



Fraunhofer Institut
Umwelt-, Sicherheits-,
Energietechnik UMSICHT



Annual Report
2003

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The year 2003 was not all plain sailing for Fraunhofer UMSICHT. Changed business environments confronted us with the tasks of making necessary adjustments and initiating a process of gradual strategic reorientation, without giving up our traditional strength concerning industrial returns and the aim of increasing scientific excellency.

Most notably, the public returns did not develop in a satisfactory manner. One reason is that our competitors on the R&D-market have been more successful in some sectors. On the other hand, several promising projects could not be taken up as a consequence of financial shortages in public spending even though all necessary positive expert opinions had been at hand. Oftentimes, the processing of applications for funding takes much too long. The current volume of orders and the scope of orders received give reason to expect noticeable improvement for 2004.

We have started our own innovation offensive with a detailed analysis of the performance of our areas of expertise and a definition of central topics. Topics such as "Vision Energy 21", "Bio-refinery", "Intelligent Interfaces", and "Networks" have been developed, and form the scientific backbone of a new business unit structure that we are planning to implement at the beginning of 2004. These fields of work also establish a basis for pilot projects of the type of the biogas plant Wissen Castle, for initiatives such as the Coal Mine Gas Days 2003, and the UMSICHT-Days "Bio refined!", for the emissions trading training "Jupiter", or for the BMBF-project "Aqua-latina", that will open up the Latin American water and waste management market for German technology suppliers. All of them will be our contribution to strengthen the location North Rhine-Westphalia and will add to the strength of the Fraunhofer Alliance "Production" that we are affiliated with since February 2003.

Strategic considerations played an important role in the past year. A detailed draft of the UMSICHT strategy plan for the coming five to ten years was completed. Progress was made in personnel and topical coupling with the universities of the Ruhr area. There are clear concepts of bringing in our core competence process engineering with its constituting actors into the business model of the Fraunhofer-Gesellschaft. In North Rhine-Westphalia we are a valued contact of government departments, authorities, offices, technology and transfer centers respectively. Our activities abroad – in central and Eastern Europe, in Latin America, East Asia, and the Middle East have been expanded. The interdisciplinary distance learning program environmental sciences (infernium) that was started in the winter semester of 2000/01 in co-operation with the open university in Hagen has been accredited and now enables scholars to attain the degree “Master of Science”.

The Annual Report 2003 illustrates the Institute’s potential by means of a few selected examples. This potential is based upon the creativity and optimism of our staff, and the encouragement by our numerous business partners and supporters. My special thanks go to all of them.

With kind regards

Yours



Rolf Kümmel
Director Fraunhofer UMSICHT



In February, Stadtwerke Herne AG and Fraunhofer UMSICHT give the symbolic starting signal for emissions trading in Germany: Deputizing for Federal Minister for the Environment Jürgen Trittin, Ministerial Counsellor Franzjosef Schafhausen accepts the first subscription warrant on one ton of carbon dioxide reduction at the international trade fair "E-world energy & water 2003".

Already for the third time, more than 100 international guests from research and practice catch up on the chances of the climate friendly energy source coal mine gas in the context of the "Grubengastage 2003" (coal mine gas days) that are carried out under the patronage of the BMU (Federal Ministry of the Environment).



"Home match" for Minister Bärbel Höhn*: At the international "World Water Day" (March 22, 2003) citizens find out all about "the refreshing liquid" in the shopping mall CentrO.

*North Rhine-Westphalian Minister of Environment, Conservation, Agriculture and Consumer Protection

Under the topic "Bio – refined" things are centered around renewable energies in July. Tours through laboratories and technical workshops fascinate pupils and teachers alike.





Noblesse oblige – at the estates of Wissen Castle (Weeze at the Lower Rhine) a biogas plant that generates power from pig manure and renewable energies, is officially inaugurated in July.

Highlights 2003

German environmental technology is in great demand in Asia:
A contract between the Japanese company NEECO Inc. and Fraunhofer UMSICHT on benchmarking of a waste incineration plant is signed at the trade fair "Entsorga" in September.



Fraunhofer UMSICHT goes international:
In October, the focus is on water and waste water technologies, solar cooling and energy generation at the QWETEX trade fair in Qatar.

Technology, that pays

The industrial nations of today owe their convenient living conditions to the, at all times, sufficient production of economic goods, the secure production and distribution of energy, as well as the free exchange of information. Production and consumption are embedded in an economic system, which presupposes economic growth and competition, and an ecological system whose absorption and provision capacities are limited.



Fraunhofer UMSICHT

The Fraunhofer Institute
for Environmental, Safety,
and Energy Technology
UMSICHT

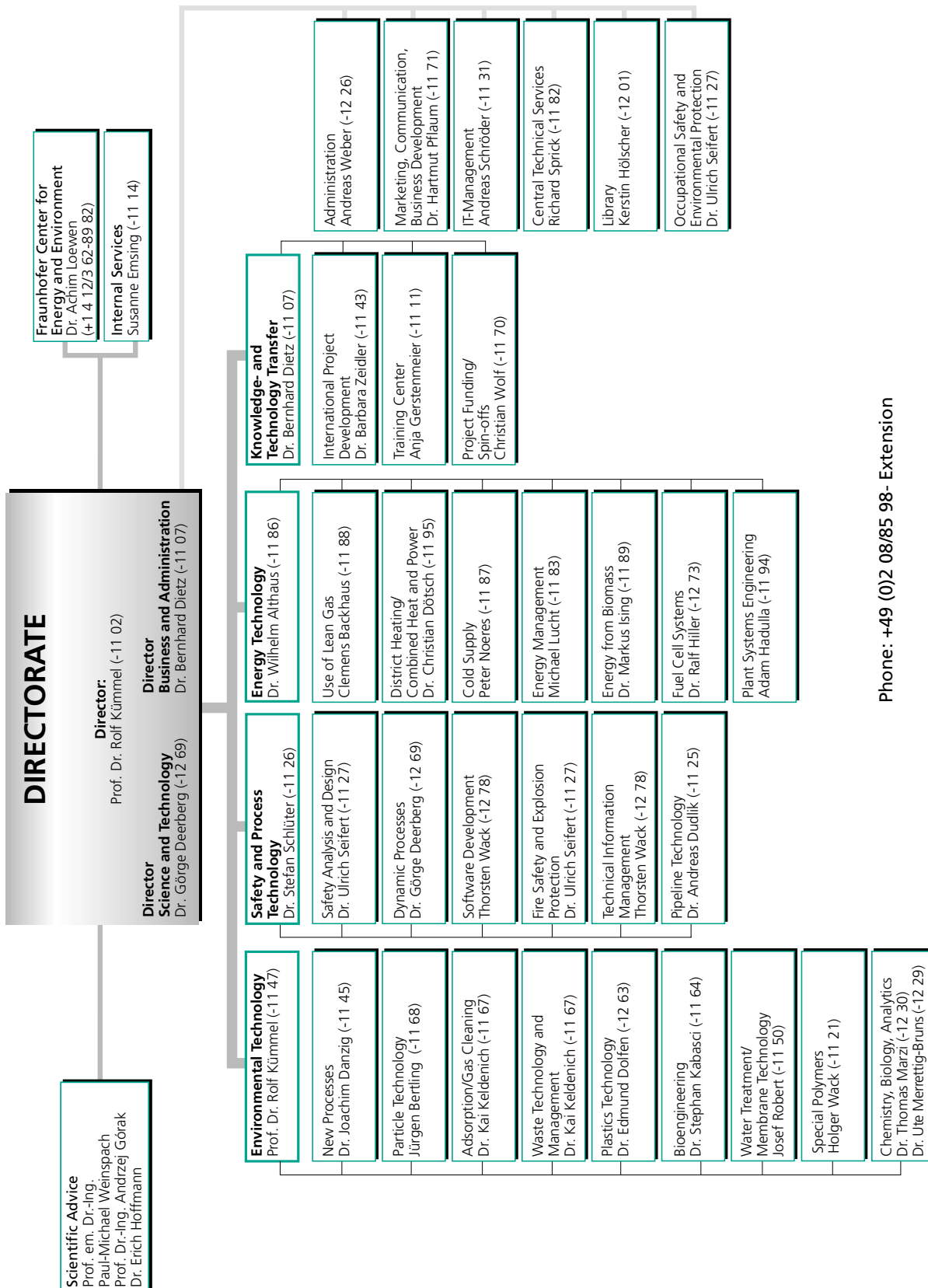
Which makes apparent: Technological progress is the engine for every modern industrial society. Technological innovations help making efficient and safe use of resources and resources and energy carriers. They allow a satisfactory and inexpensive production of innovative goods, create, and secure competitive jobs.

In this context, Fraunhofer UMSICHT develops, tests, evaluates, and optimizes technical processes as a catalyst for science and economy. In cooperation with industrial and public partners, state of the art findings are being transferred into marketable technologies, products, and services.

The business units environmental technology, safety and process technology, as well as energy technology stand for application-oriented, procedural know-how: from first feasibility and profitability studies, over sophisticated simulation programs, to demonstration plants in production scale. Innovation management, on-the-job training, and project development and financing round off the profile. Internationally, the institute is represented in the U.S., states of central and Eastern Europe, and Latin America.

Fraunhofer UMSICHT in Oberhausen is located in the vicinity of the shopping and recreation center CentrO. Its more than 270 employees produced a turnover of more than 23 m € in 2003. More than 50 % of this from industrial orders.

Fraunhofer UMSICHT engages in the structural change in Oberhausen and the region with new ideas, technology transfer, spin-offs, and the formation of research and development networks.



Phone: +49 (0) 2 08/85 98- Extension

Six core competencies are the basis of the process-technological work in the business units. They find application in the project and theme-oriented areas of expertise.

Core Competencies

- Process and application development
- Studies, expertises, and surveys for decision-making processes (process engineering, market)
- Planning, construction, and operation of pilot and demonstration plants (PD plants)
- System analysis, system technology
- Software for process engineering
- Project development and financing



Business Unit Environmental Technology

Head: Prof. Dr. rer. nat. Rolf Kümmel
Phone.: +49 2 08/85 98 -11 47
rolf.kuettel@umsicht.fhg.de



New Processes

Analysis of conventional production processes; development of low-emission syntheses; cristallization by means of supercritical fluids; microreaction technology
Contact: Dr. rer. nat. Joachim Danzig; Phone: +49 2 08/85 98 -11 45; joachim.danzig@umsicht.fhg.de



Particle Technology

Particle technology; crystallization processes; comminution; micro-encapsulation; spray drying; separation; sample processing
Contact: Dipl.-Ing. Jürgen Bertling; Phone: +49 2 08/85 98 -11 68; juergen.bertling@umsicht.fhg.de



Adsorption/Gas Cleaning

Flue gas cleaning; gas washing and adsorption; catalytic conversion of gaseous airborne contaminants; production and characterization of adsorbents; adsorber modeling
Contact: Dr. rer. nat. Kai Keldenich; Phone: +49 2 08/85 98 -11 67; kai.keldenich@umsicht.fhg.de



Waste Technology and Waste Management

Thermal waste treatment; waste reprocessing; waste confectioning; utilization of residues; looping; optimization of thermal processes; simulation of waste treatment processes; material flow management
Contact: Dr. rer. nat. Kai Keldenich; Phone: +49 2 08/85 98 -11 67; kai.keldenich@umsicht.fhg.de



Plastics Technology

Polymers from renewable materials; biodegradable polymers; product development; material, production, and recycling-oriented design; computation; prototypes; material development; compounding; injection molding; extrusion; mechanical and rheological material testing; recycling concepts; market and technology studies
Contact: Dr.-Ing. Edmund Dolfen; Phone: +49 21 54/92 51 -51; edmund.dolfen@umsicht.fhg.de



Bioengineering

Synthesis of valuable materials; reprocessing of biotechnological products; modeling; biological sewage treatment, waste air and solid waste treatment; production of biogas
Contact: Dr.-Ing. Stephan Kabasci; Phone: +49 2 08/85 98 -11 64; stephan.kabasci@umsicht.fhg.de



Water Treatment/Membrane Technology

Development of new areas of application in membrane technology; linking of process water streams; reprocessing of pickling acids with membrane-combined processes; filtration of sewage system discharge for the re-utilization of water
Contact: Dipl.-Ing. Josef Robert; Phone: +49 2 08/85 98 -11 50; josef.robert@umsicht.fhg.de



Special Polymers

Temperature sensitive/hydrophilic gels, superabsorbers, thermo chromate; syntheses; product characterization; analytics; application technology
Contact: Dipl.-Ing. Holger Wack; Phone: +49 2 08/85 98 -11 21; holger.wack@umsicht.fhg.de



Chemistry, Biology, Analytics

Thermal analysis; reaction calorimetry; rheological examinations; particle size distribution; testing of contaminants and summary parameters; characterization of products and residues; testing and online-analyses for processing systems; biological testing processes; analysis of organic materials; isolation of combined and pure-culture microorganisms; determination of combustion products

Contact: Dr. rer. nat. Thomas Marzi; Phone: +49 2 08/85 98 -12 30; thomas.marzi@umsicht.fhg.de

Contact: Dr. rer. nat. Ute Merrettig-Bruns; Phone: +49 2 08/85 98 -12 29; ute.merrettig-bruns@umsicht.fhg.de





Business Unit Safety and Process Technology

Head: Dr.-Ing. Stefan Schlüter
Phone: +49 2 08/85 98 -11 26
stefan.schlueter@umsicht.fhg.de



Safety Analysis and Design

Safety of plants and plant components; transport and storage safety; safety analyses in compliance with German regulations; thermal analyses
Contact: Dr.-Ing. Ulrich Seifert; Phone: +49 2 08/85 98 -11 27; ulrich.seifert@umsicht.fhg.de



Dynamic Processes

Pattern recognition; process control system protection and mitigation planning; model-based measuring methods; simulation of plants and scheduling of production processes; substance data provision; layout/evaluation of ethoxylation processes; application of commercial simulation software
Contact: Dr.-Ing. Gorge Deerberg; Phone: +49 2 08/85 98 -12 69; goerge.deerberg@umsicht.fhg.de



Software Development

GUI (graphical user interface) for Windows-NT and X-Windows systems; database technologies; client-server solutions; generic systems; software design
Contact: Dipl.-Phys. Thorsten Wack; Phone: +49 2 08/85 98 -12 78; thorsten.wack@umsicht.fhg.de



Fire Safety and Explosion Protection

Fire safety concepts for buildings, smoke extraction; material behavior; fire and explosion precaution policies for technical plants; consulting for fire brigades
Contact: Dr.-Ing. Ulrich Seifert; Tel.: +49 (0) 2 08/85 98 -11 27; ulrich.seifert@umsicht.fhg.de



Technical Information Management

Information management for system security and process technology; advice concerning the state of technology; support in legal permission procedures; graphically supported and dialog-based guidelines; full-text information systems; e-commerce solutions
Contact: Dipl.-Phys. Thorsten Wack; Phone: +49 2 08/85 98 -12 78; thorsten.wack@umsicht.fhg.de



Pipeline Technology

Pipeline test area (temperature up to 200 °C, pressure up to 140 bar); water and cavitation hammer; layout of pipeline systems
Contact: Dr.-Ing. Andreas Dudlik; Phone: +49 2 08/85 98 -11 25; andreas.dudlik@umsicht.fhg.de



Business Unit Energy Technology

Head: Dr.-Ing. Wilhelm Althaus
Phone: +49 (0) 2 08/85 98 -11 86
wilhelm.althaus@umsicht.fhg.de



Use of Lean Gas

Coal mine gas (CMM); landfill gas; biogas; hazardous gases; thermal utilization concepts; burner technology, emission control
Contact: Dipl.-Ing. Clemens Backhaus; Phone: +49 2 08/85 98 -11 88; clemens.backhaus@umsicht.fhg.de



District Heating/CHP (Combined Heat and Power Generation)

Generation; distribution; network concepts; GIS; leakage localization; energy supply concepts; solar/geo-thermal energies; local heating; refrigerants (ice-slurry); expert reports; energy trading; efficiency; energy policies
Contact: Dr.-Ing. Christian Dötsch; Phone: +49 2 08/85 98 -11 95; christian.doetsch@umsicht.fhg.de



Cold Supply

Cold supply technologies; thermal cold production; steam jet refrigeration plants; cold storage and distribution; air conditioning technology; combined heat, cold and power generation (CHPC); solar thermal refrigeration; energy supply concepts
Contact: Dipl.-Ing. Peter Noeres; Phone: +49 2 08/85 98 -11 87; peter.noeres@umsicht.fhg.de



Energy Management

Energy management; energy trading; power plant planning; optimized co-generation; IT solutions for energy networks (consulting, realization)
Contact: Dipl.-Ing. Michael Lucht; Phone: +49 2 08/85 98 -11 83; michael.lucht@umsicht.fhg.de



Energy from Biomass

Re-utilization concepts; power generation; combustion; gasification; gas generation using fluidized bed combustion (FBC); hot gas and tar analytical testing
Contact: Dr.-Ing. Markus Ising; Phone: +49 2 08/85 98 -11 89; markus.ising@umsicht.fhg.de



Fuel Cell Systems

Fuel cell systems: PEFC, MCFC, SOFC; regenerative gases, gas separation technology, system modeling and analysis, flue bed combustion, computational fluid dynamics (CFD)
Contact: Dr.-Ing. Ralf Hiller; Phone: +49 2 08/85 98 -12 73; ralf.hiller@umsicht.fhg.de



Plant Systems Engineering

Process control and visualization; planning, construction and operation of pilot and demonstration plants; heating, refrigerating, and air conditioning technologies

Contact: Dipl.-Ing. Adam Hadulla; Phone: +49 2 08/85 98 -11 94; adam.hadulla@umsicht.fhg.de



Business Unit Knowledge and Technology Transfer

Head: Dr.-Ing. Bernhard Dietz

Phone: +49 (0) 2 08/85 98 -11 07

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International Project Development

Head office of the German-Polish research association INCREASE; cooperation in the North Rhine-Westphalian action program for the promotion of external trade with central and Eastern European countries CEEC; scientific alliances and business cooperation; consulting services to central and Eastern European countries; European Union projects

Contact: Dr.-Ing. Barbara Zeidler; Phone: +49 2 08/85 98 -11 43; barbara.zeidler@umsicht.fhg.de



Training Center

Knowledge, know-how, and expertise transfer; distance studies program Environmental Sciences (infernum); network programs with schools, universities, and private enterprises; vocational training programs; customized courses for industry; multi-media learning; seminars, workshops; courses

Contact: Dipl.-Ing. Anja Gerstenmeier; Phone: +49 2 08/85 98 -11 11; anja.gerstenmeier@umsicht.fhg.de



Project funding/Spin-offs

Combined and single project funding; implementation of pilot and demonstration projects; financial support; consulting services to spin-off enterprises; finding business partners

Contact: Dipl.-Ing. Christian Wolf; Phone: +49 2 08/85 98 -11 70; christian.wolf@umsicht.fhg.de

Infrastructure



Administration

Human resources; project monitoring; research contracts; budgeting; purchasing; accountancy; business trips; infrastructure; controlling

Contact: Dipl.-Betriebswirt Andreas Weber; Phone: +49 2 08/85 98 -12 26; andreas.weber@umsicht.fhg.de



Marketing, Communication, Business Development

Innovation management; market surveys and technology studies; project development; marketing concepts; sales; business field policies; strategic planning; intellectual property rights; public relations; composition and layout of print media; media work; information medium internet

Contact: Dr.-Ing. Hartmut Pflaum; Phone: +49 2 08/85 98 -11 71; hartmut.pflaum@umsicht.fhg.de

Contact: Dipl.-Chem. Iris Kumpmann; Phone: +49 2 08/85 98 -12 00; iris.kumpmann@umsicht.fhg.de



IT Management

Support of the IT infrastructure; user help desk; highly-efficient servers and services; software design; installation and support of LAN and WAN; development of web-applications; training of IT specialists; consulting in IT-specific projects

Contact: Dipl.-Ing. Andreas Schröder; Phone: +49 2 08/85 98 -11 31; andreas.schroeder@umsicht.fhg.de



Central Technical Services

Project management; basic and detail engineering; sampling, analytical testing and pilot programs; technical services; central implementation of measurement and control and PLS (process control systems); internal technical services; mechanics and electric workshops; construction of demonstration and pilot plants

Contact: Dipl.-Ing. Richard Sprick; Phone: +49 2 08/85 98 -11 82; richard.sprick@umsicht.fhg.de



Library

Information systems; online literature research; document supply; Fraunhofer Publica updating; UMSICHT publications

Contact: Dipl.-Bibl. Kerstin Hölscher; Phone: +49 2 08/85 98 -12 01; kerstin.hoelscher@umsicht.fhg.de



Occupational Safety and Environmental Protection

Coordination and advice in topics related to occupational safety; vocational training and on-the-job courses; registration and notification procedures; monitoring of legislative regulations; safety-relevant instruction of the staff

Contact: Dr.-Ing. Ulrich Seifert; Phone: +49 2 08/85 98 -11 27; ulrich.seifert@umsicht.fhg.de



Fraunhofer Center for Energy and Environment

Development of Fraunhofer technologies for the U.S. market: process water and sewage treatment; power generation from biomass; integrated energy supply concepts

Contact: Dr.-Ing. Achim Loewen; Phone: +49 2 08/85 98 -11 52; achim.loewen@umsicht.fhg.de

Experiencing Development

In dialogue with Dr.-Ing. GÖRGE DEERBERG

1. You deal with dynamic processes. Dynamics means driving power. Since 2003 you are Director Science and Technology at Fraunhofer UMSICHT. Where is your driving power aimed at in this function?

It is my main task to further strengthen the scientific force of Fraunhofer UMSICHT also in times of narrow means. I should like to boost and challenge the profitability which is present in the minds of our staff.

2. Where are the Institute's strengths and where is it headed for in the future?

Our strengths are the team spirit and the high multidisciplinary of the institute. Networked areas of work guarantee that our resource "knowledge" is being incorporated efficiently into products and services. Nevertheless, we have to strive towards focusing on our core topics. Promising central topics could be:

Bio-refinery

This is about the vision of developing and providing products and closed production and recycling cycles from the plant to the product on the basis of renewable materials. We research on the material and energetic aspects of this future topic.

Intelligent Interfaces

With respect to the catchword functionalized interfaces we expand our know-how concerning the production of micro and nano-scale structures with defined, profitable characteristics.

Local supply concepts with intelligent components

Smart energy systems to us means

individually matching production and demand of supply technologies for power, heat, and cold, that flexibly link the productivity of local systems with the strengths of national networks.

Networks

Networked structures gain significantly in importance even in environmental technologies and process engineering. As is generally known, the total optimum is not the sum of all partial optima, hence we try to utilize the potential hidden in the networks through holistic reflection.

3. The catchword multidisciplinary could also be interpreted as: in cooperation we are strong. Since February 2003 UMSICHT is member of the Fraunhofer Alliance "Production", in which eight Fraunhofer Institutes have affiliated in order to conduct production oriented research and development together. How is UMSICHT positioned in the Alliance "Production"?

We represent the topics safety, environmental compatibility, and sustainability in the Alliance. To some extent the other Alliance partners do this as well, however, we complement the profile of the Alliance and the Fraunhofer Gesellschaft with an emphasis on material and energy conversion very well. Especially in times where the main focus is put on economy and efficiency of processes the aspect of sustainability increasingly gains in importance. The trend goes away from a consumptive towards a sustainable production.

We have to work with raw materials, energies, and means of production in a way that resources are preserved for the future.

4. "Sustainability" has become quite a buzzword. Is there not a risk of the term becoming trivial and not being perceived as important by society anymore?

Nowadays, society changes its notions quickly, but no matter what you call it, sustainability, environmental protection, or protection of resources: Changing the term does not change the task. The task is not new, though it will increasingly come into focus in the future, because it is a fact: Resources are running short and for this reason their prices are increasing. This is the need for action today, which economy is fortunately recognizing more and more. When we support sustained, and thus economic, management today, then this will be of benefit to our customers, does us good, and generations to come will profit as well.

5. How do you judge trends in process engineering?

Process technologies are getting more of a producing character. The trend in process engineering goes way from mass production towards a production of small batches of special products. This is what brings product and industrial engineering, process and chemical technology ever closer together.

In addition, technologies have to be integrated further. In the past people tried to separate process stages. Today it turns out that a process integration is more favorable from a technical point of view but above all for economic reasons. This trend will continue and lead to multifunctional approaches with which not only one but many different tasks can be solved simultaneously.



Dr.-Ing. Görgen Deerberg

Born in 1963, he studied chemical engineering at the University of Dortmund. His promotion was on semi-batch processes with gas/liquid systems. His main focus is on model-supported treatment of multiphase reactions and procedural processes.

Director Science and Technology at Fraunhofer UMSICHT since 2003.

We as engineers will be more and more required to consider complete process chains: from the process idea to the commercial process, and from the raw material to the recycling of waste material after product utilization. I can see enormous potential that has to be set free when scientists from basic research in chemistry and biology develop the utilization and provision of natural agents and materials together with engineers. All researchers and developers are called upon their ability to see beyond the end of their noses and to think more far-sightedly.

A few personal questions at the end:

6. *What is your favorite book?*

I cannot actually name "the" favorite

book of all time but "The Hitch Hiker's Guide to the Galaxy" by Douglas Adams comes pretty close.

7. *Assuming you were a candidate in "Who Wants to Be a Millionaire?", what kind of question would make you ask the host Günther Jauch to call your telephone joker?*

(laughs): Definitely a sports questions. I would call my father then.

8. *What is your motto?*

I would like to experience development. So a thought by Hans Pichler suits quite well: Research is always on its way, never at the finishing line.

(Hans Pichler, 1882-1958)

Guidelines

The guidelines of the organization "Fraunhofer UMSICHT" describe the basic self-conception of the Institute and its staff. Therefore, they are kept in a general form and build a frame which is to be completed and acted out but which also is to be advanced.

Guidelines are to bring continuity and stability into dynamically changing requirements of environment and daily routine. They are to accompany the Institute's work beyond office hours and are to be communicated

inside and outside the Institute. Thus, mission, policies, and expectations the Institute operates with and wants to be perceived in its surroundings with are reflected in the guidelines.

The ten guidelines of the organization "Fraunhofer UMSICHT" are deduced from the regulations and guidelines of the "Fraunhofer Gesellschaft" and concretize them for the concerns of the Institute's work.

- 1 Fraunhofer UMSICHT sees itself as a link between its business partners, staff members, the "Fraunhofer Gesellschaft", the scientific community, and other social actors.
- 2 Fraunhofer UMSICHT wants to be a reliable research and development partner for its clients, relieve them during all project phases, give them all respective services from one hand, and support them in accessing subsidies and commercial funding.
- 3 Fraunhofer UMSICHT offers its clients qualitatively high-quality scientific, results-oriented, interdisciplinary, and innovative research and development work. It provides them with competitive advantages through advance in know-how and recognized competence in problem solving.
- 4 The staff members form the Institute's backbone. Fraunhofer UMSICHT encourages and challenges the staff's professional, scientific, entrepreneurial, and social skills. These skills determine the Institute's efficiency. Fraunhofer UMSICHT wants to fill its staff with enthusiasm for research and development.
- 5 Fraunhofer UMSICHT acts according to the principles of the "Fraunhofer Gesellschaft" and contributes to enhancing the reputation of the "Fraunhofer Gesellschaft". The institute cooperates in partnership with the board of directors, headquarters, and other Fraunhofer Institutes and facilities.

6

Fraunhofer UMSICHT is actively committed to the formation of strategic alliances and networks in economy, science, politics, and society.

7

Fraunhofer UMSICHT forces up activities abroad in respect of project work and exchanging staff members (know-how transfer).

8

Fraunhofer UMSICHT acts actively in the scientific community. The institute cooperates with other research facilities, universities, technical colleges, and industrial partners in the national and international research and development scene, and faces up to scientific debate.

9

Fraunhofer UMSICHT is independent. It supports clear, understandable, and interdisciplinary consolidated positions and aligns its objectives according to these positions. Fraunhofer UMSICHT aims at a long-term realization of social visions through concrete innovations which can be efficiently transferred into economically utilizable progress and can be transferred into the environment.

10

Fraunhofer UMSICHT sees itself as a pathfinder for technical changes in the areas of environment, energy, process engineering, and safety. The Institute promotes effective management, environmentally friendly technologies, and environmentally conscious behavior in order to enhance society's overall quality of life.





Strategy

Between Expertise and Market: Strategic Planning

Anyone can learn from the past. Today we have to be able to learn from the future.

[Herman Kahn, 1922-1983]

Fraunhofer UMSICHT has already been running a systematic strategy planning process since 1996. Its focus is on setting up market-oriented business units from the Institute's existing core competencies. These units are to succeed in the competition with their products and services.

This strategic process is supported by intensive customer-oriented marketing. That way, the Institute's aims and resources can be adapted to the quickly changing chances on the market. Furthermore, risks can be identified at an early stage. The Institute's strategic planning initializes and integrates tactic operative planning which is performed in the business units. The renowned marketing expert Philip Kotler arranges both segments in a simple way:

"Following a **strategy** means doing the right things. **Tactics** means doing things right."

By completing the first version of a **strategic plan** in the summer of 2003, Fraunhofer UMSICHT presented a self-contained management document. Analyses of the current status, market, and competition are linked with potentials of future trends in process engineering and energy management in a single performance guideline. Highly compressed technology and performance roadmaps form the "schedule" for the next five years. They form the basis for the Institute's further economic and scientific planning. SWOT¹ and portfolio analyses are used to strategically analyze Fraunhofer UMSICHT's core competencies and business units. Through this, the **market's attractiveness** and Fraunhofer UMSICHT's **own power of resources** are compared and evaluated.

The market potential for research and development in process and energy technology is calculated from the exter-

nal research and development expenses of procedural branches and amounts to 170 million up to 1.6 billion Euro. The resulting market share of Fraunhofer UMSICHT is about 1% (with regard to all external research and development expenses) or 7% respectively (with regard to the external research and development expenses acquired by universities and research and development institutes).

All business units have the potential for intensively backed growth. Business units which are traditionally rather scientifically-orientated perceive the regressing public support most noticeably. Here, transfers into the industrial sector need to be intensified.

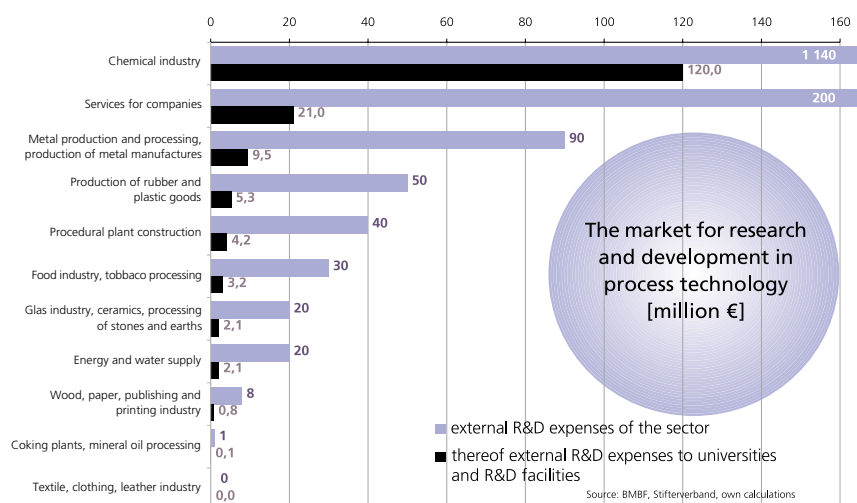
Fraunhofer UMSICHT will consolidate and grow moderately on the basis of its core competencies until 2008. Furthermore, the Institute will work economically-oriented and turn its attention towards process development and associated systems engineering. The innovational potential which lies in the method and system-oriented process engineering for sustainable products, technologies, and services is enormous.

Anyhow, Fraunhofer UMSICHT needs to be geared to the attractive and profitable segments of process and energy technology now. At present the following segments are being analyzed as potential topics:

- Intelligent materials, micro and nano technology
- New processes for the water and wastewater sector
- Bio refinery and bio fuels; polymers and materials from renewable resources
- Vision Energy 21 – smart energy systems, security of supply, climate protection,
- emergency and crisis management, and
- Chemtronics.

Business Units and Competencies

Core Competency \ Business Units	Environmental Technology	Safety and Process Technology	Energy Technology	Knowledge and Technology Transfer
Process and application development	◆◆◆	◆◆◆	◆◆◆	◆
Studies, expertises, expert reports	◆◆	◆◆◆	◆◆	◆◆◆
Planning, building and distributing pilot, and demonstration plants	◆◆◆	◆	◆◆◆	
System analysis und system technology	◆	◆◆◆	◆◆◆	
Software for process technology	◆	◆◆◆	◆	
Project development and financing	◆	◆	◆◆◆	◆◆◆



Competition tightens every day. All the more, it is important that unique selling points for specified core competencies are defined more clearly and "critical masses" are reached. That is why successfully initiated processes for the building of networks and strategic alliances – particularly in the internal Fraunhofer and university sectors – as well as equipment-related investments are unabatedly continued.

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1 strength | weakness | opportunities | threats

Chemistry and Analytics

Precise and reliable analytics are a precondition for the solution of environment-chemical questions. Scientists and technical staff work together in the highly qualified and experienced team "Chemistry and Analytics" to complete this task. For this purpose, laboratories with an extensive instrumental equipment, among others state-of-the-art analytical system combinations, are available at the Institute.

The wide spectrum of services offered particularly contains the development of innovative, custom-made methods, currently for example

- ultra trace analysis of pharmaceuticals and endocrine matters in wastewater,
- characterization of secondary fuels,
- plastics analysis and
- biocide determination in art treasures made from wood as well as
- measuring of siloxanes in landfill gases.

The validation of measurement results is carried out among others by comparison with external laboratories (inter-laboratory tests).

We further focus on the optimization of technical processes for qualitative improvement of products (ash, slag).

Our team offers analytical solutions, consulting services in the planning of examinations, and helps evaluating your analytical results.



Chemistry and Analytics



Biotechnological Laboratory

Biotechnological Laboratory

The biotechnological laboratory handles tasks on the cleaning of polluted media (water, soil, air), examines biological decomposition and production potentials, and develops novel microbiological processes from laboratory to pilot plant scale.

New biotechnological processes and plants are planned step by step, designed and examined to ensure technological feasibility at a high level of efficiency and operational safety. The biotechnological laboratory can realize creative and efficient solutions by cooperating with engineers and natural scientists of the analytics and the engineering departments.

As an approved testing laboratory of "Bundesgütegemeinschaft Kompost e. V." (Federal association of compost quality standards), and approved testing laboratory of DIN CERTCO for testing of composting capability of materials according to DIN V 54900-1 to -3, ISO 13432, ASTM 6400 we offer:

- microbiological analyses according to DIN, ISO, OECD-processes,
- testing of biodegradability under aerobic and anaerobic conditions (e. g. AT_4 and GB_{21} according to "Abfallablagerungsverordnung" [Regulations concerning waste disposal]).

Contact us.



Marketing, Communication, Business Development

Marketing, Communication, Business Development

The marketing of products and services, analyzing, and handling of business sectors, developing new market strategies, and finally representing the Institute in public are the tasks of the department of "Marketing, Communication and Business Development". Being directly responsible to the directorate, we support the scientific staff in the positioning of new products and fields and in tailoring them to the customer's requirements. Market surveys and technology studies help to assess opportunities and risks of new developments at an early stage.

Developing and preparing the Institute's public relation materials and web appearance is among our strengths. Our web news regularly and readily keep editors and journalists updated about the latest research results at Fraunhofer UMSICHT. To protect new developments from plagiarism, our department is also responsible for the registration of inventions, assistance in intellectual property rights, and in license agreements.

Innovation management and marketing are more than void phrases for us: our services encompass guided brainstorming, market surveys, business sector analyses and strategies, market introduction of products, marketing concepts and industrial property rights policies as well as public relation concepts, particularly offered to small and medium-sized enterprises. We want projects with Fraunhofer UMSICHT to be attractive, successful, and reliable projects – for our customers and together with our customers!

IT-Management

An efficient and reliable information and communication technology service is an indispensable prerequisite for any efficient project work. The IT management provides internal and external services, focusing on the following areas of expertise:

- planning, continuous operation and support of the DP infrastructure
- provision and update of software packages
- assistance in IT-specific problems
- provision of IT systems to support the work flow

A powerful server network equipped with a gigabit backbone is available for the efficient use of resources such as computer servers or data bases.

The system comprises highly available file servers with capacities in the terra-byte range including adequate band security, as well as intranet services, which are of increasing importance.

The IT management also offers services to external customers, in particular to small and medium-sized enterprises, including:

- DP-auditing
- planning, installation, and operation of local networks
- applications development concepts of central data management and storage
- development of system solutions

The department currently employs six trainees who are becoming IT-specialists in the field of system integration and applications development.



IT Management

Central Technical Facilities



Central Technical Facilities

The cycle times of technological innovations are minimizing rapidly in industrial and process engineering.

In order to secure a technological head-start and not only keep pace with others, a smooth and prompt realization must be guaranteed.

The central technical facilities realize technological know-how for internal and external costumers quickly and competently.

Specialized on the sector of test, pilot and demonstration plants our strenghts lie in:

- basic and detail engineering
- implementation of process control systems and
- measurement, control technology and control engineering.

Technical service is the basis of our work. Our team, consisting of electricians, mechanics and engineers, accompanies you the whole way: starting with the consultation, over planning and construction to the final production of your plant, we try to find the best solutions together with you. Among other things our repertoire comprises the made-to-order production of special components and the production of ready-to-operate technical plants.

We invest in the future by handing our know-how down to the succeeding generation. Trainees in different fields have set out on their way into the future in our facilities.

Library – Specialist Information Service

“Knowledge” has long since become an economic factor securing technological advantages of a location. For keeping the scientific-technical qualification of our staff always highly up to date, the scientific specialist library provides literature on the UMSICHT-specific topics environment, energy, safety and process technology as well as knowledge and technology transfer.

At present our stock comprehends approximately

- 7 000 monographs,
- 52 subscriptions to scientific journals,
- 43 permanently updated loose-leaf-collections,
- 30 information services (among others publication series of ministries, organizations, and institutions) and
- bulletins issued by government boards in various research disciplines.

The Library

- supports scientific personnel in obtaining specialist information in the Internet via an own Intranet-homepage serving as specialist portal,
- carries out literature and patent researches,
- trains staff in researching in end user services provided,
- documents own publications for the world wide accessible database Fraunhofer Publica and
- is in charge of UMSICHT publications (conference transcripts, dissertations etc.) from advisory support the author to the delivery of the printed copy to the “Technische Informationsbibliothek” (TIB, Technical Information Library) in Hanover.

Library





On 1 March 2003 CEE moved into new offices

Fraunhofer Center for Energy and Environment (CEE), Pittsburgh

Fraunhofer UMSICHT operates the Fraunhofer Center for Energy and Environment in Pittsburgh, Pennsylvania, USA which offers UMSICHT's technologies and services on the American market, handles projects in the areas of energy technology and wastewater treatment, and supports the connection to the technology development in North America through cooperation with project partners in both countries.

One of the Center's fields of work is concerned with the treatment of process and wastewaters. In a cooperation project with the University of Pittsburgh micro-filtration membranes for the treatment of municipal sewage (Combined Sewer Overflows, CSO)

Fraunhofer Center

have been examined. CSO emerge when the sewer's capacity has been transgressed through high rainwater quantities. They contain germs and bacteria that have to be separated. On the basis of various bacteria serving as indicators it was demonstrated that the quality of separation is very high: all concentrations examined in the permeate were below the detection limit which makes the technical feasibility of the process apparent.

A process for the cleaning of water bodies that have been polluted by mining is developed in the context of a cooperation project with the Department of Agriculture and the University of Pittsburgh. In addition, metals can be recovered with this process. And the call for action is urgent: in Pennsylvania alone more than 4 000 kilome-



The University of Pittsburgh with its landmark the panther

Pittsburgh

Densely wooded Northern Pennsylvania offers a lot of wood rests that can be used for energy generation.

ters of rivers as well as many surface waters have been severely damaged by acid mining erosions, so-called "Acid Mine Drainages". When the pH-value and the oxygen entry in the polluted water bodies are increased, iron hydroxides can be precipitated and used as raw material in the industries or as fertilizer when mixed with manure or other biomasses.

During process development the most effective and economical variant of numerous possibilities for precipitation and utilization of iron hydroxides is determined.

In a study, financed by the Department of Trade and Industry, Pennsylvania, CEE has generated an energy supply concept based on renewable resources for Meadville, a small town in the north-west of Pennsylvania. In co-operation with Allegheny College, the local university, possible biomass suppliers and potential consumers of power, heat, and cold have been identified. After developing several scenarios for gasification and fermentation of biomasses and after extensive economic consideration it showed that an ideal concept was the operation of a central fermentation plant on the site of an animal food producer. In this plant food leftovers from the production process as well as manure and other agricultural waste products from various farms can be transformed into gas to replace natural gas which has been used in the production process so far.

The Department of Environment, Pennsylvania has financed a study on wood gasification where CEE, in co-

operation with the University of Pittsburgh, examine the appearance of wood rests in Clarion County and carried out profitability considerations for various sites of a potential plant as well. It could be shown that a plant on a production site with constantly high gas demands is economical when the wood gas produced replaces the natural gas being used so far. Looking at the current wood rest, power, and gas prices power generation is not profitable. Taking under consideration possible aid money and an increase of 20 % of power costs though, power generation for own consumption could indeed become interesting in the future.

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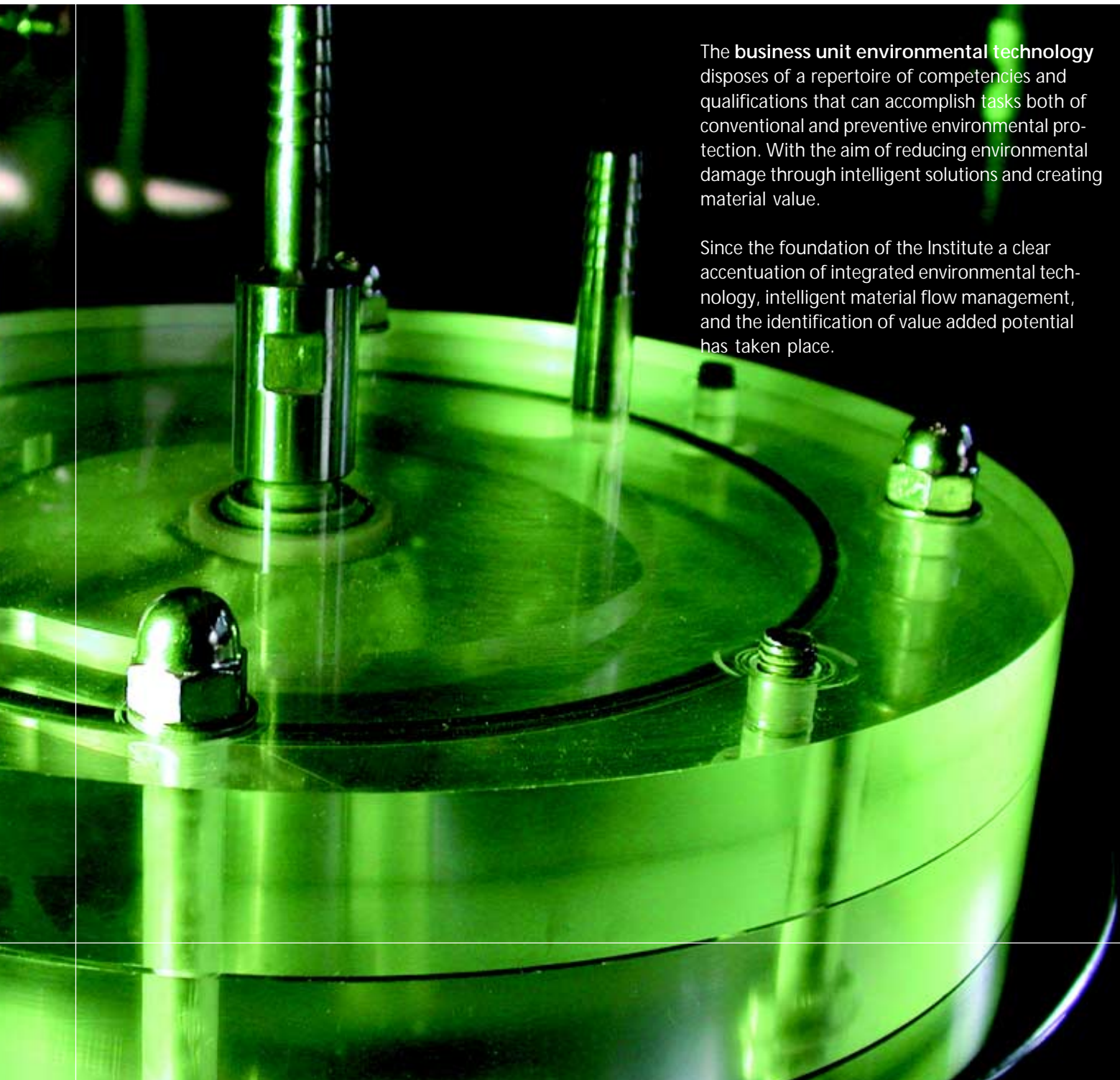
“Modern environmental technology is above all intelligent design of different inter-linked material flows and energy fluxes.”

[Prof. Dr. Rolf Kümmel, Business Unit Manager Environmental Technology]



The **business unit environmental technology** disposes of a repertoire of competencies and qualifications that can accomplish tasks both of conventional and preventive environmental protection. With the aim of reducing environmental damage through intelligent solutions and creating material value.

Since the foundation of the Institute a clear accentuation of integrated environmental technology, intelligent material flow management, and the identification of value added potential has taken place.



The Institute

Business Unit Environmental Technology

Adsorbents and Supercritical Fluids

Micro-Sieves and Confocal Microscopy

Plastics Recycling

Modeling of Spray Drying

Environmental Technology in Chile

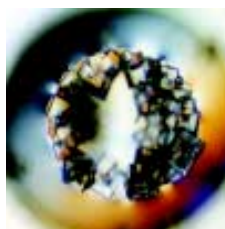
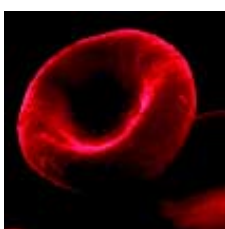
Bottom Ashes

Business Unit Safety and Process Technology

Business Unit Energy Technology

Business Unit Knowledge and Technology Transfer

Names, Data, Events





Silica gel as support (white)
impregnated with red
pigment yields the end
product (right)

Impregnation of Microporous Adsorbents from the Supercritical Phase

Microporous sorbents such as activated carbon are impregnated to attain special adsorption characteristics or to support catalysts. Usually, the impregnating agents are transported into the adsorbent's pore system using liquid solutions, often requiring subsequent energy-intensive drying steps with solvent residues remaining in the solid. Using supercritical carbon dioxide (sc-CO₂) above 74 bar and 31 °C as a solvent offers an economically as well as ecologically attractive process alternative. Having finished the impregnation, the solvent can be transferred into the gas phase simply by reducing pressure. The gaseous CO₂ often desorbes completely and can be reused in a closed CO₂ cycle.

Fraunhofer UMSICHT develops processes for modification of adsorbents by supercritical solvent impregnation (SSI). A co-operation project concerning SSI was supported by the Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke" e. V. (AiF). According to the results, activa-

ted carbon can be successfully impregnated from sc-CO₂ with complexing agents such as hydroxiquinoline, thiazolylazonaphthole-compounds, and alkylphosphine-acids (Cyanex®) or with catalysts such as metallocenes (application: olefine polymerization) and zinc acetate (application: polyvinyl-acetate-production), respectively.

In addition, the pore structure of activated carbon can be influenced by supercritical impregnation with aromatic compounds such as benzoic acid and subsequent pyrolysis. Further studies examine the potential offering to supercritical solvent impregnation of other sorbents, such as silica gels as well as the adsorptive immobilization of pharmaceuticals for controlled release applications for the human body.

Partners of the AiF project:

- Deutsches Textilforschungszentrum Nord-West (DTNW)
- Department of Mechanical Engineering – Division of Thermodynamics of the University of Siegen
- Institute of Pharmaceutical and Medicinal Chemistry of the Saarland University

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Development and Application of Micro-structured Systems in Separation Technology and Process Engineering

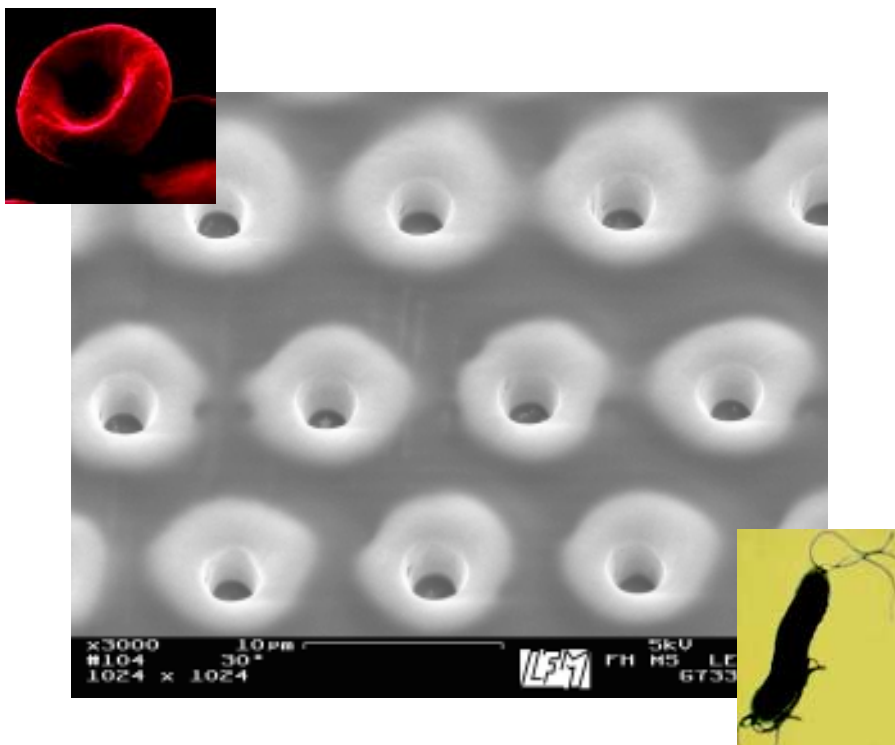
The introduction of miniscule components, such as micro-blenders and micro-pumps, has opened up the opportunity of realizing new production processes for traditional process engineering ever since the boom in micro-systems technology. Alongside with miniaturization, especially micro-structuring of materials (e. g. lotus effect, shark skin) has gained great importance in process engineering. In the area of environmental technology novel methods for laser-supported micro-structuring are developed in order to produce sieves of macroscopic size with a multitude of more than 100 billions microscopic holes per square meter. The microsieves are composed of stainless steel and feature a custom-made pore geometry. They are characterized by high filtrate capa-

city (10 to 40 m³/hm²), high selectivity, great robustness (500 N/mm²), as well as easy cleaning, and sterilization. A newly developed, laser-supported micro-welding method allows to weld the microsieves into gas-tight compact filter modules. The microsieve modules are implemented in a filter system with oscillation-based anti-fouling processes. The promising results of permeation experiments in laboratory scale were validated with various industrial product flows (e. g. laundry sewage). The implementation of such microsieve systems in production scale for the area of Life Science and the pharmaceutical industry are in preparation.

Process-accompanying and in cooperation with the company NanoFocus, a confocal microscope as instrument for quality control of micro-structured materials is currently being advanced. In addition, this optical 3D-measuring system provides the geometrical basic conditions for a planned computer-aided process simulation.

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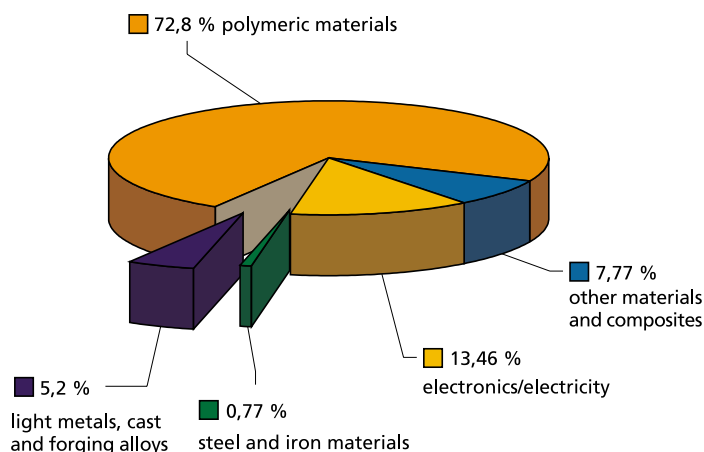
SEM-micrograph of a laser-made microsieve, for size comparison: red blood cell and unicellular organism

Studies on Utilization and Recycling of Plastic Fuel Containers

For automotive manufacturers and their suppliers guidelines concerning the recycling ability of their products are mandatory since the coming into force of the end-of-life vehicle directive (ELV) in July 2002. From 2005 onwards the creation of a recycling concept will be essential for the type approval of a new vehicle.

The implementation of the ELV demands component-oriented recycling concepts already in the offering phase. For Volkswagen AG, two variants of the tank system of the new Touran (petrol and diesel) were assessed theoretically and in practical examinations, and proof of recycling and utilization ability for the type approval were provided. Reference points for optimal extent of dismantling, quotas for the ways of utilization, and the estimated costs of the individual process steps were determined. Further on, adequate application areas for the recycled materials

Practical investigations for the determination of the optimal extent of dismantling of a plastic fuel container



Typical material distribution of a plastic fuel container

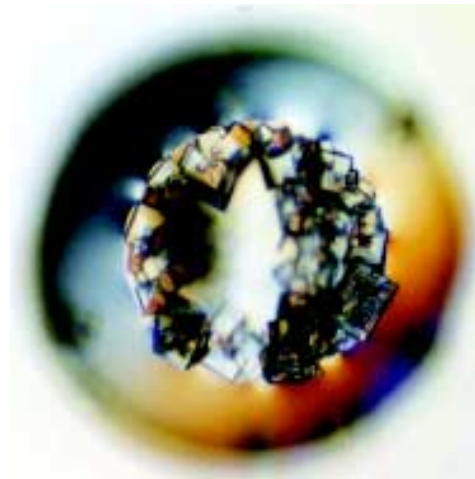
were determined, and appropriate utilization and development partners for practical implementation, respectively, were recommended.

Considering possible ways of recycling for the plastic fuel containers (KKB) examined, it turned out that material as well as feedstock recycling are technically practicable.

By application of feedstock recycling, higher recycling quotas can be achieved. The guidelines of the ELV for type approval are fulfilled with regard to components KKB of the Touran.

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Oil-fielded dried saline solution. Particles form a shell around a liquid core



Modeling of the Particle Morphology in Spray Drying

Spray drying is a widely-used production process in the chemical, pharmaceutical, and food industry. In times of steadily rising market requirements the producers of solids can be sure of a vital competitive advantage when product attributes can be predicted and controlled purposefully. Therefore, targeted prognosis and control of product attributes gain more and more in importance.

The development of a one-dimensional model for the drying of a single droplet with simultaneous solid formation is supposed to contribute to a deeper physical understanding of the procedures during the spray drying process in order to facilitate better control of the process. It is the aim to predict the emerging microscopic solid structure in the drop against the macroscopic process parameters and material specific properties. By integrating the single droplet-model into a commercial CFD-program it is possible to simulate a complete spray dryer.

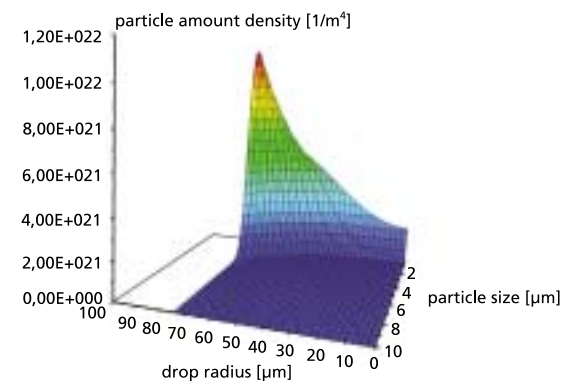
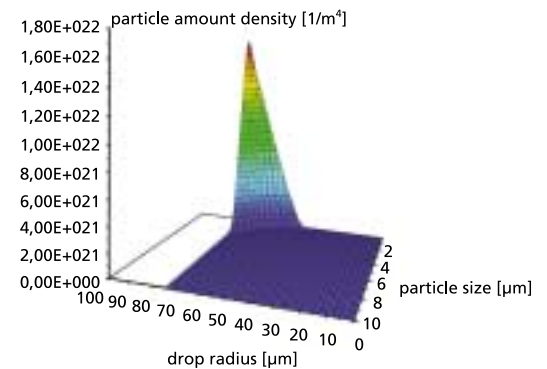
In order to model the solid formation, the local and chronological concentration and temperature distributions in the drop are calculated.

The material transport is accounted for by Fick diffusion and convection, and the heat transmission by conduction as well as mass transfer. For the modeling of the solid formation particle size distributions over the drop radius are calculated with the help of population balances. The experimental validation of the model is carried out by drying of mono-disperse solution and suspension drops created by a frequency controlled drop generator.

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Density allocation of particle quantity in the drop at drying gas temperatures of 200 °C (top) and 100 °C (bottom)

German-Chilean Co-operation Projects on Waste and Water Management

In 2001, Fraunhofer UMSICHT has signed a memorandum of co-operation with the Chilean Institute UDT of Concepción University. Joint activities of applied industry research that were started in 1997 are to be further extended on the basis of tangible projects and a regular personnel exchange with current emphasis on the areas of waste and water management.

In Chile more than 90 % of domestic, commercial, and industrial waste are currently deposited on landfill sites that mostly do not meet environmental standards. In the context of a research project supported by Volkswagen Foundation (Hanover) possibilities for establishing concepts of closed loop recycling management on the basis of regional waste streams are investigated. In the region around Concepción, municipal and industrial waste sources are to be identified; technical as well as economical strategies for their linking-up with the producing industries are to be developed.



Tender beginnings: Separate collection of paper, cardboard, and plastics waste by a recycling-agency in Concepción



Partial view on the UDT technical shops: Pilot plants for wet oxidation of special refuse (in front) and for the extraction of natural materials (background)

Since 2003, Fraunhofer UMSICHT has dealt with a project in the area of water treatment supported by the BMBF (Federal Ministry for Education and Research) for the development of an Internet platform for water management in Latin America. www.aqua-latina.info is supposed to inform local authorities and companies of technologies available for water/wastewater treatment in the future, and shall provide first conceptual designs for water management adapted to their needs online. Algorithms for interpretation and economical-ecological assessment of "application clusters" are to be developed and innovative technologies with German SME on location are to be realized in form of pilot plants.

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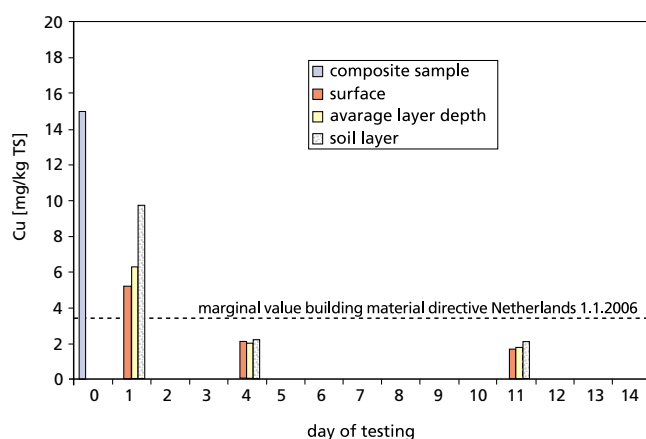
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Rapid Aging of Bottom Ashes for Immobilization of Ecologically Relevant Heavy Metals

The utilization of bottom ashes from thermal waste incineration plants has been complicated increasingly by low-priced competitive products and requirements by the government over the past years. This development led to considerations of decreasing the share of leachable elements in bottom ashes in the past. Processes, such as integrated leaching, melting or sintering, though did not take hold due to high costs.

The popular practice at present is a mechanical treatment which separates the ashes in different particle size fractions.



Reduction of soluble copper compounds in the Dutch elution test by treatment with carbon dioxide

Conventional aging and treatment of bottom ashes from thermal waste incineration plants



This treatment is combined with an upstream aging where the ashes are heaped up into heaps with the height of several meters. Depending upon the layer depth, two aging-mechanisms occur. At the heap's surface, alkaline shares of the ash react with the carbon dioxide in the air to hardly soluble calcium carbonate. Through this the pH-value decreases and the solubility of amphoteric heavy metal compounds decreases. The formation of hardly soluble sulfate compounds is dominant in deeper layers, since diffusion of carbon dioxide into the heap's inside is a very slow process. The compliance with limiting values for soluble heavy metal compounds is not guaranteed in the lower heap layers.

As the permitted amounts of copper, molybdenum, and antimony compounds for bottom ashes – which are used as building material – will be decreased considerably in the Netherlands from 2006 on, a large-scale experiment in cooperation with a Dutch waste management enterprise was carried out. Altogether, 170 t of bottom ashes were treated with carbon dioxide-containing gas in a compost tunnel. Within a few days, a noticeable reduction of soluble shares of lead, zinc, copper, and molybdenum compounds was achieved.

In the future, especially carbon dioxide-containing media that are available cost-free such as landfill and biogases are to be employed. Thus, by combination of diverse waste-economic elements like waste incineration and composting, a sensible concept for the cost-efficient quality improvement of bottom ashes can be established.

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“The networked information technology offers reasonable tools to entrepreneurs in order to gain control of their documentation requirements and obligations in a cost-efficient way. That is safe to say!”

[Dr.-Ing. Stefan Schlüter, Business Unit Manager Safety and Process Technology]



The **business unit safety and process technology** is concerned with the technical design, optimal operation, and safety evaluation of industrial plants and processes. Technical processes need to be safe, reliable, and optimally controllable and optimal safety for the staff, the neighborhood of the plants, and the environment needs to be ensured.



The Institute

Business Unit Environmental Technology

Business Unit Safety and Process Technology

Hot Smoke Tests

Safety Concepts

Pipeline Networks

Information Networks

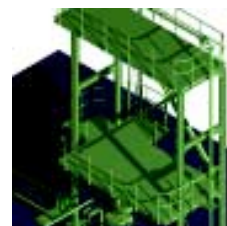
Process Simulation

Guideline for the Storage of
Hazardous Substances

Business Unit Energy Technology

Business Unit Knowledge and Technology Transfer

Names, Data, Events



Practical Testing of Smoke Management Systems in Underground Building Structures

Special geometries and extraordinary evacuation routes in underground building structures often require specially adapted smoke management systems for each individual object.

Fraunhofer UMSICHT was contracted to undertake practical smoke tests in underground caverns containing hydro power stations. The performance of the installed smoke venting systems had to be evaluated with regard to an inclined access tunnel and two different "machine caverns".

In the tests, pool fires of methylated spirits with a heat output of up to 2,2 MW were used. Tracer smoke was added in order to illustrate the flow of hot air.

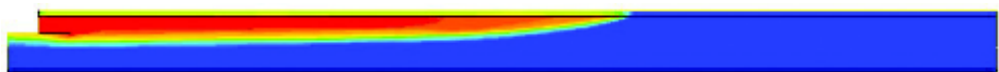
Thus, the flow characteristics of the visible test smoke can be observed; the data of smoke spread are verified by additional measurements of the distribution of gas temperature and carbon dioxide concentration in the object.

Hot smoke test in a machine cavern



Hot smoke test in a tunnel

CFD-simulation of smoke spread against a forced airflow: Temperature profile in a tunnel



The test in the access tunnel has revealed that no upward smoke spread would occur against the forced airflow from the tunnel entrance to the machine cavern. In the machine caverns the stratification of hot smoke under the ceiling and relatively clean air underneath can be used to assure the usability of evacuation routes in the course of fire over a sufficient period of time. Based on the test results, further improvements of the smoke venting system could be suggested (e.g. location of fire detectors, supply of make up air).

The evaluation of smoke management concepts for underground building structures often requires knowledge about the effect of superimposed horizontal airflow on smoke spread. For systematic investigation of this phenomenon, a CFD-model has been created. The simulation results have permitted some generalized conclusions concerning the influence of heat release rate and smoke temperature on the spreading characteristics of smoke.

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Safety Concept for an Oxidation Process with Pure Oxygen

The efficiency of an oxidation process is determined to a high degree by the oxygen content of the oxidizing medium. An increased oxygen content, however, increases process hazards and narrows the limits for safe operation. When pure oxygen is used, even materials which cannot be ignited at all under normal atmospheric conditions may become ignitable and can create fires that are very difficult to extinguish.

The application of pure oxygen in oxidation processes, on the other hand,

offers the opportunity to reduce costs of equipment and operation significantly due to smaller devices and reduced off-gas flow rates.

In the framework of further development of the continuous oxidation of an organic compound, Fraunhofer UMSICHT was commissioned to investigate the physico-chemical properties of the substances with a particular view to explosion hazards and to perform a risk assessment of the entire process.

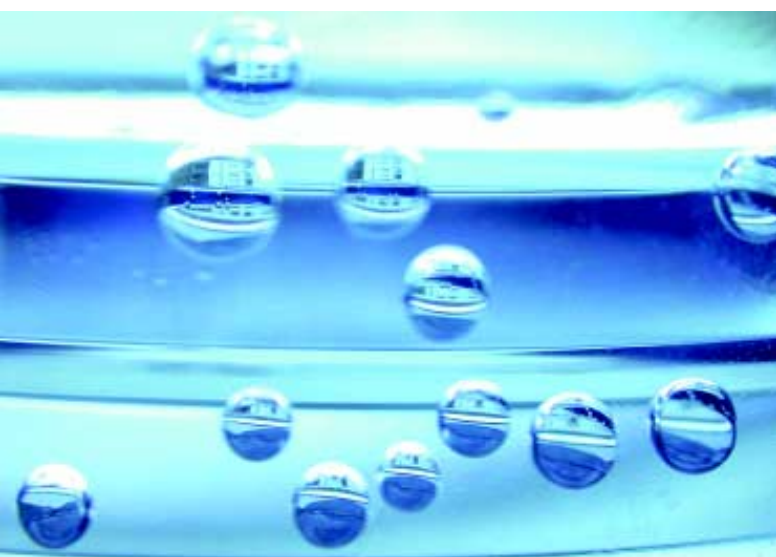
Based on experimentally determined properties of the compound, such as wave propagation velocity, electrical conductivity, and auto-ignition temperature, measured at atmospheric conditions and at process conditions, conclusions for safe process design and operation were derived.

Risk assessment considered normal operation as well as start-up and shut-down of the process and taken account of possible causes for non-specified operation.

Fraunhofer UMSICHT has contributed to the design of a new oxidation process in order to ensure safe and reliable operability.

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Process stream oxidation with pure oxygen – safe and reliable!

Dangerous States in Pipeline Systems – Detecting, Analyzing, Optimization

Pipeline systems are the highways for liquid and gas flow of all kind for modern industrial and consumer society. Unforeseen dynamical straining like condensation of steam in power plants, sudden change of liquid speed (chemical industry, water supply) or plug flow of oil and gas may result in water hammer, cavitation hammer or condensation hammer in the pipeline. The risk of high pressure surges and forces to the pipe supports (noise, leakage, burst of pipe) is rising with increased length of the pipeline and increasing of the valve closing speed.

By using the measurement of water hammer on location, the reason of failure and the possibility of a failure in the piping system can be determined. Due to close co-operation with other science institutes and measurement companies the latest state-of-the-art measuring equipment and analyzing equipment can be used. The results of the water hammer measurement are analyzed and evaluated by commercial computer software. High performance evaluation software for pipe systems and their components complete the technical spectrum.

Therefore, in the economic way (productivity) and the way of plant safety, the customer receives an optimized pipeline system.

References from chemical industry, water suppliers, power plants and oil and gas industry do confirm the quality of the methods we developed.

Our performance includes:

- Planning and calculating of pipe systems (statically and dynamical calculation)
- Manufacturing and optimizing of pipe systems
- Testing of fittings
- Detection of leakage and on-the-spot measurement of force and pressure (detection of water hammer)
- Expert's reports on the topics safety and availability of pipelines
- Avoidance of water hammer and cavitation hammer by using ABS-Armatur® oder KAVITAS®
- Scientific evaluation and validation of computer software using our large-scale test plant (P_{\max} : 140 bar, T_{\max} : 200 °C)

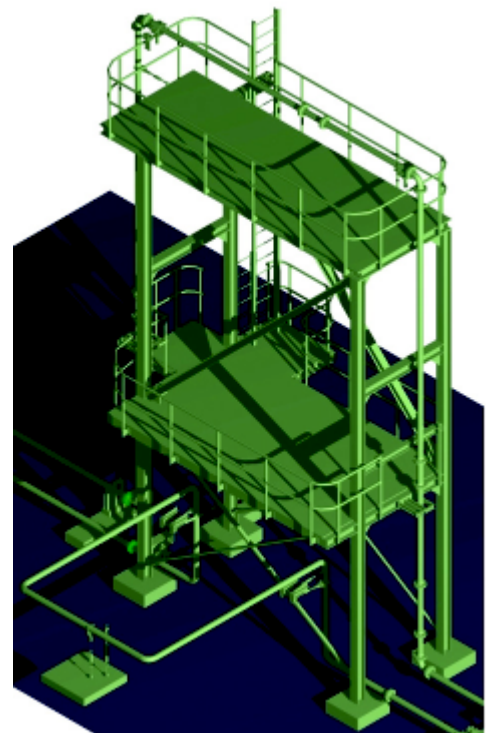
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Dipl.-Ing. Ralf Müller (+49 2 08/85 98 -14 02)



Large-scale test plant
at Fraunhofer UMSICHT
(below: partial view)





A Network of Information to the Company-specific Conformance of Statutory Organization Duties to the Industrial Safety and Environmental Care as well as Maintenance of the Certification of Management Systems.

Employers in all commercial and industrial fields are obliged by the labour protection laws and operational management systems to build up a suitable organization in their enterprise under supply of the necessary means which ensures health protection and security for the employees according to the state of the art. The fulfilment of these duties is checked and supervised by authorities and auditors. If lawful offense is ascertained, legal proceedings can be taken.

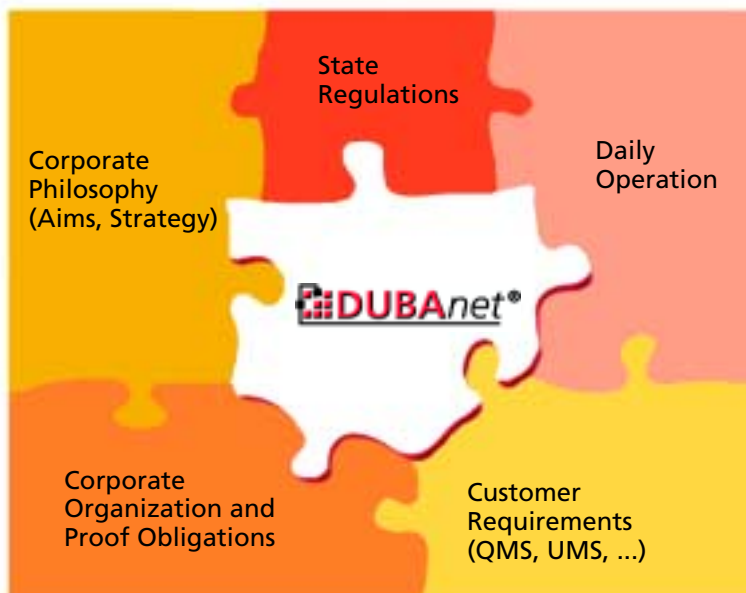
On the market a huge number of engineering utilities is available which support enterprises in gathering information, data management as well as document preparation. Indeed, they consider mostly only single aspects, so that several parallel systems must be used in the company. The application of such systems is mostly time-consuming and can usually only be carried out with expert's knowledge. Often an adaptation of the engineering solutions to the company-specific workflow is not possible.

With DUBAnet® an integrated solution was created which supports the entrepreneur from gathering information up to spreading information, so that after the initial system design and operational introduction no further expert's knowledge for maintenance is necessary. At the same time an organizational fault by breach of statutory duty is excluded. The company-specific design allows a workplace-related supply of information in daily business, searching times are avoided.

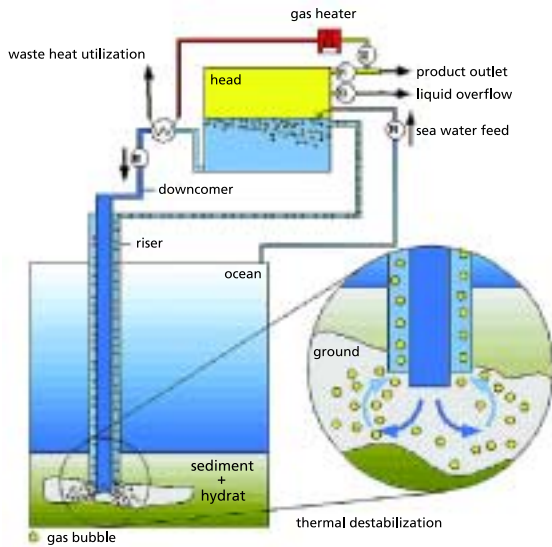
The method is directed mainly at small and medium-sized enterprises which are legally obligated to the keep topical instructions and operating instructions, documentations, hazard (peril) evaluation etc. This includes enterprises which are certified by German Institute for Standardization ISO 9 000 or 14 0001. In particular security representatives and the managers have a considerable time profit by using the system. Besides, the applicability of the procedure is not limited to certain industrial sectors.

Further information at: www.dubanet.de

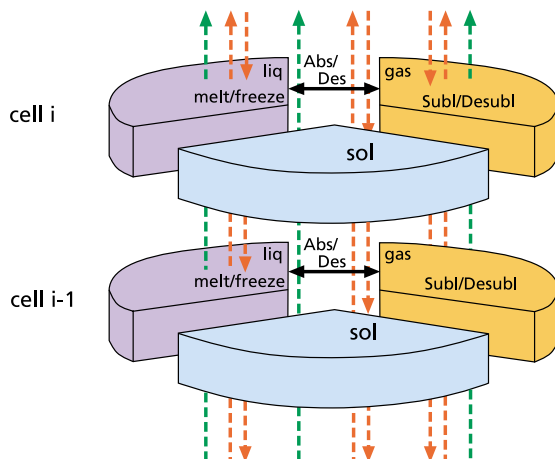
Contact
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Dr.-Ing. Ulrich Seifert (+49 2 08/85 98 -11 27)



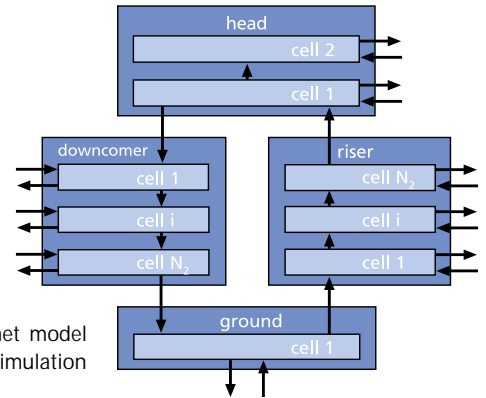
DUBAnet® as an integration medium for operational management systems



Gas hydrate winning apparatus based on mammoth-pump principle



Relevant interactions of the process



Multi-section cell net model used for process simulation

Dynamic Process Simulation of Oceanic Gas Hydrate Winning

It is assumed that gas hydrates contain more than twice as much carbon as all other fossil energy resources, so the controlled use of gas hydrates as a natural resource could guarantee the world-wide energy supply.

The proposed gas hydrate winning method is based on the mammoth-pump principle. A concentric tube arrangement is used to feed the gas hydrate deposit with warmed sea water in order to de-stabilize the solid gas hydrate and to set free the gas components, predominantly methane gas. The rising gas bubbles accelerate the fluid of the surrounding area. A circulating flow process is induced by the difference of mean fluid density in the two flow sections of the tube arrangement (downcomer: liquid phase; riser: liquid, gas, [solid] phase). The gas won flows through the riser (outer annulus in figure 1) and reaches the top of the apparatus, where it is separated and supplied to further utilization.

A dynamic process simulation of the proposed winning apparatus can be realized by using a multi-section cell net model. The cell net based discretization of the apparatus sections enables the calculation of pressure, concentration, temperature and velocity profiles as function of time and position. A detailed modeling of the multi-phase flow and the complex interaction between the flowing phases is included. The model implementation as a computer code enables the evaluation and optimization of the proposed gas hydrate winning technology.

Knowledge about gas hydrate stability is very important, with respect to realizing controlled de-stabilisation as well as to developing procedures to avoid new gas hydrate formation inside the apparatus (plug).

The investigation of the proposed gas hydrate winning apparatus by intensive application of the process simulation program permits the conclusion that the innovative process is technically well suited for natural oceanic gas hydrate winning. All in all, the winning process can be evaluated as safe and economical in the energetic sense.

Contact

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LAGERguide – Knowledge-based Guideline for the Storage of Hazardous Substances and Waste

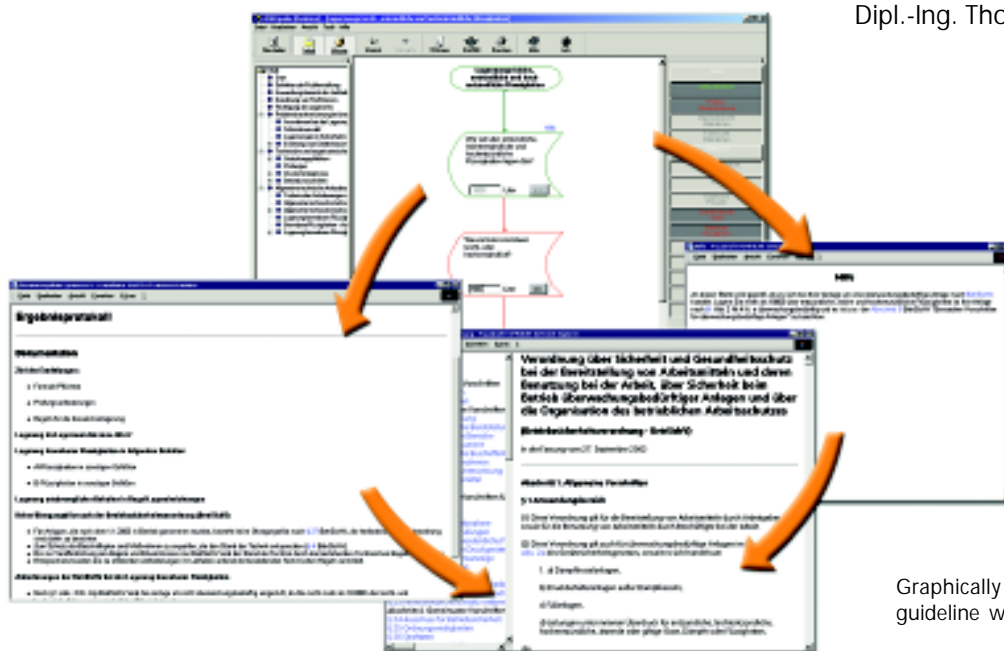
The storage of hazardous substances and waste must meet numerous state-of-the-art security requirements. Therefore it is essential to have a precise knowledge of the relevant regulations with their different protection purposes and security measures. For the user who deals with this complicated topic only briefly or with varying questions the gathering of information is mostly time-consuming and labor-intensive.

For gathering information concerning certain problems in the area of hazardous substance storage professional databases with free text search are often used. These systems do not need any additional amount of maintenance except text actualization. Furthermore they facilitate the navigation in the technical corpus of legislation for the experienced user in comparison with classical print media. Indeed, the full text databases do not provide any intelligent algorithm which could support the inexperienced user in acquiring information.

On the basis of experiences in the expert system development the state of the art for storage problems was illustrated in rule-based and object-oriented knowledge. For the navigation through the structures of the knowledge bases modern Internet technologies are used in form of so-called "clickable maps". Besides, the easy processing of the graphical display of decision workflow allows the inquiry of all relevant measures.

Supported by this IT-tool questions can be answered comprehensively for the compilation of legal-correspondent protection systems concerning the storage of waste and hazardous substances. Thus, target groups are storage operators in the area of chemical industry, manufacturing companies, plastics processing, energy providers, logistics service providers as well as engineering consultants involved in planning of storages.

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Graphically supported guideline with LAGERguide

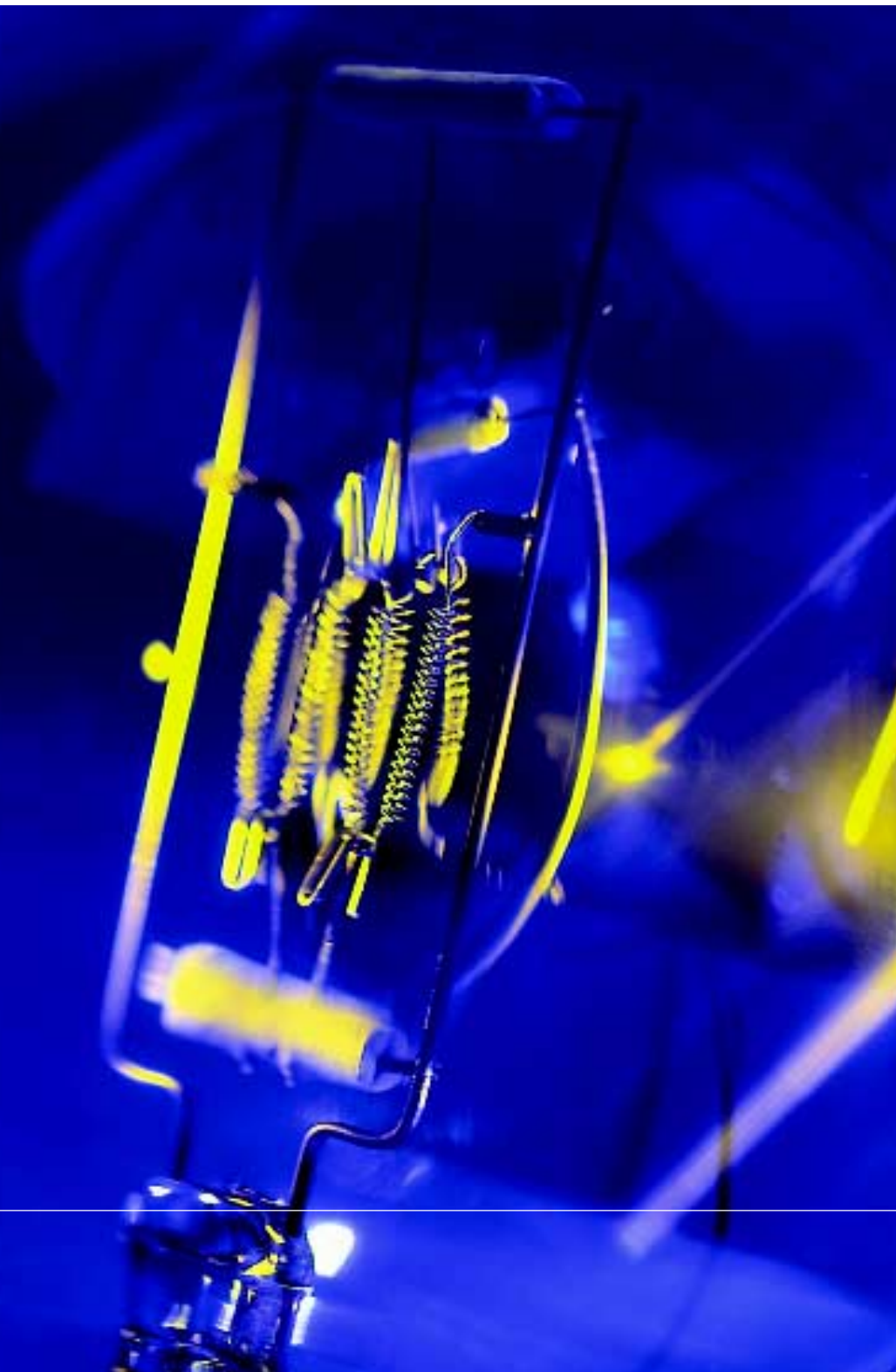


“There is no technological progress without sustainable and competitive energy technology. Therefore, it is important to integrate energy systems in an intelligent way.”

[Dr.-Ing. Wilhelm Althaus, Business Unit Manager Energy Technology]

In the **business unit energy technology** application-oriented developments in power, heat, and cold supply are carried out. With highly efficient energy supply in combination with rational application, maximum efficiency and high sustainability are achieved.

The motto is to successfully position companies in the changed energy market with the help of smart energy technology.



The Institute

Business Unit Environmental Technology

Business Unit Safety and Process Technology

Business Unit Energy Technology

Cleaning of Sewage and Landfill Gas

Energy from Low BTU Gases

Gas Cleaning for the Use in Fuel Cells

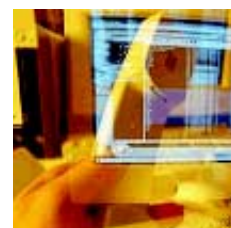
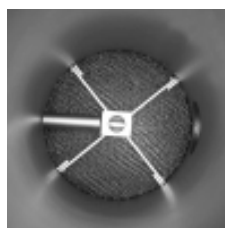
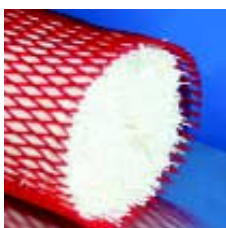
Cooling and Latent Cooling Energy Storage

Supply Networks

Climate Protection and Emissions Trading

Business Unit Knowledge and Technology Transfer

Names, Data, Events



Removal of Organic Silicone and Halogen Hydrocarbon Compounds

Sewage and landfill gases cause difficult problems to gas engines when they contain organic silicone. Hard and abrasive silicone oxides are formed during combustion and settle on the valves, pistons and turbos and catalysts causing severe engine damages. Fraunhofer UMSICHT is testing a new method to remove organic silicon from the fuel gas. The capacity of activated carbon filters is significantly increased by a catalyst step. Halogenous hydrocarbons are also eliminated. Due to very promising results of practical tests on various landfill sites the construction of a demonstration plant is intended.

Within the EU-Project EROB a modular testing plant was constructed in co-operation with 5 project partners for research on gas cleaning processes. Low temperature and energy saving gas scrubbing methods can now be investigated on site in different process arrangements. For adsorptive gas cleaning with activated carbon a mo-

dular "ready-to-fit" filter system was developed which can easily be filled and changed by big bag units.

Network for Renewable Gases ReGasNet

Fraunhofer UMSICHT is building up the network ReGasNet which develops solutions for the cleaning of renewable gases, which are to be used for power generation.

Feeding of Biogas into the Natural Gas Net

The scope of the study performed were the boundaries and restrictions under which renewable gases, which are listed in the EEG (German Renewable Energies Law), can be fed into the natural gas net in order to promote the substitution of fossil fuels.

Oxygen Enrichment of Combustion Air

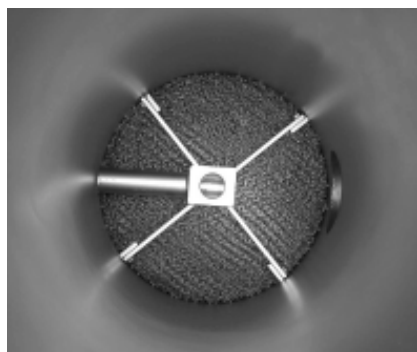
A new technology for oxygen enrichment of combustion air with hollow fibre membranes has been developed and realized in the form of a container system. This technical prototype is to be used for various applications for example combustible gas with a low energy density. We are testing the use of landfill gas in plants based on gas engines, as well as the increase of the firing temperature for metallurgic applications.

Contact

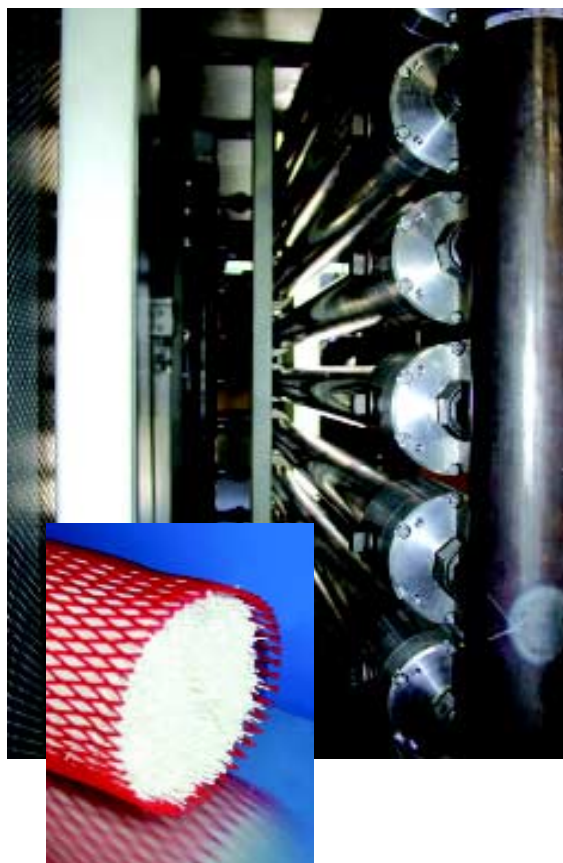
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Landfill and sewage gases are cleaned without the use of cleaning and softening agents



In the membrane plant a number of hollow fibre membranes (see partial view) enriches the air with oxygen



Drillmasters work day and night in order to get the coal mine gas out of abandoned mine shafts

Fluidized bed plant for gasification or combustion of biomass feedstocks



Inspection of Tightness at Filled Mine Shafts

Coal mine gas that escapes from abandoned pits contains the high potential climate gas methane, which in some cases has to be sucked off for avoiding endangerments or which is used for power production. To ensure that only a minimum of the coal mine gas escapes uncontrolled, Fraunhofer UMSICHT developed a technique to prove the tightness at filled coal mine shafts.

Pre-gasification of Solid Biomass and RDF

Pre-gasification is an effective way of utilizing several feedstocks which are difficult to handle by converting them to combustible gases. Appropriate gas treatment enables gas utilization in different downstream processes (i.e. lime/cement kilns, gas engines, fuels cells, or chemical synthesis). For gas utilization in IC engines for CHP-generation e.g. can be fed with gasification gas which has passed a special reforming stage. Pre-gasified sewage sludge e.g. can be used for power generation by partially substituting biomass in grate combustion boilers. For scientific investigation and further development a novel test plant is available at Fraunhofer UMSICHT. It is a modular fluidized bed plant for both gasification or combustion of biomass or RDF.

Direct Biological Hydrogen Production

A look into the future unveils the hydrogen production by green algae. Fraunhofer UMSICHT works on the assessment of different bio-reactors and the possibilities to generate electricity economically.

Efficient Automation Solutions for Biogas Plants

Within the scope of detail engineering of biogas plants extensive operational experience in automation solutions was gained. Based upon this experience optimization of plant operation and the automation system was carried out. Using remote maintenance, notice of malfunction via sms-messages and straight handling idea, maximum possible operational availability of the biogas plants is achieved.

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Additive Natural Gas and Coal Mine Gas Processing for a PEMFC

A gas cleaning system, which fulfills the requirements of fuel cells, always represents a special challenge. Some PEM fuel cell systems need natural gas with H-quality.

At locations with L-quality and especially fueled with coal mine gas or biogas a fuel processing system is unavoidable before feeding these gases into a PEM fuel cell. Nitrogen, oxygen, carbon dioxide and odorants must be removed since they are unwanted accompanying components. For operating a 250 kW-PEM fuel cell, type Alstom Ballard P2B, an activated carbon THT filter and after this a two line pressure swing adsorption plant has been installed.

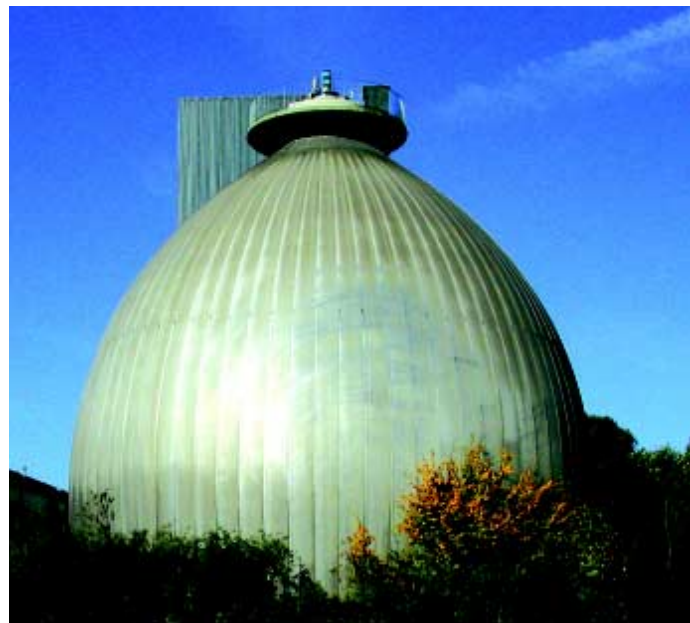
Gas Cleaning with MCFC Pilot Plant Testing

The process analysis reveals that MCFC high temperature fuel cells are particularly suitable for CO₂-containing gases (e.g. biogas, coal mine gas, sewage gas, landfill gas). The use of standardized gas cleaning modules is requested by our customers.

The starting point of the development was the analysis of the minor quantities with an error of less than 1 ppm. On this basis an innovative gas cleaning system has been designed, which is



The PEM-fuel cell has taste for bio and sewage gas processed in a two-line pressure swing adsorption



A digester of a sewage plant in the sun

being tested at a sewage plant together with the MCFC fuel cell at the moment.

From the first promising results a good reliability and economy can be expected. The current investigations focus on the effect of varying gas compositions on the electrical output and efficiency of the stack.

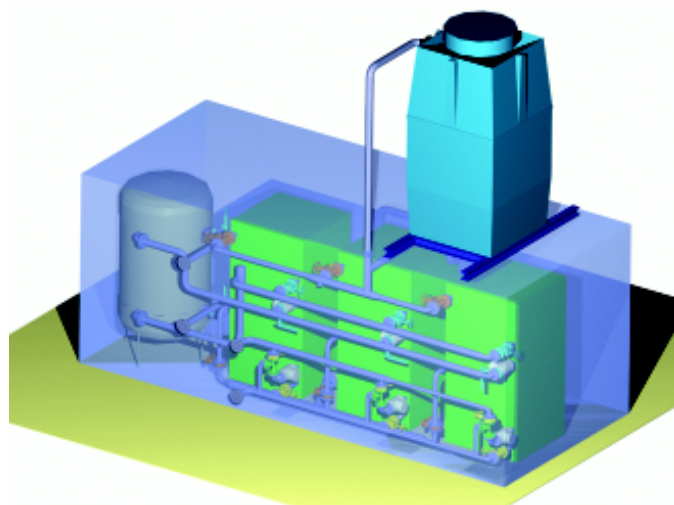
Multi Fuel Reformer

For testing purposes of different reforming processes a modular and transportable test facility has been erected. With this facility different catalysts and gas compositions can be investigated with regard to the suitability for hydrogen production. Furthermore the feeding of well defined portions of pollutants allows lifetime tests. The test facility is equipped with a gas mixing system, gas humidification, a tempering device up to 1,200 °C and a flexible and highly-precise gas analysis system (GC, MS, NDIR).

Contact

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Not only famous on TV:
Engineers specializing on
chilling technologies like con-
tainers as well, since they
are an ideal home for chilling
machines and storage tanks



Ice-Slurry Technology

With brine ice mixtures (ice slurries) Fraunhofer UMSICHT combines high storage density of ice with pumpability of water to make it usable for refrigeration technology. The rheological behavior of different ice slurries was patterned in a physical model, basis for the piping system layout and optimization of operating parameters of technical supply systems. In a pilot-plant for an air-conditioned laboratory important planning characteristic values were attained. Ice slurries enable a simple and low-priced retrofit of existing plants. Further on the efficient ice slurry production is part of the research, e.g. in rugged and efficient steam jet injectors.

Phase Change Material (PCM) Cold Storage for Air-conditioning

Instead of ice slurries, PCMs with high melting temperatures, for example paraffins, can be used in air-conditioning applications. Experiments with PCM emulsions and micro-encapsulated paraffin have shown a very good rheological behavior and a three times increased thermal transport capacity, compared to cold water networks, within a 25 vol.-% mixture. As a result, the costs of the cold supply can be reduced. Alternative possibilities of applications are storage elements filled by the PCMs and used for example in cooling systems. During night time, the obtained cold of free cooling is stored by freezing of the PCMs. This could be used for an inexpensive way of air-conditioning or process cooling. The tooling up of an existing cooling tower is already planned. The combination of operating experiences and computed simulations helped optimizing operation and plant design.

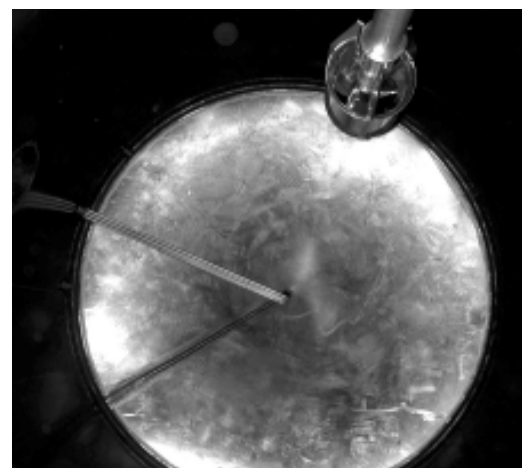
Thermally Driven Container Chiller Plant

An effective integration of thermally driven chiller plant into an existing supply system can be obtained by container modules. Fraunhofer UMSICHT is developing a water-LiBr absorption chiller plant (30-150 kW) as well as a steam jet ejector chiller (50-250 kW) in form of a container module. Both plants dispose of the chiller as well as the necessary auxiliaries for cold generation, therefore only the connection to the power and heat supply has to be realized.

Contact

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Shaken, not stirred:
According to this famous quotation
in the ice-slurry-reactor the
aqueous suspension consisting of
tiny ice crystals is always ready to
transport cold.



With the help of adequate software you do not lose sight of the optimal operation within the energy supply grid

There are many ways to operate economically – PortO. helps to find the best



Strategic Supply Temperature Optimization – Heat Storage within the Pipeline System

On the basis of the detailed knowledge within the field of unit commitment and the optimization of energy supply systems a model describing the characteristics of district heating systems has been developed. With this approach it is possible to model the dynamic heat storage capacities of the pipeline system of a district heating network. By application of systematic network aggregation methods the calculation time was significantly reduced. The aggregated non-linear model describing the dynamic characteristics of the pipeline system enables the optimization of heat storage processes with respect to a minimization of running costs. Applying this software prototype a potential to reduce operating costs was determined for different existing district heating systems.

Leak Detection with Dissolved Helium at Earthlaid Pipelines

Detection and precise localization of leaks is an arduous task for owners and users of pipeline systems. Fraunhofer UMSICHT developed a new method which does not require to interrupt the service during leak search at district heating pipelines. Helium which is dissolved in water is released at any of the leaks and is spread in the underground by diffusion. Leaks can thus be localized at the surface by mobile Helium detectors. In cooperation with district heating utilities and industrial partners many applications were successfully carried out.

For Local Heat Supply

Specialized knowledge is the basis to decide on investments. www.nahwaerme-forum.de provides users, decision makers and non-professionals with information about technology and economical as well as legal conditions of a local heat supply. Therewith alternative solutions can be evaluated and technically and economically interesting options can be identified. In the forum visitors can discuss questions, socialize with other users e.g. constructors/manufacturers, planners, etc. and present their own projects and products.

Optimizing the Portfolio of Energy Products

Since the liberalization of the European energy market many power purchasers change over their purchase strategy from long-term contracts to a structured purchase strategy using power exchanges and financial derivatives to hedge against the resulting price risks. The portfolio optimization tool PortO. supports an efficient portfolio management. PortO. is based on price scenarios and stochastic optimization models with regard to the integrated optimization of profit and risk.

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The "jupiter" Emissions Trading Training

The Emission Trading Scheme of the European Union starting in 2005 implements economic instruments for climate protection. The "jupiter" emissions trading training (www.jupiter.nrw.de) prepares concerned emissions-intensive enterprises in North Rhine-Westphalia for this market. It offers an Internet-based, realistic simulation of the emissions trade including CDM_{ji} and technical emissions reduction projects. Extensive training and consultation helps the participating enterprises to develop their strategic goals in the CO₂-emissions market and to test suitable work-flow schemes practically.



Enterprises joined the emissions trading training camp "jupiter" in order to be prepared for the trading with emissions starting in 2005



Symbolic starting signal for emissions trading in Germany: the first subscription warrant on one ton of carbon dioxide reduction

New Business Models in Emissions Trading

Fraunhofer UMSICHT is founder member of the German Emissions Trading Association and possesses expertise in the field of emissions trading. Fraunhofer UMSICHT took part in a valuation project for the Joint Implementation and Clean Development Mechanism approval process of the German ministry for the environment. Together with the power producer "Stadtwerke Herne" Fraunhofer UMSICHT presented the first warrant for a German Joint Implementation project. Together with the power producer "Stadtwerke Unna" Fraunhofer UMSICHT brings the idea of emissions trading to the household level. Stadtwerke Unna pays their customers a premium dependent on the individual emissions reduction reached by exchanging old oil fired heatings by modern gas fired heatings. Fraunhofer UMSICHT developed the calculation tool for the expected emissions reduction due to heatings change-over.

Technical Optimization of Systems

The lack of energy data is the most common cause for misplanning of energy systems. Besides energy saving potentials cannot be evaluated especially in case of properties spread over several locations. Fraunhofer UMSICHT acquires and evaluates data concerning energy use and costs for such premises e. g. the Caritas Wohn- und Werkstätten Niederrhein and shows opportunities for achieving potential energy and cost savings.

For operators of complex energy supply systems there are always a number of possibilities to reduce the energy demand. In case of a chilled water network of a large university hospital energy saving potentials and starting points to optimize the operation were worked out by conducting an inventory survey and simulating the pipeline system characteristics based on a small number of measuring points.

Based on the experiences in energy supply concepts the Institute developed the energy supply concept and accompanied the basic engineering for the design of a new complex of buildings for two vocational schools with 4,000 pupils and is now working on the development of the model house for the German-Japanese project "Eco City".

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“ Ideas develop in our heads. To make money with them, though, we need to individually realize and market them all over the world. To me that is innovation! “

[Dr.-Ing. Bernhard Dietz, Business Unit Manager Knowledge and Technology Transfer]



The **business unit knowledge and technology transfer** pursues the goal of marketing know-how acquired within the Institute and spreading its utilization. This marketing is done by transfer “into heads” (further education), transfer into other countries (international project development), and via transfer of the know-how into companies (spin-offs). Moreover, the knowledge about the design of research and development processes and the implementation of innovations for interested customers is directly offered as a consulting-service.

The Institute

Business Unit Environmental Technology

Business Unit Safety and Process Technology

Business Unit Energy Technology

Business Unit Knowledge and Technology Transfer

International Project Development

North Rhine-Westphalian Action Program for CEEC Countries

Learning on the Job – the TheoPrax® Model

Distance Learning Program Environmental Sciences (infernum)

Sound Imission Survey

Environment – Technology – Recreation

Names, Data, Events



Globalization and international competition represent the challenge of today's economic and cultural activities and affect the scientific community in market positioning and asserting in an international development. Establishing the department "International Project Development" at Fraunhofer UMSICHT in 1997 has been one measure to address this development.

The department focuses on internal and external services in the fields of scientific and economic co-operation responding to the requirements of the scheduled enlargement of the European Union and European research policy.

In projects involving multiple institutions such as the German-Polish research network INCREASE and the North-Rhine Westphalian Action Program efficient networking platforms are established that include political and scientific institutions as well as economic and scientific organizations. Internal and external clients benefit from these networks.

Activities focus predominantly on the central and Eastern European countries CEEC.

INCREASE

"Addressing current environmental problems and advancing the relations between Germany and Poland through co-operation in joint projects". This is the guideline of the German-Polish research network INCREASE (International Cooperation on Research in Environmental Protection, Process Safety and Energy Technology), established in Warsaw in 1997. Today, more than 30 scientific institutions of both countries are members of the INCREASE network.

The access of Poland to the European Union in 2004 will bring a new dimension to German-Polish cooperation. Under the leadership of the Chairmen of the Steering Committee, Prof. Dr.-Ing. Andrzej Górak (University of Dortmund) and Prof. doc. Dr. hab. inz. Jacek Laczny (Institute for Ecology of Industrial Areas, Katowice), the focus on integrating INCREASE projects into European programs will be further emphasized.

Fraunhofer UMSICHT as the German head office of INCREASE, collaborating with the Polish head office at the Institute for Ecology of Industrial Areas in Katowice, will actively contribute to this reorientation process. Bi- and multilateral collaboration in projects with Polish partners will be continued.



Doc. dr. hab. inz. Ludgarda Buzek, head of the Polish head office of INCREASE (holding flowers) is bid farewell by Prof. Dr. Stanisław Ledakowicz, University of Łódź; Elżbieta Sobótka, Polish Consul General; Prof. Dr. Rolf Kümmel, head of Fraunhofer UMSICHT; Dr.-Ing. Barbara Zeidler, head of the German head office of INCREASE, Fraunhofer UMSICHT; Prof. Dr.-Ing. Andrzej Górak, University of Dortmund

North Rhine-Westphalian Program for the Promotion of Foreign Trade in CEE Countries

The North Rhine-Westphalian (NRW) Program for the Promotion of Foreign Trade in CEE Countries is a bi-lateral initiative launched in January 2001 on behalf of the NRW State Ministry for Economy and Labor. The program has been set up to support European enterprises in the environmental, energy and transport sectors in initiating and implementing projects in the target countries Hungary, Czech Republic, Romania, and Poland. In addition to environmental, energy, transport, and financing matters, activities also comprise political support. Assistance is provided by a project group consisting of four partners, with Fraunhofer UMSICHT acting as consultant for environmental and energy technologies.

The program is politically anchored in the "Mutual Agreements on Economic Co-operation" issued by the state of NRW and the target countries or regions. Since the program started, several of these agreements have been signed. In compliance with the procedures set therein, early project information is researched and readily made available to the interested enterprises. Successful approaches developed within the project have been published in two Guidelines on "Opening up wind energy resources in CEEC" and "Opening up resources for energetic use of biomass in CEEC".



Further assistance and information on market potentials has been provided in workshops and publications. Among the topics addressed are:

- Renewable energies in CEEC: Current state, general framework, programs, perspectives
- Utilization of combustion residues (venue: Hungarian Ministry for Environment, Budapest) and emission trading – new opportunities for NRW enterprises in CEEC countries (venue: NRW Ministry for Transport, Energy and Spatial Development)

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TheoPrax® presents a practice and system-oriented education model targeted at the early linking of theory and practice in learning. The program dates back to 1998 when it was introduced by the Fraunhofer ICT (Institute for Chemical Technology) at Pfinztal. Since then it has been very successfully applied in the state of Baden-Württemberg. During a nation-wide extension, a TheoPrax® communication center was established at Fraunhofer UMSICHT, with the objective to introduce the TheoPrax® network in the greater Rhine-Ruhr region.

How does TheoPrax® work?

Fraunhofer UMSICHT acts as a regional communication platform in the networking between industrial enterprises and schools/universities. Working groups are formed among students to work on problems set by the industrial

partners. The workshops are co-ordinated and normally tutored by UMSICHT.

What are the Benefits of TheoPrax®?

TheoPrax® provides an early basic understanding of real world work and helps students develop key practical skills such as creativity, conflict management, communicative and team skills and other soft skills. When entering their professional career, students are better prepared and know what is really required in practice. TheoPrax® projects thus give employers an ideal opportunity to present their profile and to select and recruit qualified future staff.

Contact

Dipl.-Ing. Anja Gerstenmeier
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The image shows three young men in a workshop or laboratory environment. They are gathered around a desk, looking at a document held by one of them. In the background, a computer monitor is visible. The text 'TheoPrax®' is overlaid in the top left corner of the image.

TheoPrax®



infernum

In collaboration with the FernUniversität in Hagen (Open University), Fraunhofer UMSICHT has introduced the interdisciplinary distance learning program Environmental Sciences (infernum) in November 2000. This four-semester course aims at providing updated, practical and comprehensive environmental know-how to students both in their own and related disciplines and is equally designed for engineers and natural scientists as well as for economists and graduates from humanities and law. The students are trained in interdisciplinary skills, which are indispensable for solving complex environmental problems.

In October 2003 infernum has been granted the accreditation to confer the degree "Master of Science". Thus infernum is to date the only Master's degree distance learning program in the field of environmental studies available in Germany.

infernum has encountered wide-spread interest and acceptance both nationally and internationally, for instance from Austria, Switzerland, the U.S., China, and South Africa. Students enrolled display a variety of qualifications from different disciplines, ranging from

engineering, sciences, business studies and economy, medicine, theology to educational sciences.

Workshops that are regularly conducted at Oberhausen and other German cities offer the opportunity to meet fellow students and teaching staff, and to deepen the knowledge gained through printed study materials and information conveyed via the Internet and to practise the work in interdisciplinary teams.

Regularly, the Hochschulgesellschaft Oberhausen e. V. awards scholarships for the infernum course. The scholarship holders stand out by high scientific qualification and a special personal or professional commitment to matters of environmental protection and sustainable development.

The innovative training model infernum has become an important building block in the scientific life of the Rhine-Ruhr area, acting as a transregional pole of attraction for the site of Oberhausen.

Contact

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Sound Immission Survey for a Planned Leisure Park

An enterprise plans to build up a modern leisure park in an area which was previously intended to be an industrial area. The park will be open all the year. Apart from attractions with local character (like theme parks, markets) there will be opportunities to arrange events indoor or outdoor.

A hotel with conference and meeting rooms is planned close by the park. Large parking-lots for cars and buses belong to the park, too.

There is a residential area nearby the planned leisure park. Already in the previous urban planning for the industrial use of the area an extensive noise control concept was compiled, in order to co-ordinate the different types of use and prevent harmful environmental impacts by noise.

In the survey conducted by Fraunhofer UMSICHT the sound emission and the sound immission within the intended park area and in the neighborhood caused by operating the park including

traffic noise was determined. Especially the impact of the changed use compared to the former planning as an industrial area in reference to the sound immission situation was evaluated.

The expected sound immission in the neighborhood of the park was determined based on a noise propagation with statistically secured calculation methods. The noise propagation and noise mapping was calculated with special software for computer-aided sound immission prognosis.

In the result of the calculations possibilities to optimize the environmentally compatible adaptation of the leisure park to the present neighborhood were pointed out.

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Sound Immissionen Survey

Solutions for Major Recreational Projects

Besides “classical” singular leisure facilities, facilities containing a whole range of offers gain in importance increasingly. These can range from theme parks over gastronomy, and hotel businesses to sports, wellness, and even shopping. In order to operate such complex facilities failure-free, among other things, intelligent concepts for the management of waste, water, energy, noise and fire protection are needed.

Fraunhofer UMSICHT develops these concepts for several major projects, among others the International Entertainment Center Krefeld IEC, the Lighthouse Park Rostock, and the ICE-Tower Bahrain, and in this connection sets ecological benchmarks through preferably environment-friendly and at the same time cost-saving solutions.

The basis for these activities always is the assessment of local boundary conditions, which besides the ascertained demands of the respective project also includes legal and geographic factors – for the fulfillment of refrigeration needs in the case of Krefeld for example the waste heat of an adjacent steel work can be utilized by means of combined heat, power, and cold generation, whereas employing solar-power-heat-cold-coupling would provide a solution in Bahrain.



Environment Technology Recreation

The development of these concepts takes place in close collaboration of the single specialist departments.

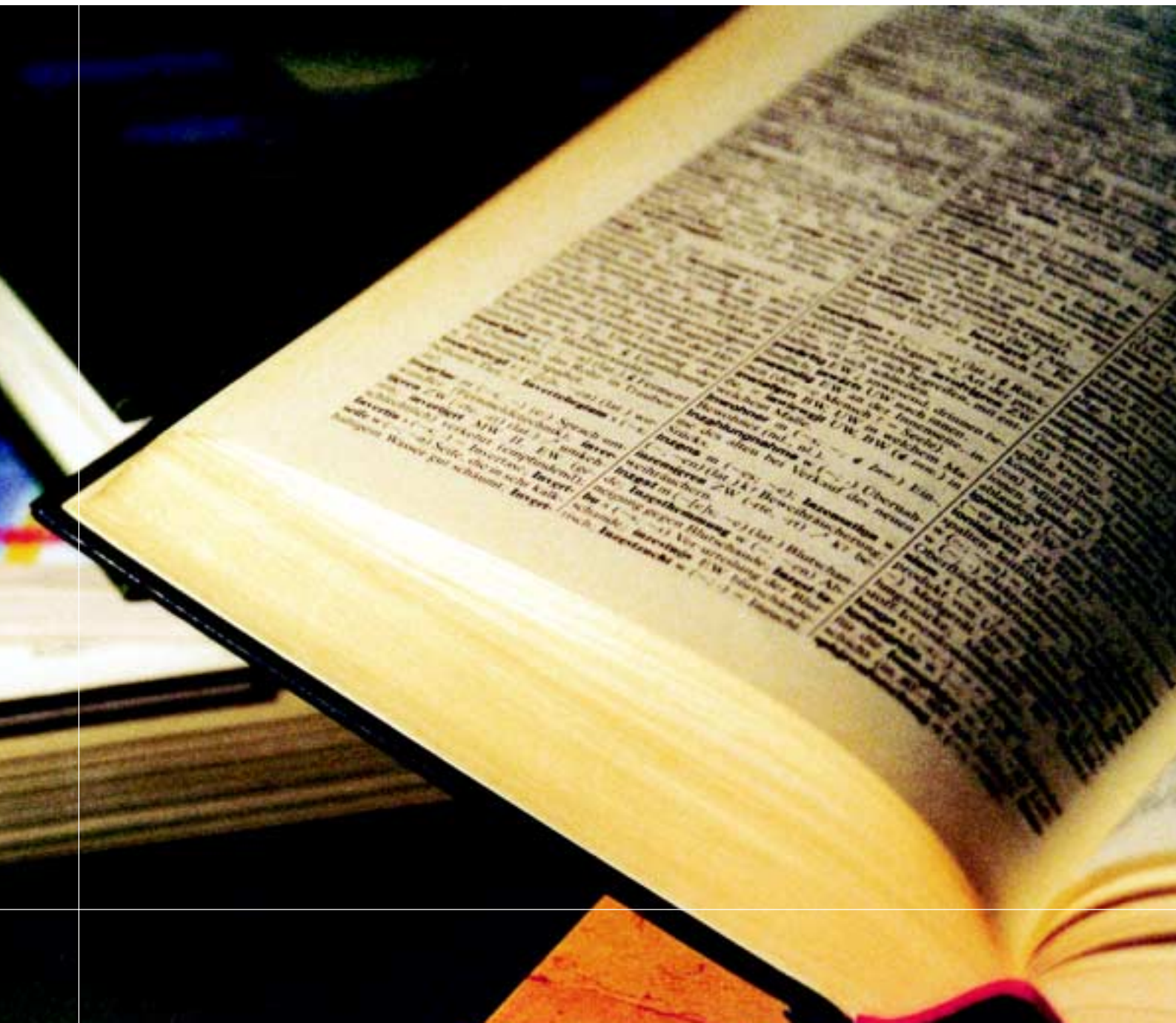
That way, Fraunhofer UMSICHT ensures that interfaces between specific partial concepts can be identified, and synergistic solutions can be developed at an early stage. Examples of such interfaces are the energetic utilization of biomass or the snow-snowmelt-cycle in the ICE-Tower.

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»A book is like a garden
carried in a pocket.«

[Arabian proverb]



The Institute

Business Unit Environmental Technology

Business Unit Safety and Process Technology

Business Unit Energy Technology

Business Unit Knowledge and Technology Transfer

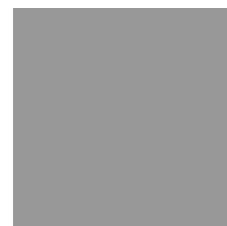
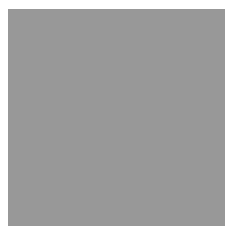
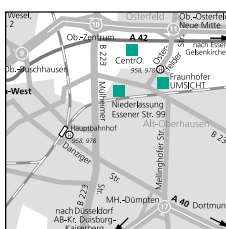
Names, Data, Events

Publications

Selected Clients and Contacts

Patents

Spin-offs



Publications

The following survey only includes lectures and publications which were written and/or delivered in English. For a complete bibliography, see the German version of our annual report.

Publications

Bergant, A.*; Dudlik, A.; Pothof, I.**;
Schoenfeld, S.-B.; Tijsseling, A.S.***;
Vardy, A.E.****;
Case studies of fluid transients in subcooled pipe flow
Eindhoven: University of Technology, 2003
(Reports on Applied and Numerical Analysis. RANA 03-10)
*E.I. d.o.o., Slovenia
**Delft Hydraulics
***TU Eindhoven
****University of Dundee

Bergstedt, U.; Deerberg, G.; Fahlenkamp, H.*:
A systematic approach for modeling and simulation of biological production processes in stirred tank reactors
In: Deutsche Gesellschaft für Chemisches Apparatewesen, Chemische Technik und Biotechnologie e. V. -DECHEMA-, Frankfurt/Main: 27th International Exhibition-Congress on Chemical Engineering, Environmental Protection and Biotechnology AICHEM 2003. Frankfurt, 19-24 May 2003; p. V25
*University of Dortmund

Deerberg, G.; Bergstedt, U.; Fänger, C.;
Wack, H.; Heinemann, M.*; Eberhard, W.*;
Büchs, S.*; Steinsiek, S.*; Schumacher-Ansorge, M.*:
Stereospecific production of hydrophobic compounds with immobilized biocatalysts in stirred tank reactors
In: Deutsche Gesellschaft für Chemisches Apparatewesen, Chemische Technik und Biotechnologie e. V. -DECHEMA-, Frankfurt/Main: 27th International Exhibition-Congress on Chemical Engineering, Environmental Protection and Biotechnology AICHEM 2003. Frankfurt, 19-24 May 2003; Frankfurt/Main, 2003, p. 58
*RWTH Aachen

Deerberg, G.; Grän-Heedfeld, J.; Wack, T.;
Schwichtenberg, H.*; Winter, G.*:
SimCARE – Software tool for development and implementation of lasting simulation models in process technology
In: Deutsche Gesellschaft für Chemisches Apparatewesen, Chemische Technik und Biotechnologie e. V. -DECHEMA-, Frankfurt/Main: 27th International Exhibition-Congress on Chemical Engineering, Environmental

Protection and Biotechnology AICHEM 2003. Frankfurt, 19-24 May 2003; Frankfurt/Main, 2003, p. 246
*Fraunhofer SCAI

Deerberg, G.; Schlüter, S.:
Dynamic simulations of two-phase semibatch processes for safety related analysis
In: Deutsche Gesellschaft für Chemisches Apparatewesen, Chemische Technik und Biotechnologie e. V. -DECHEMA-, Frankfurt/Main: 27th International Exhibition-Congress on Chemical Engineering, Environmental Protection and Biotechnology AICHEM 2003. Frankfurt, 19-24 May 2003; Frankfurt/Main, 2003, p. 58

Dudlik, A.; Schoenfeld, S.-B.; Hagemann, O.;
Fahlenkamp, H.*:
Water hammer and cavitation hammer in process plant pipe systems
In: Kerntechnik 68 (2003), no. 3, p. 91-96
*University of Dortmund

Dudlik, A.; Schlüter, S.; Hoyer, N.*;
Prasser, H.-M.**:
Pressure surges – experimental investigations and calculations with software codes
In: International Association of Hydraulic Engineering and Research -IAHR-, Work Group on the Behaviour of Hydraulic Machinery under Steady Oscillatory Conditions; International Round Table on the Behaviour of Hydraulic Machinery under Steady Oscillatory Conditions: 11th International Meeting of the Work Group on the Behaviour of Hydraulic Machinery under Steady Oscillatory Conditions, Stuttgart, 2003
*Studsvik Scanpower, Norway
**Forschungszentrum Rossendorf

Ehrenstein, U.; Kabasci, S.; Kreis, P.*;
Dörmö, N.**; Bélafi-Bakó, K.**:
Development of a process for the production of natural flavour compounds by enzymatic esterification with continuous water removal using pervaporation
In: VDI-Gesellschaft Verfahrenstechnik und Chemieingenieurwesen; IVT, Institut für Verfahrenstechnik der RWTH Aachen: 9. Aachener Membran-Kolloquium 2003; Aachen, 2003, article P4.5
*University of Dortmund
**University of Kaposvár, Hungary

Hessel, G.*; Kryk, H.*; Schmitt, W.*; Seiler, T.*;
Weiß, F.-P.*; Hilpert, R.**; Roth, M.**;
Deerberg, G.:
Monitoring system for multiphase hydrogenation in chemical plants
In: Preprints of the 5th IFAC Symposium on Fault Detection, Supervision and Safety for Technical Processes <2003, SAFEPROCESS>
*Forschungszentrum Rossendorf
**Degussa AG, Düsseldorf

Issa, M.; Robert, J.; Denecke, M.*; Kümmel, R.:
Water re-use in practice: Closing loops in food industry, wastewater reduction in composting plants and municipal wastewater re-use for irrigation purposes
In: Management of Environmental Quality 14 (2003), no. 5, p. 571-576
*University of Duisburg-Essen, Campus Essen

Jelen, E.; Weber, A.*; Unger, A.**;
Eisbein, M.***:
Detox cure for art treasure
In: Pesticide outlook 14 (2003), no. 1, p. 7-9
*GoshenBiotech, Korea
**Rathgen Forschungslabor, Berlin
***Landesamt für Denkmalpflege Sachsen, Dresden

Lewandowski, I.*; Heinz, A.:
Delayed Harvest of Miscanthus – Influences on Biomass Quantity and Quality and Environmental Impacts of Energy Production
In: European Journal of Agronomy 19 (2003), p. 45-63
*University of Utrecht, Netherlands

Spangardt, G.; Lucht, M.; Althaus, W.:
Optimization of physical and financial power purchase portfolios
In: Central European Journal of Operations Research 12 (2003), no. 4, p. 335-350

Strohm, H.*; Sgraja, M.; Bertling, J.;
Löbmann, P.*:
Preparation of TiO₂-polymer hybrid microcapsules
In: Journal of Materials Science 38 (2003), no. 8, p. 1605-1609
*University of Würzburg, Chair of Silicate Chemistry

Selected Clients and Contacts

Selected Clients and Contacts

A

A. + E. Lindenberg GmbH & Co. KG, Bergisch Gladbach
 ACCESS e.V., Aachen
 ACROSS FINANCE AND TRADE GmbH, Hamburg
 ADAC Test und Umwelt, Munich
 AGFW, Arbeitsgemeinschaft Fernwärme, Frankfurt
 AG Solar NRW, Jülich
 Andritz AG, Vienna, Austria
 AiF, Arbeitsgemeinschaft industrieller Forschungsvereinigungen »Otto von Guericke« e. V., Cologne
 AIR PRODUCTS GmbH, Hattingen
 Air Products PLC, Basingstoke, Hampshire, Great Britain
 AKNZ, Akademie für Krisenmanagement, Notfallplanung und Zivilschutz, Bad Neuenahr-Ahrweiler
 AKZO Nobel Central Research b.v., Arnhem, Netherlands
 AKZO Nobel Chemicals GmbH, Emmerich
 AKZO Nobel, Stockholm, Sweden
 ALSTOM Ballard GmbH, Bremen/Dortmund/Frankfurt
 Altenburger Maschinen Jäckering GmbH, Hamm
 Ansaldo Fuell Cells SpA (AFCo), Genova, Italy
 Arrotrass GmbH, Cologne
 ASEW, Cologne
 A-TEC Anlagentechnik GmbH, Duisburg
 ATT Automatisierungstechnik GmbH, Lutherstadt Wittenberg
 Autobar Group, Brentford, Great Britain
 AWAS-Ihne GmbH, Wilnsdorf
 Axima Refrigeration GmbH, Lindau, Bodensee

B

BAFA, Bundesamt für Wirtschaft und Ausfuhrkontrolle, Eschborn
 BASF AG, Ludwigshafen
 Bauordnungsamt Aachen
 Bau- und Liegenschaftsbetriebe, Aachen and Dortmund
 Baust Holzbetrieb GmbH, Eslohe-Bremke
 Bayer AG, Leverkusen
 Bayer 04 Leverkusen Fußball GmbH, Leverkusen
 Benteler AG, Paderborn
 Berufsfeuerwehr Düsseldorf
 Bezirksregierung Arnsberg, Abteilung Energie, Dortmund
 Biofam Company Ltd, Bangkok, Thailand
 BIOPOS Forschungsinstitut Bioaktive Polymersysteme e. V., Teltow
 biorefinery.de GmbH, Teltow
 BLB NRW, Bau- und Liegenschaftsbetrieb NRW Düsseldorf
 Boehringer Ingelheim Pharma KG, Ingelheim am Rhein
 BRZ Bodenreinigungszentrum Herne GmbH & Co. KG, Herne
 BTU, Brandenburgische Technische Universität, Cottbus

Bückmann GmbH Sieb- und Separationstechnik, Mönchengladbach
 Bundesamt für Sicherheit in der Informationstechnik, Bonn
 Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie, Bonn
 Bundesministerium für Wirtschaft und Technologie, Bonn/Berlin
 BWS Technologie GmbH, Grevenbroich

C

Cargill Dow BV, Naarden, Netherlands
 C.A.R.M.E.N. e. V., Straubing
 Celanese Chemicals Europe GmbH, Oberhausen
 CentrO Management GmbH, Oberhausen
 Ciba Spezialitätenchemie Lampertheim GmbH, Lampertheim
 Clariant GmbH, Hürth-Knapsack
 COESFELD MATERIALTEST, Coesfeld GmbH & Co. KG, Dortmund

D

DBU, Deutsche Bundesstiftung Umwelt, Osnabrück
 Degussa AG, Darmstadt/Frankfurt/Hanau-Wolfgang
 Degussa INFRACOR GmbH, Marl
 Delft University of Technology, Laboratory for Process Equipment, Delft, Netherlands
 DELU, Deutsche Leckageortungs- und Umwelttechnik AG, Düsseldorf
 De Lucia Italienische Feinkostspezialitäten GmbH, Heiden
 Deutsche Bank AG, Innovationsteam Umwelttechnologie, Munich
 Deutsche Projekt Union GmbH, Cologne
 Deutsche Structured Finance, Frankfurt a. M.
 Deutz Energy GmbH, Mannheim
 DFG, Deutsche Forschungsgemeinschaft, Bonn
 DKR, Deutsche Gesellschaft für Kunststoffrecycling mbH, Cologne
 DLR, Deutsche Forschungsanstalt für Luft- und Raumfahrt e. V., Cologne/Bonn
 DLR – Projektträger des BMBF für Informationstechnik, Berlin
 DMT, Deutsche Montan Technologie GmbH, Bochum
 Dole Fresh Fruit Europe OHG, Hamburg
 DPU, Deutsche Projekt Union GmbH, Cologne
 DREWAG Stadtwerke Dresden GmbH
 Durit Hartmetall, Wuppertal

E

Eastman Chemical Co., Kingsport, Tenn., USA
 ECOMARES GmbH, Büsum
 eCF, Electricité de France, Paris, France
 EFA, Effizienz-Agentur NRW, Duisburg
 EGG, Energieversorgung Gera GmbH
 Empresarios Agrupados, Madrid, Spain
 Entwicklungsgesellschaft Neu-Oberhausen mbH – ENO, Oberhausen
 Energieagentur NRW, Wuppertal
 essent Milieu, Buggenum, Netherlands
 ENR Energiegesellschaft nachwachsender Rohstoffe mbH, Dorsten

E.ON Engineering GmbH, Gelsenkirchen
 Europäische Kommission – Generaldirektion Enterprises, Brussels, Belgium
 EUS GmbH, Dortmund
 EVO, Energieversorgung Oberhausen AG

F

Fachhochschule Münster, Münster/Steinfurt
 Fachhochschule Niederrhein, Krefeld
 farmatic biotech energy AG, Nortorf
 FernUniversität in Hagen
 FEE GmbH, Idar-Oberstein
 Fernwärme Wien Ges.m.b.H., Vienna, Austria
 FITR, Forschungsinstitut für Tief- und Rohrleitungsbau Weimar e. V.
 FKUR - Forschung und Engineering GmbH, Willich
 FN, Fernwärmeversorgung Niederrhein GmbH, Dinslaken
 FNR, Fachagentur Nachwachsende Rohstoffe e. V., Gülzow
 Forschungszentrum Jülich GmbH, Jülich
 Forsthandel und Dienstleistung Lucht, Vorderhagen
 Framatome ANP, Offenbach
 Fritz Winter GmbH, Stadthallendorf
 Frösche Stahl- und Maschinenbau GmbH, Neusaess/Vogelsang
 FW-Fernwärme-Technik GmbH, Celle
 FZR-Forschungszentrum Rossendorf, Dresden

G

Gas-Wärme-Institut, Essen
 gct german carbon teterow GmbH, Teterow
 GEA AG, Bochum
 GEA Jetpumps GmbH, Ettlingen
 GE Bayer Silicones GmbH & Co. KG, Leverkusen
 GEFAS, Gesellschaft für Anlagenbau und Service mbH, Oberhausen
 GEF, Gesellschaft für Energietechnik und Fernwärme mbH, Leimen
 Gemeinde Greußenheim (Bavaria)
 GIGATON GmbH, Viernheim
 Goshen Critch Corp., Seoul, Korea

H

H. Anger's Söhne GmbH, Hessisch Lichtenau
 Hansa Consult mbH, Glinde
 HdT Haus der Technik e. V., Essen
 Heller Leder GmbH & Co. KG, Hehlen
 Henkel KGaA, Düsseldorf
 Herbold GmbH Meckesheim, Meckesheim
 HEW, Hamburgische Electricitätswerke AG, Hamburg
 Hosokawa Micron GmbH, Cologne
 H & R, Bannewitz
 Hubert Loick, VNR GmbH, Dorsten
 Humana AG, Herborn
 Hüttenwerke Krupp Mannesmann GmbH, Duisburg
 H.U.T. Heuwieser Umwelttechnik GmbH, Linsengericht
 Hydac Technologie GmbH, Sulzbach/Saar

Selected Clients and Contacts

I
 IBEK Verpackungshandels GmbH, Markt Erlbach
 IEA, Internationale Energieagentur, Paris, France
 IKA-Werke GmbH & CO. KG, Staufen
 Illertaler Biomasseheizkraftwerke Bau GmbH, Immenstadt/Oberallgäu
 imat-uve GmbH, Mönchengladbach
 INEOS Phenol GmbH & Co. KG, Gladbeck
 INFRASERV Dienstleistungen Gera GmbH, Gera
 Ingenieurbüro Prof. Brachetti, Springe
 Institut für Marktscheidewesen, RWTH Aachen
 Institute for Environmental Science and Engineering, Singapore
 Institute for Refactory Materials Gliwice, Poland
 Interdisziplinäre Dortmunder Energie-forschung, DIE e.V., Dortmund
 Intracar GmbH, Marl
 invenio Kunststoff Engineering GmbH, Erwitte
 IÖWg GmbH, Institut für gemeinnützige Wirtschaftsforschung, Berlin
 Isobrigg Stahlmantelroht GmbH, Lehrte
 IUTA, Institut für Energie- und Umwelttechnik e. V., Duisburg
 IZES e. V., Saarbrücken

J
 Jenbacher AG, Jenbach
 Jenbacher Energiesysteme GmbH, Mannheim
 Johnson Controls GmbH, Burscheid/Grefrath
 Jülich Fine Chemicals, Jülich

K
 Kautex Textron GmbH + Co. KG, Bonn
 Kerm GmbH, Herne
 KFKI Atomic Energy Research Institute, Budapest, Hungary
 KITECH, Korea Institute of Industrial Technology, Chonan, South Korea
 Knippers Metall-Chemie o.H., Mülheim a. d. R.
 Koch AG, Wallisellen, Switzerland
 Kompetenz-Netzwerk Brennstoffzelle NRW, Düsseldorf
 Krupp Uhde GmbH, Dortmund

L
 Landesamt für Denkmalpflege Sachsen, Dresden
 Landesinstitut für Bauwesen des Landes NRW (LB), Aachen
 Landgericht Heilbronn
 Laserzentrum Münster, Münster
 LEM, Ingenieurbüro Last- und Energiemanagement, Leipzig
 Loick Holding AG, Dorsten
 LUA, Landesumweltamt Nordrhein-Westfalen, Essen
 LÜNTEC, Technologiezentrum Lünen GmbH

M
 Malvern GmbH, Herrenberg
 MAN Turbo, Oberhausen
 Mann + Hummel GmbH, Speyer
 MAT-TEC Engineering GmbH, Willich
 Materialprüfungsamt NRW, Erwitte

Medizinische Einrichtungen der Heinrich-Heine-Universität, Düsseldorf
 Merck KGaA, Darmstadt
 Messer Griesheim GmbH, Krefeld
 Metall-Technik GmbH, Düsseldorf
 Ministerium für Schule, Wissenschaft und Forschung des Landes NRW (MSWF), Düsseldorf
 Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes NRW (MUNLV), Düsseldorf
 Ministerium für Verkehr, Energie und Landesplanung des Landes NRW (MVLE), Düsseldorf
 Ministerium für Wirtschaft und Arbeit des Landes NRW (MWA), Düsseldorf
 Mogensen GmbH & Co KG, Wedel
 MTS Machinery Tools & Services AG, Oetwil am See, Switzerland
 MVV InnoTec Systemanalyse GmbH, Berlin

N
 Naue Fasertechnik GmbH & Co. KG, Lübbecke
 NEUENHAUSER Maschinenbau GmbH & Co. KG, Neuenhaus
 Niederrheinische IHK, Duisburg
 Nivelsteiner Sandwerke GmbH, Herzogenrath
 Noll GmbH, Cologne
 Norddeutsche Affinerie AG, Hamburg
 Norwegian University of Science and Technology Trondheim, Norway
 NOVEM, Nederlandse maatschappij voor energie en milieu bv, Sittard, Netherlands
 n.s.w.energy gmbh, Herzogenrath
 NUON Vertrieb GmbH, Düsseldorf
 NUTECH Solutions GmbH, Dortmund

P
 Pacovis AG, Stetten, Switzerland
 Parsum GmbH, Chemnitz
 Pro2 Anlagentechnik GmbH, Willich/Dresden
 Projektträger PT3 des BMBF und des BMWa, Jülich
 Polyplast Müller GmbH, Straelen
 Provico GmbH & Co. KG, Nordhorn
 Pulsar GmbH, Stuttgart

R
 Ralf Hacker Edelstahl, Hüllhorst
 Rathgen-Forschungslabor, Berlin
 RBG Strüder GmbH, Iserlohn
 Research Institute of Chemical and Process Engineering, Veszprem, Hungary
 Rethmann Rohstoff GmbH, Nordwalde
 Retsch GmbH & Co. KG, Haan
 RETTENMAIER UND SÖHNE GmbH & Co., Holzmühle b. Ellwangen
 Rhein-Plast GmbH, Bad Dürkheim
 RosenbergRheinhalle GmbH, Wülfrath
 Ruhrgas AG, Essen
 Ruhr-Universität Bochum, Institut für Thermo- und Fluidodynamik und Botanisches Institut, Bochum
 RWTH Aachen, Institut für Aufbereitung und Recycling fester Abfallstoffe, Aachen
 RWTH Aachen, Lehrstuhl für Biotechnologie und Bioverfahrenstechnik, Aachen
 RWTÜV Systems GmbH, Essen

S
 Saarberg Fernwärme GmbH, Saarbrücken
 Schering AG, Bergkamen
 Siemens AG ISS, Karlsruhe
 SILOXA AG, Essen
 Solarc GmbH, Berlin
 Solvay Intra GmbH, Rheinberg
 Staatliche Museen zu Berlin, Rathgen-Forschungslabor, Berlin
 Stadt Bergheim
 Stadtentwässerungsbetriebe Cologne, (AöR)
 Stadtwerke Bielefeld GmbH
 Stadtwerke Bochum GmbH
 Stadtwerke Dinslaken GmbH
 Stadtwerke Duisburg AG
 Stadt Düsseldorf, Stadtentwässerungsbetrieb,
 Chemisch-biologische Laboratorien
 Stadtwerke Düsseldorf, GmbH
 Stadtwerke Frankfurt/Main AG
 Stadtwerke Hannover AG
 Stadtwerke Herne AG
 Stadtwerke Unna GmbH
 Stadtwerke Schwerin GmbH
 STAWAG Stadtwerke Aachen GmbH
 STEAG, Essen
 Studsvik Scandpower AS, Kjeller, Norway
 SYSTEC, Der Grüne Punkt - Gesellschaft für SYSTem TEchnologie mbH, Cologne

T
 TECHNIP Deutschland GMBH, Düsseldorf
 Technische Akademie Esslingen
 Technische Fachhochschule Bochum
 Technische Universität Wien, Institut für Verfahrens-, Brennstoff- und Umwelttechnik
 Technoplast Engineering AG, Diepoldsau, Switzerland
 Technopool Schwimmbadtechnologie GmbH, Bissendorf
 TFI, Deutsches Teppich-Forschungsinstitut e. V., Aachen
 TODA KOGYO Europe GmbH, Düsseldorf
 Tönsmeier Dienstleistung GmbH & Co. KG, Porta Westfalica
 Tractebel, Brussels, Belgium
 Triavel Energie trading GmbH, Aachen
 TU Bergakademie Freiberg, Institut für Energieverfahrenstechnik und Chemieingenieurwesen

U
 Uhde Hochdrucktechnik GmbH, Hagen
 Umweltbundesamt, Berlin
 Unikliniken in Bonn, Düsseldorf, Cologne, Dortmund
 Universidad de Concepción, Chile
 Universität Berlin, Lehrstuhl für Mathematik
 Universität des Saarlandes, Fachbereich Pharmazeutische und Medizinische Chemie
 Universität Dortmund, Lehrstuhl für Energieprozesstechnik, Thermische Verfahrenstechnik und Umwelttechnik
 Universität Duisburg Essen, Standort Duisburg
 Institut für instrumentelle Analytik
 Universität Duisburg Essen, Standort Essen,
 Lehrstuhl für Umweltverfahrenstechnik und Anlagentechnik

Selected Clients and Contacts

Universität Duisburg Essen, Standort Essen,
Lehrstuhl für Abfallwirtschaft und Abfall-
technik
Universität Duisburg Essen, Standort Essen,
Lehrstuhl für Technische Chemie
Universität Köln, Institut für Physikalische
Chemie
Universität Rostock, Abteilung für Analytische,
Technische und Umweltchemie
Universität Siegen, Institut für Fluid- und
Thermodynamik
University of Pittsburgh, School of
Engineering, Pittsburgh, Pennsylvania, USA
Urenco Deutschland GmbH, Gronau

V

VdS Schadenverhütung, Cologne
VKU, Cologne
Volkswagen AG, Wolfsburg

W

WAM Technik GmbH, Hilden
WEDECO Umwelttechnologie GmbH, Herford
WEIMA Maschinenbau GmbH, Ilsfeld
Westfalia Foodtec GmbH, Oelde
Wirtschaftsministerium Mecklenburg-
Vorpommern, Schwerin
WS Wärmeprozessstechnik GmbH, Renningen
Wuppertaler Stadtwerke AG
Wupperverband, Wuppertal

Z

ZERMA Zerkleinerungsmaschinenbau GmbH,
Sinsheim-Dühren

Patents Spin-offs

Patents 2003

Issued Patents:

Method for the air-conditioning of vehicles and adsorption chiller machine for the implementation thereof (Wigbels, Hölder, Dietz, Giebelhausen*, Spieker*)

Powder-like material for producing high-temperature super conducting coatings and/or bodies (Bertling, Kummel)

Method and device for the purification of biogas (Schwerdt, Doczyck*)

Method for the cleaning of a solid matter system and device for the implementation thereof (Balke, Heunemann, Ising, Unger)

Demonstration device modelling a living organism (Weinspach) – Russia, USA, Australia

* = external inventors

Trademarks:

DUBANET® (word trademark)

MARS® (word trademark)

Kid's Light® (symbol and word trademark)

Glass Giant® (international word trademark)

KAVITAS® (word trademark)

Human Park® (US-word trademark)

Human World® (US-word trademark)

Spin-offs

AIROX GmbH, Alpen
Systems for oxygenation

Andreas Schröder IT-Consulting GmbH, Schermbeck
Counseling and service in the area of information and telecommunication technologies

A-TEC Anlagentechnik GmbH, Duisburg
Innovative solutions concerning coal mine gas; hazard prevention: analyses, extraction, safety concepts; utilization for power and heat generation: energy concepts, design and operation of plants

DataPool Engineering GmbH, Oberhausen
Software development, system analyses, EDP-consulting

Emissions-Trader ET GmbH, Alpen
Emissions trading

ENR – Energiegesellschaft nachwachsender Rohstoffe mbH, Dorsten
Planning and set-up of biogas plants, including consulting, concession, and funding; agricultural nutrient balances and area management; commissioning and management

FKuR Forschung und Engineering GmbH, Willich
Innovative solutions concerning plastics and recycling; comminution technology; extrusion, injection molding; elastomer recycling; material analyses; test technology; recycling concepts

gct german carbon teterow GmbH, Teterow
Development and production of high-performance cylindrical activated carbon; production of special activated carbons; development of adsorption processes

IDESYS Ingenieurgesellschaft für dezentrale Energiesysteme mbH, Oberhausen
Planning, development, production, installation of local energy systems and plants

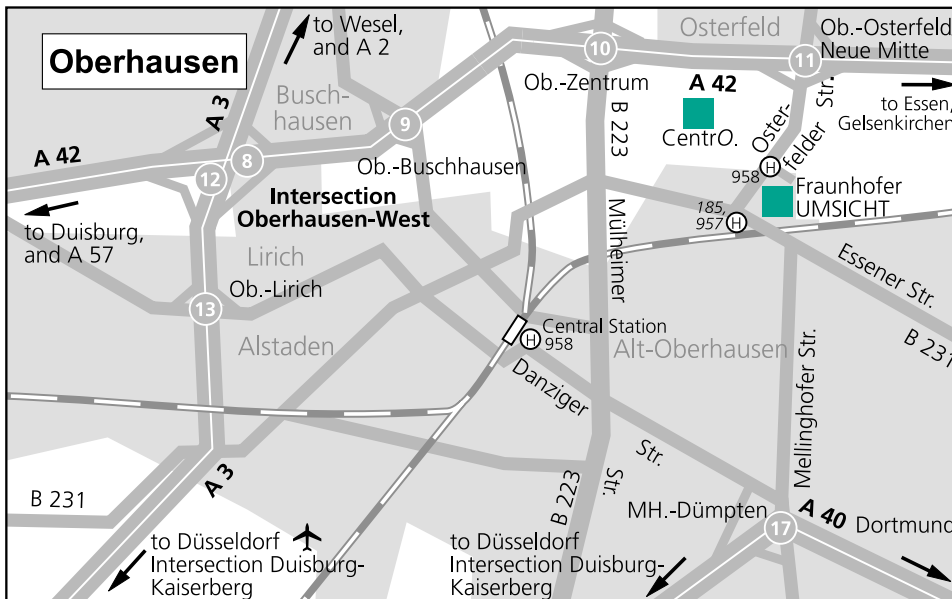
inecs GmbH, Dortmund
Innovative energy technology, consulting & systems, fuel cell systems

invenio KUNSTSTOFF ENGINEERING, Erwitte
Product development and optimization of plastics components with numerical analyses; FEM structure analyses, injection molding analyses; construction

VENTAX Big-Bag Network GmbH & Co. KG, Willich
Big-Bag cleaning facilities, reusable Big-Bag, packaging systems

WAGRO Systemdichtungen GmbH, Dortmund
Expansible polymere seals; sewer and building refurbishment; consultation, planning, and implementation; development and production of sealing systems (area of application: engineering and pipeline construction)

How to Find Us



By car

Freeway A 42: Exit Oberhausen-Osterfeld/Neue Mitte. At the end of the exit turn onto Osterfelder Strasse towards "Neue Mitte" or Oberhausen-Zentrum/ Essen respectively. Follow the road for approximately 1,5 km (behind the sign "Fraunhofer UMSICHT") turn left into the parking lot of the institute.

Freeway A40: Exit Mülheim-Dümpten; coming from Dortmund turn right at the end of the exit. At the next intersection turn left onto Mellinghofer Strasse and at its end turn left onto Essener Strasse. At the next major intersection turn right onto Osterfelder Straße. At the first traffic light turn right into the parking lot.

By train

From Oberhausen central station to UMSICHT with bus no. 185 (direction Essen Borbeck Bf.), no. 957 (direction Kiebitzstrasse), no. 958 (direction Spechtstrasse) to bus stop "UMSICHT".

By plane and train/car

From Düsseldorf Airport terminal A/B/C take the Skytrain to Düsseldorf Airport Station, then change to the Regional Express to Hamm or Wesel respectively. Leave the train at Oberhausen central station; to continue see: By train or if you are traveling by car take Freeway A 44 from the airport till you reach intersection "Düsseldorf-Nord". Take freeway A 52 (direction Essen/Oberhausen). At intersection "Breitscheid" change onto freeway A 3 and keep going until you get to intersection "Oberhausen West"; From there turn onto freeway A 42 (direction "Dortmund") and take the exit "Oberhausen-Osterfeld/Neue Mitte"; to continue see: by car.

Address

Fraunhofer UMSICHT

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The Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft

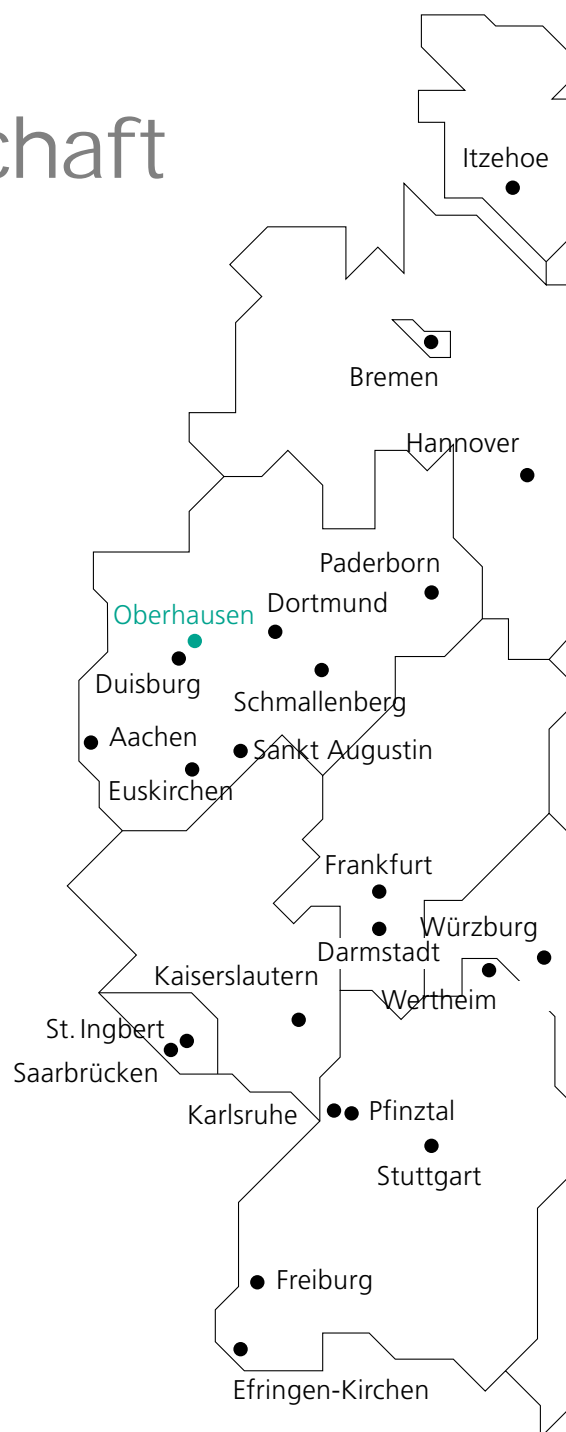
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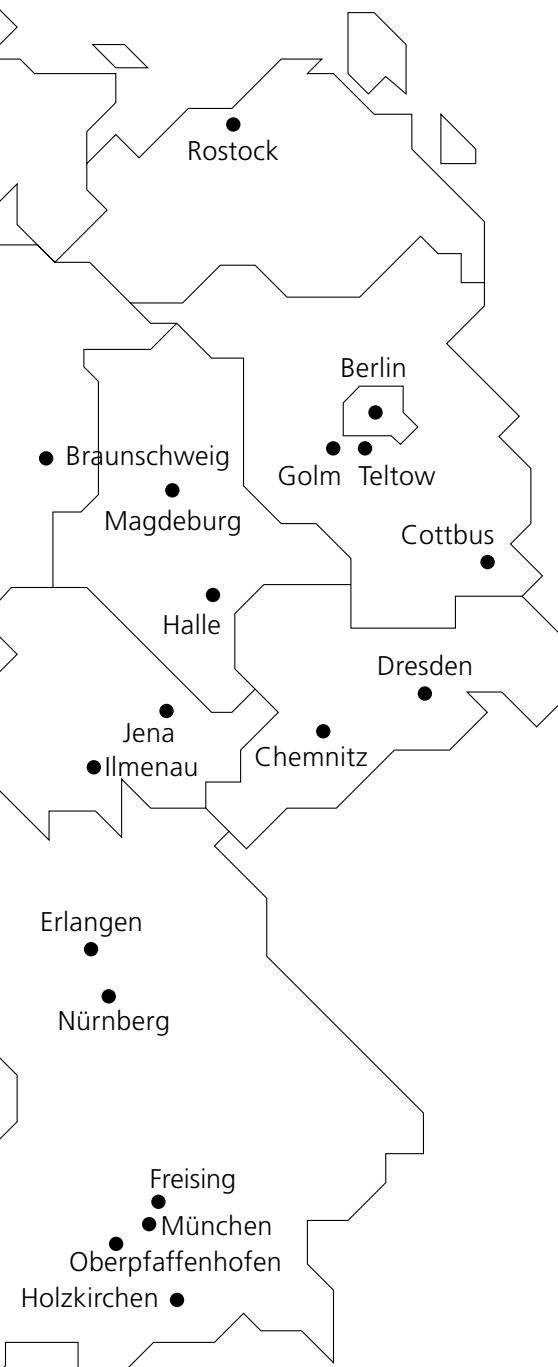
to promote the successful economic development of our industrial society, with particular regard for social welfare and environmental compatibility.

As an employer, the Fraunhofer-Gesellschaft offers a platform that enables its staff to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, in other scientific domains, in industry and in society.

At present, the Fraunhofer-Gesellschaft maintains roughly 80 research units, including 58 Fraunhofer Institutes, at over 40 different locations in Germany. A staff of some 12,500, predominantly qualified scientists and engineers,



The Fraunhofer-Gesellschaft



work with an annual research budget of over 1 billion €. Of this sum, more than € 900 million is generated through contract research. Roughly two thirds of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. The remaining one third is contributed by the German federal and *Länder* governments, as a means of enabling the institutes to pursue more fundamental research in areas that are likely to become relevant to industry and society in five or ten years' time.

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The organization takes its name from Joseph von Fraunhofer (1787-1826), the illustrious Munich researcher, inventor and entrepreneur.

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The second meeting of the Board of Trustees took place on 28 November 2003 at Fraunhofer UMSICHT in Oberhausen.

Imprint

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Prof. Dr. rer. nat. Rolf Kümmel

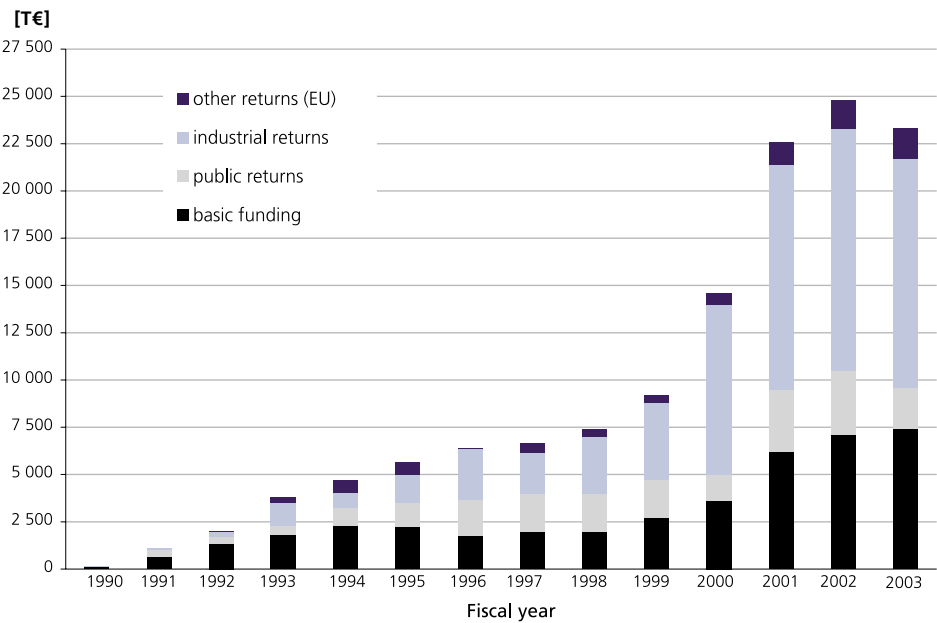


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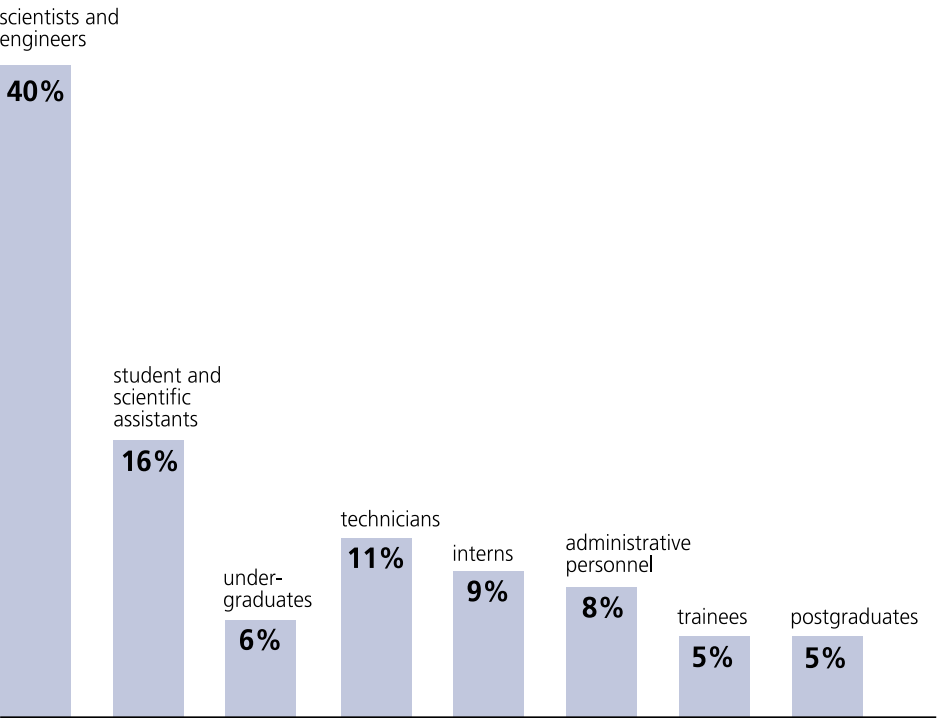


Director Business and Administration:
Dr.-Ing. Bernhard Dietz

At a Glance: Facts and Figures



Development of the operational budget since the establishment of the institute



Structure of staff at Fraunhofer UMSICHT

At a Glance: Facts and Figures

Staff

Staff at Fraunhofer UMSICHT 2003

Number

Permanent Staff	161
- Scientists and engineers	108
- Technical infrastructure	31
- Central services	22
Other Staff	112
- Postgraduates	13
- Undergraduates	16
- Student assistants	46
- Interns, guest scientists	24
- Trainees	13
Total Staff	273

Expenditure and Returns

Expenditure 2003

(m €)

Operational Budget	23.3
- Staff costs	9.3
- Other costs	14.0

Investments	1.2
-------------	-----

Returns Operational Budget 2003

(m €)

- Industrial returns	12.1
small and medium-sized enterprises	10.1
large enterprises	2.0
- Public returns	2.2
- Others (EU, communities)	1.6
- Basic funding	7.4
Total Returns	23.3

At a Glance: Our Business Units

The Business Unit
Environmental Technology
comprises the areas of expertise

New Processes

Particle Technology

Adsorption/Gas Cleaning

Waste Technology and Management

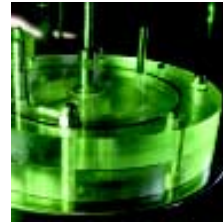
Plastics Technology

Bioengineering

Water Treatment/Membrane Technology

Special Polymers

Chemistry, Biology, Analytics



The Business Unit
Safety and Process Technology
comprises the areas of expertise

Safety Analysis and Design

Dynamic Processes

Software Development

Fire Safety and Explosion Protection

Technical Information Management

Pipeline Technology



The Business Unit
Energy Technology
comprises the areas of expertise

Use of Lean Gas

District Heating/Combined Heat and Power

Cold Supply

Energy Management

Energy from Biomass

Fuel Cell Systems

Plant Systems Engineering



The Business Unit
Knowledge and Technology Transfer
comprises the areas of expertise

International Project Development

Training Center

Project Funding/Spin-offs

