prepared based on the standard of the Global Reporting Initiative, level C, we are listed there (Sustainability Disclosure Database), we have implemented the German sustainability codex, and we have expanded our Internet presence all around the topic of sustainability. What is making me particularly happy is that the topic is gaining in importance within the Fraunhofer-Gesellschaft. We are in charge of the Fraunhofer-wide project for the development of a guideline for sustainability reports. It is expected to be completed by the end of 2013, in 2014, the first Fraunhofer sustainability report is expected to be published in accordance with the GRI standard.

What are your plans for 2013?

We want to anchor sustainability even more deeply at the institute and cause an even stronger awareness for it among the employees. Currently, we are reviewing the suggestion for an energy management system at the institute. Then, we want to expand the dialog with society, especially via our event format of "UMSICHT Debates". In those, experts provide short presentations regarding societal topics such as the Slow Food Movement or regarding Work/Life Balance to then discuss them with employees and the interested public. In addition, we are constantly looking for new ideas regarding the topic of sustainability and are always open to suggestions.



1



2

THE ENGINEER'S PROFESSION IS ONLY SOMETHING FOR MEN? THINK AGAIN!

Katja Buß, 27 years old, has studied industrial engineering. The fact that she was moving within a male domain was even more of an incentive to her to change something. In 2012, her commitment and her Master's thesis earned her a prize by the Soroptimist organization.

Why did you want to become an industrial engineer?

At school, I already enjoyed doing math, chemistry and computer studies and therefore I wanted to have something to do with calculations and formulas in my studies, too. Then, I listened to a lecture on mechanical engineering and I was immediately full of enthusiasm. When I then was led through the labs by one of the professors, I thought to myself: "You definitely have to do this!" Since I am also interested in business, I decided on a combination of economics and mechanical engineering.

What does the prize from Soroptimist mean to you?

It does, of course, feel nice when others acknowledge what you have created. What was particularly special for me is that it was a prize "from women for women". The Soroptimist organization has made it its objective to help women and girls to achieve their set goals, and I can identify well with this principle. Privately, I champion that more girls and women develop an interest in the engineer's profession, e. g. as mentor at the "Summer University" or at the Girls' Day.

You are writing your dissertation at UMSICHT.

What's your topic?

I am researching stationary lithium ion batteries that are charged by renewable energies, meaning wind power and photovoltaics, and discharged by consumers. This is, for example, the case when a household has a solar system installed on the roof, with a battery that stores the electricity generated, and then uses it itself again at a later point in time. My objective is to develop a standardized test cycle

for battery storage with which different batteries can be tested and compared.

What do you like the most about your job?

There is always something new to find out, that is amazing to me. In addition, I like the future-oriented aspect of my work. Everybody is talking about the shift in energy and renewable energies – what I do fits right into this.

What does provide you with the necessary balance to work?

Sport! I need something where I can switch off the head, and sports activities are just the right thing for that. I particularly enjoy going swimming, jogging, rowing, walking and climbing. Or, I go sailing, since I obtained my sailing license last year.

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- 1 Fresh air feels good: When sailing, Katja Buß gathers strength for her work.
- 2 Katja Buß received an award for her Master's thesis and her commitment.



ENERGY SUPPLY – RESIDENTIAL AREAS AS VIRTUAL STORAGE

Electricity and energy surround us day in, day out. Therefore, the research of Michael Metz is never leaving his side. Each lamp that the 31-year-old turns on and off again can remind him of the core of his doctoral thesis: our energy supply.

You have studied industrial engineering.

How did you end up in the energy sector?

A lot of my fellow students chose logistics as focal point which I did not want to do. Everything having to do with energy and environmental technology has always been exciting to me. Furthermore, I believe research in this area to be very relevant and full of promise for the future. Because everybody is consuming electricity, it comes out of the outlet as though it were the most natural thing in the world, yet hardly anybody thinks about this. But this taking for granted should be questioned more.

You are putting the finishing touches on the dissertation at Fraunhofer UMSICHT. What's its topic?

I am researching the flexibility of supply system as virtual storage. Because electrical storage that can supply energy as

needed is becoming more and more important. I am looking at the supply systems as virtual storage which bundles a lot of decentralized plants and storage systems. You can think of it as a virtual battery that absorbs the excess energy from the power grid, provides intermediate storage and releases it if a bottleneck occurs – depending on demand. In this, I am including all components attached to the power grid: kitchen appliances just as well as storage systems – always taking into consideration that another consumer with fluctuating power consumption is located behind it.

What is the result of your research?

I have developed the VEDIS computer model. Through data entry masks, a supply area consisting of buildings, households and system can be defined; then load profiles are created for each device. In the end, the program contains all the data that describe how a flexible supply system can provide energy. The program calculates the time-dependent energy fill level, so to speak. VEDIS is designed such that it is also reproducible for other residential areas.

Is there anything where you do not care about the electricity consumption?

I like to listen to rock music and go to concerts when I have time for that. In addition, I am teaching myself to play guitar. This is a good balance for my rather intense day-to-day work. Here, I can simply forget about everything.

CONTACT

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1 Prospective doctor in engineering: Michael Metz.


2 Michael Metz at work. To determine the load profiles, he has equipped devices consuming electricity (here, a dishwasher) with a current-measuring device.



NETWORK

LUCKILY, WE ARE NOT ALONE ON THIS EARTH.

We construct networks, link into existing networks, work in cooperation with partners, friends and patrons. We are happy to introduce some of them to you.

- 
- 
- ⁴⁴ Research and teaching / Involvement with institutions of higher learning
 - ⁴⁵ Interdisciplinary distance learning program "Environmental Sciences" (infernum)
 - ⁴⁶ Fraunhofer Environmental Talent School
 - ⁴⁷ Cooperative education at Fraunhofer UMSICHT
 - ⁴⁸ UMSICHT Science Award
 - ⁴⁹ The Fraunhofer-Gesellschaft
 - ⁵⁰ Spin-offs: How researchers become entrepreneurs
 - ⁵¹ International: Focus on Europe



RESEARCH AND TEACHING / INSTITUTIONS OF HIGHER LEARNING

- 1 Ruhr University Bochum:
Home to more than 36,500 students from 130 countries.
- 2 European Bioenergy Research Institute (EBRI).

The research and development market is fast-paced. As an institute that, with its application and market-oriented services and products, is acting at the intersection of research at the university and industrial practices and products, we particularly rely on strategic partnerships with institutions of higher learning in Germany and Europe. There is an active exchange between institutions of higher learning, students, and Fraunhofer UMSICHT. In addition to joint projects, many employees teach at colleges or universities in the region. Via the Fraunhofer Academy, we also make a contribution to external continuing education.

RESEARCH AND TEACHING

Prof. Dr.-Ing. Eckhard Weidner manages both Fraunhofer UMSICHT and the Chair of Process Engineering Transport Processes at the Ruhr University Bochum, where he also teaches. This provides the institute with a direct connection to the university and strengthens the scientific network of both research facilities.

Prof. Dr.-Ing. Gorge Deerberg, Deputy Director of the institute of Fraunhofer UMSICHT, has been holding the adjunct professorship "Environmental and Process Technology" at the Faculty of Mechanical Engineering of the Ruhr University Bochum since January 2011. This expands the involvement with the Ruhr University.

Prof. Dr. Andreas Hornung, Director of the Institute Branch in Sulzbach-Rosenberg, is as Director in charge of the European Bioenergy Research Institute EBRI which he founded at the Aston University in Birmingham.

FURTHER EDUCATION WITH FRAUNHOFER

MORE INFO

www.umsicht.fraunhofer.de/en/partnerships



The Fraunhofer Academy is an institution of the Fraunhofer-Gesellschaft for external further education. The Academy offers excellent courses of study, certificate course and seminars to specialists and executives, based on the research activities of the Fraunhofer institutes, in cooperation with select and reputable partner universities and partner institutions of higher learning. The infernum study program is one of the founding courses of study of the Academy which has developed into a permanent fixture and recognized institution in the German further education landscape.



Photo: Lucian Trudt/fotolia.com

INTERDISCIPLINARY DISTANCE LEARNING PROGRAM INFERNUM

The successful and scientifically founded solving of complex tasks in the areas of environment and sustainability presupposes an interdisciplinary way of thinking and approach. The interdisciplinary distance learning program "Environmental Sciences" (infernium) teaches the knowledge necessary for this and provides the ability to understand the "languages" of the different disciplines. infernium is characterized by the interdisciplinarity of the teaching content, the broad spectrum of the teaching content and the flexibility of the organization, and is in this form one of a kind in the university-based further education in Germany.

The sustainability dimensions of economic performance, social responsibility and ecological compatibility are taken into consideration so that the students – even without a prior degree from an institution of higher learning – receive a qualified further education in the spirit of an education about sustainable development.

As a distance learning program, infernium allows students to obtain scientific further education in parallel to job and family, and to improve their chances in the job market. Individual teaching programs can be compiled from (inter)disciplinary modules and the studies can be started at any time.

The following degrees can be obtained:

- Master of Science (M.Sc.)
- University diploma "Environmental Manager"
- University diploma "Environmental Sciences"
- Certificates for individual modules

infernium is a joint offer of the FernUniversität in Hagen (Hagen Distance Learning University) and the Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT in Oberhausen.

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1 Studying where and when you want to: Master's study program infernium.



SUSTAINABLE

Ecology, Society: Sustainably learning with infernium: the German UNESCO Commission once again recognized the infernium study program for the 2012/2013 period as project of the UN Decade of "Education for Sustainable Development." The recognition is awarded to initiatives that exemplarily implement the cause of the United Nations' worldwide education initiative and that teach sustainable thinking and activities. According to the jury's vote, infernium impressively shows what sustainable education can look like.

MORE INFO

www.umsicht.fraunhofer.de/en/infernium

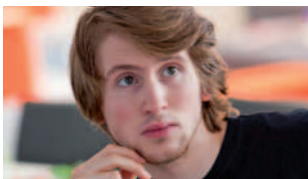




FRAUNHOFER ENVIRONMENTAL TALENT SCHOOL

1 High school students of the Fraunhofer Environmental Talent School 2012.

The talents of today are the scientists of tomorrow. It is an important basis for our innovations to get into contact with creative, team-oriented and highly motivated young people. From October 18-20, 2012, the Fraunhofer Environmental Talent School took place at UMSICHT. Under the guidance of researchers of the institute, 30 students conducted research regarding the topics of bionics, biomass and biofuels in three workshops. Here are a some impressions:



BIONICS PASCAL PATOCK (17)* from Sprockhövel, *Gymnasium Holthausen*

"I find the combination of biology and technology very interesting because it combines the knowledge from biology with the utilization for technology. In bionics, various disciplines come together: physics, mathematics, computer sciences or biology. That is very attractive to me because a lot of disciplines are combined."



BIOFUELS ZARAH THIEL (16)* from Bonn, *Ernst-Moritz-Arndt-Gymnasium*

"I wanted to approach the topic of environment from a different perspective – from a scientific point of view. Here, theory and practice are combined. We receive a lot of information and did also take a look at the technical shops and pilot plants. There, I could see how the research results are put to commercial use. I liked that very much."



BIOMASS BEN LUKAS OPGEN-RHEIN (14)* from Oberhausen, *Heinrich-Heine-Gymnasium*

"We work a lot in groups and I like that much better than at school where you have to do too many things individually. One person is better at one thing, and another is not so good at that one thing and vice versa. You complement each other very well in the group. Here, we can all contribute."

The Fraunhofer Environmental Talent School, which is funded by the DBU – Deutsche Bundesstiftung Umwelt (German Federal Foundation for the Environment), is a program for talented and technically interested adolescents of grades ten to thirteen. In workshops of a length of 3 days, each, the students work on exciting topics in the area of the environment and sustainability. The next Fraunhofer Environmental Talent School will take place at UMSICHT October 21-23, 2013.

*As of 2012

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COOPERATIVE EDUCATION AT FRAUNHOFER UMSICHT

Fraunhofer UMSICHT provides a good start into a professional career to qualified school graduates. The training programs are not held every year in every career path. The complete portfolio includes a career path in the natural science and technical, in the commercial/business and administration, and in the IT sector. In 2012, six trainees started their cooperative education at Fraunhofer UMSICHT at the Oberhausen site. Shortly after their first steps in working life, they talk about their impressions that they got from their work at the institute and what they are expecting from their cooperative education.

FABIO STOBRAWA

Trainee as industrial mechanic for mechanical and plant engineering

"I think it is great to have such a nice interaction between the employees. Everybody is lending me a hand at the workshop when I have questions."

MAYURATHAN KUGANESAN

Trainee as management assistant for IT

"What I like in my cooperative education is that I can combine the business aspects with the IT sector. I am very interested in both. Typical at UMSICHT is the work environment. Everybody is friendly and very helpful."

DENNIS SCHENDZIELORZ

Trainee as IT specialist with a focus on application development

"What I like is that I can learn a lot here and that there are exciting projects."

STEFAN BAUMGÄRTNER

Trainee as IT specialist with a focus on system integration

"I appreciate the very pleasant environment that lets me come to work in good spirits."

CAROLIN DÖRING

Trainee as specialist for office communications

"I like the exchange and the contact with the friendly colleagues. Everybody you encounter is greeting and everybody wishes a pleasant evening. And if you ever need help, everybody is quite willing to help."

LISA HÜSKEN

Trainee as technical system planner

"I hope that I can learn a lot in my cooperative education and am of course also wishing for a good final grade. Most exciting to me, to date, was the drawing with AutoCad and especially the result that was produced from it thereafter."

1 *Fraunhofer UMSICHT provides a good start into a professional career to qualified school graduates. From left to right:*

Fabio Stobrawa, Mayurathan Kuganesan, Dennis Schendzielorz, Stefan Baumgärtner, Carolin Döring.

2 *Lisa Hüsken started her cooperative education in September 2012.*

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UMSICHT SCIENCE AWARD

The Association for the Promotion of Environmental, Safety, and Energy Technology awarded the UMSICHT Science Award for the third time. Dr. Jan Meiß received the prize in the science category for his work regarding new concepts for organic solar cells. Dr. Max Rauner and Gerhard Samulat are the prize winners in the journalism category. They receive the award for their comprehensible communication of energy and environmental topics. The patron, Prof. Dr. med. Dietrich Grönemeyer, Chairman of the Science Forum Ruhr (Wissenschaftsforum Ruhr e. V.) awarded the prizes on July 4, 2012 at Fraunhofer UMSICHT in Oberhausen.

AWARD WINNER IN THE SCIENCE CATEGORY:

DR. JAN MEISS

received the UMSICHT Science Award 2012 in the science category for his dissertation "New Material Concepts for Organic Solar Cells". In his doctoral thesis, the 31-year-old is dealing with organic solar cells, specifically with transparent contacts and with increasing their performance.

AWARD WINNER IN THE JOURNALISM CATEGORY:

DR. MAX RAUNER

received the award for the article "The good instead of plastic". In his text, published in "ZEIT Wissen Magazin" (issue 5/2011), he goes on a search for the perfect shopping bag. He poses questions such as how ecological bioplastics are and in which garbage such bags should be placed.

AWARD WINNER IN THE JOURNALISM CATEGORY:

GERHARD SAMULAT

draws a comprehensive picture of the present and future of wind energy in his contribution "Fresh breeze". The article published in "Spektrum der Wissenschaft" (issue 2/2012) reflects both the opportunities and the risks of wind power

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utilization.

The Science Award awarded by the UMSICHT Friends and Patrons Group promotes the dialog between science and society regarding current topics in the areas of environmental, safety, and energy technology. Industry and market-oriented works of research as well as journalistic contributions from these areas are awarded by the Friends and Patrons Group with a total of 15,000 euros. The prize is awarded annually. The deadline for submission of applications is March 31st of any given year.

WE INVITE YOU TO BECOME A MEMBER, AS WELL

The UMSICHT Friends and Patrons Group is open to new members! They promote research and development, strengthen their scientific-technical reputation and invest in the upcoming generation of managers in industry.

1 Award ceremony for the UMSICHT Science Award (from the left):

Dr. T. Mathenia, G. Samulat, Prof. Dr. med. D. Grönemeyer, Dr. J. Meiß, Dr. M. Rauner and Prof. G. Deerberg.

MORE INFO

www.umsicht.fraunhofer.de/en/friendsandpatrons





Photo: Fraunhofer

THE FRAUNHOFER-GESELLSCHAFT

Fraunhofer is the largest organization for application-oriented research in Europe. Our fields of research are based on the needs of the people: health, safety, mobility, energy and environment. And because of this, the work of our researchers and developers has a great impact on the future life of people. We are creative, we design technology, we develop products, we improve processes, we open up new paths. We invent the future.

FACTS AND FIGURES AT A GLANCE*

Our contractual partners and clients are:

- industry companies, service providers
- the public sector

Fraunhofer is the largest organization for applied research in Europe and was founded in 1949.

- It conducts application-oriented research for the benefit of business and to the advantage of society.
- At present, it maintains 66 institutes and independent research institutions in Germany.
- It has approx. 22,000 employees, primarily with degrees in the natural sciences or engineering.
- It has an annual research budget of 1.9 billion euros, of which 1.6 billion euros are generated in the contract research. More than 70 percent of this is derived from contracts with industry and from publicly financed research projects. Almost 30 percent is contributed by the German Federal and Länder Governments in the form of base funding, enabling the institutes to work ahead on solutions to problems that will not become acutely relevant to industry and society for another five or ten years.
- International affiliated representative offices ensure contact to the most important current and future scientific and economic areas.

*As of January 24, 2013

FRAUNHOFER AS EMPLOYER

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, at universities, in industry and in society. Students who choose to work on projects at the Fraunhofer Institutes have excellent prospects of starting and developing a career at companies due to the practical training and experience they have acquired.

WHERE DOES THE NAME COME FROM?

The Fraunhofer-Gesellschaft, which is a recognized non-profit organization, takes its name from the illustrious Munich scholar, Joseph von Fraunhofer (1787-1826). He was equally successful as a researcher, inventor and entrepreneur.

MORE INFO

www.fraunhofer.de/en/about-fraunhofer.html



¹ The building of the Fraunhofer-Gesellschaft (FhG) in Munich.



SPIN-OFFS: HOW RESEARCHERS BECOME ENTREPRENEURS

The objective of the Fraunhofer-Gesellschaft is to develop innovative technologies that lead to products ready for market. These then have to be marketed by customers who license the technology - or by our own employees who risk the step into independence, that is the Fraunhofer model. At Fraunhofer UMSICHT there are currently 12 spin-offs. One of them, the Ruhr Compounds GmbH, received multiple awards in 2012.

The Fraunhofer UMSICHT spin-off Ruhr Compounds GmbH even received two awards at the founders' contest start2grow 2012. On October 1, 2012, Ruhr Compounds convinced against 50 business plans presented nationwide and won a total prize money award of 35,000 euros. The newly founded company processes rubber residues into high quality plastics.

UTILIZING RUBBER PRODUCTION WASTE

In the beginning, the researchers were faced with the wish to efficiently utilize rubber as production waste. Worldwide, 22 million tons of rubber are produced per year. Previously, rubber residues were quite often only reusable for secondary products. Crushed into a powder or granulate, it was found in modern playground surfaces and padded mats. The Ruhr Compounds GmbH was able to process rubber residues into high quality plastics. Elastomer powder modified thermoplastics – in short: EPMT® is the name of the innovative and ready for market materials. It saves raw material costs and enables customers to increase their material efficiency since they now can manufacture high quality products such as hub caps and splash guard caps, handles or transport rollers from recycled rubber.

TECHNOLOGY TRANSFER VIA SPIN-OFFS

"After first discussions and deliveries of samples to customers, it turned out that they have a strong interest in the product. As soon as a product is ready for market and evokes (consider-

able) interest, the question to us is: would it be possible to found an independent company?" reports Dr. Holger Wack, employee of Fraunhofer UMSICHT and Managing Director of Ruhr Compounds. The reason: Fraunhofer does not market any products, but rather only the technology, the process. A spin-off is an ideal technology transfer which is an important objective of the institute. Furthermore, there is the option that the newly founded spin-off may contract the institute for new technology developments or that the institute provides corresponding licenses.

The recycling of elastomers increases the added value and opens up new market perspectives. Production waste from rubber processors no longer has to be disposed of but rather can be recycled. The researchers can check elastomer residues of any quality for their recyclability. Fraunhofer UMSICHT is holding a European patent for EPMT®.

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1 *Elastomer powder modified thermoplastics (EPMT®) as soft prototype.*



Photo: Shutterstock

INTERNATIONAL: FOCUS ON EUROPE

Excellent results and sustainable successes of scientific research and development in a lot of cases require international networking. For this reason, Fraunhofer UMSICHT actively participates in the cross-country project development and in numerous international projects. As part of industry and facilitation projects, Fraunhofer UMSICHT cooperates with partners in the following countries outside of Europe: India, Indonesia, Chile, Vietnam, Korea, China, Mozambique and Columbia.

ECLIPSE

In the ECLIPSE project, nine European and four South American partners are working, as part of a bio-based economy, on closing material cycles and developing co-generated products. For this, algae and biomass that occur as residues in the production of biodiesel are utilized for the manufacturing of the bio-based plastic polylactic acid (PLA). The properties of the PLA are improved through the use of fibers and nano scale fillers from agricultural and fish industry waste. The tasks of Fraunhofer UMSICHT include the development of plastics, the industrial implementation into agricultural films and packaging as well as the ecological assessment (LCA).

ALL-GAS

In the All-Gas project, the sustainable production of biofuels based on micro algae is demonstrated. For this, micro algae are farmed on an area of 10 hectares in Southern Spain. To preserve resources, communal waste water is used which also provides the algae with nutrients, in addition to the water. At the same time, the farming of algae in waste water saves energy for wastewater cleaning. Fraunhofer UMSICHT supports

the project in the area of biodiesel manufacturing and is conducting a sustainability analysis of the overall system.

MICROGRASS

The Micrograss project provides an efficient, fast and less energy intensive technology for the breakdown of cellulosic biomass into sugars for the production of ethanol. This technology allows the European Union to satisfy the growing demand for bio-fuels without conflicting with food production and giving the farming community a product, which can be grown in poor soil and will generate additional income for them. A system of microwave frequency tuner and stirred tank reactor has been developed, designed and built by taking into consideration that temperature of 200 °C can be reached and kept constant during the breakdown of cellulose.

MORE INFO

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BIBLIOGRAPHY

Bibliography; -, [Greek bibliographía = the writing of books]: table listing and describing books, articles and publications.

Source: Duden – German Universal Dictionary, Duden Publishers 2007

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Under **www.publica.fraunhofer.de**, you can find pointers to papers, conference presentations and proceedings as well as research reports, studies, publications of institutes of higher learning and patents and/or registered designs. Documents available electronically can be retrieved directly from the database in full text.

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WE LOOK FORWARD TO HEARING FROM YOU!

If you have any questions, suggestions or project ideas, please contact us. You can reach us in several different ways.

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