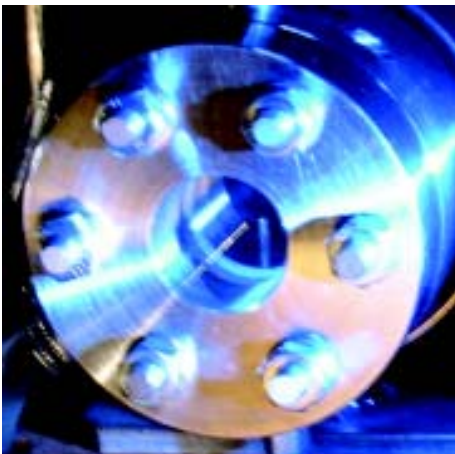




Fraunhofer Institut
Umwelt-, Sicherheits-,
Energietechnik UMSICHT

Annual Report 2002



At a Glance: Our Departments

The Department of
Environmental Technology
comprises the areas of expertise

New Processes

Particle Technology

Adsorption/Gas Cleaning

Waste Technology and Management

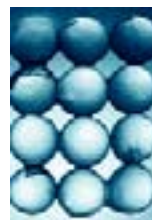
Plastics Technology

Bioengineering

Water Treatment/Membrane Technology

Special Polymers

Chemistry, Biology, Analytics



The Department of
Safety and Process Technology
comprises the areas of expertise

Safety Analysis and Design

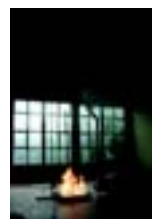
Dynamic Processes

Software Development

Fire Safety and Explosion Protection

Technical Information Management

Pipeline Technology



The Department of
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 Department of
Knowledge and Technology Transfer
comprises the areas of expertise

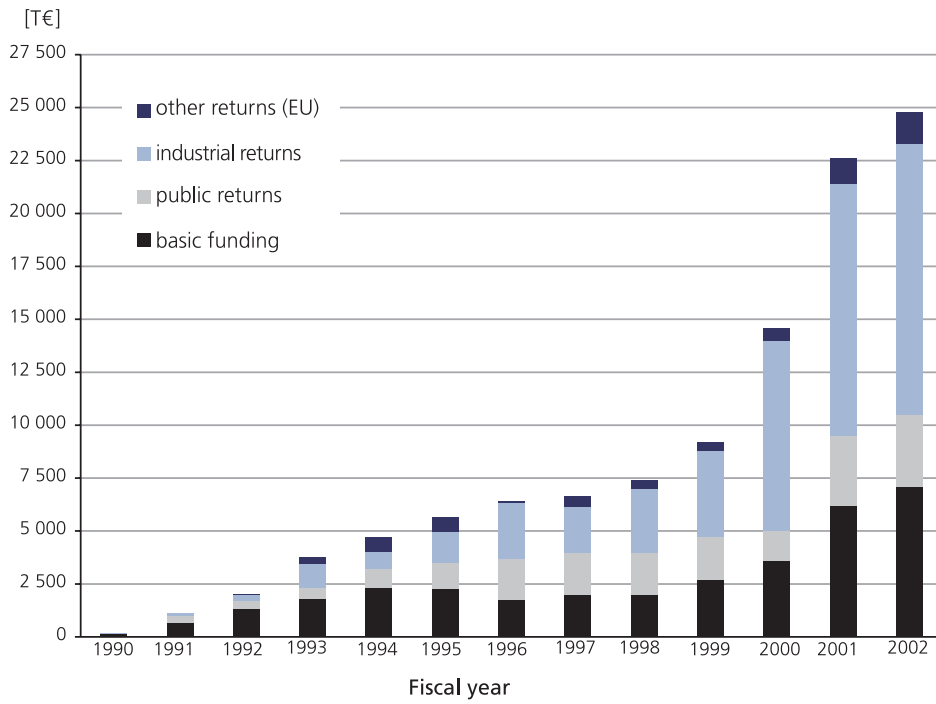
International Project Development

Training Center

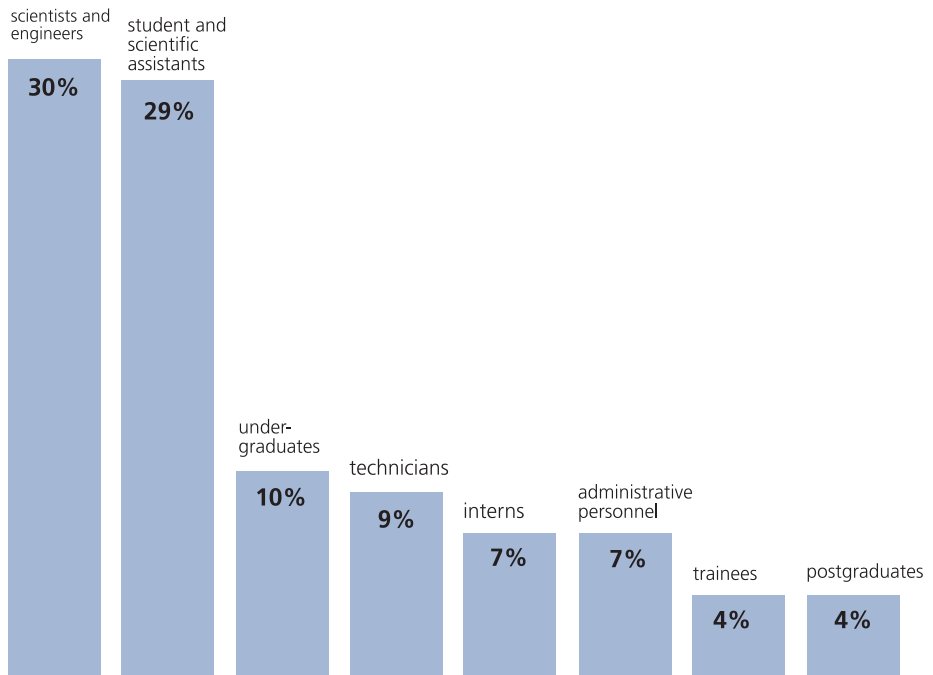
Project Funding/Spin-offs



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 2002 Number

Permanent Staff	145
- Scientists and engineers	95
- Technical infrastructure	29
- Central services	21
Other Staff	174
- Postgraduates	12
- Undergraduates	32
- Student assistants	93
- Interns, guest scientists	24
- Trainees	13
Total Staff	319

Expenditure and Returns

Expenditure 2002 (Mio. €)

Operational Budget	24.8
- Staff costs	9.5
- Other costs	15.3

Investments **2.8**

Returns Operational Budget 2002 (Mio. €)

- Industrial Returns	12.8
small and medium-sized enterprises	10.6
large enterprises	2.2
- Public Returns	3.4
- Others (EU, communities)	1.5
- Basic funding	7.1
Total Returns	24.8



The good news first: In 2002, Fraunhofer UMSICHT could confirm the previous year's remarkable increase of returns. A sprint to the finish line – in which all business segments participated to varying extents – could compensate for the severe problems of the first six months. Once again, it were the innovative technical concepts, realized in pilot and demonstration plants – the institute's core competencies and hallmarks – that made for economic turn-around and new motivation.

UMSICHT's expertise can be highlighted by three examples: The modular fuel cell power plant (PEM-Oberhausen) was inaugurated on the institute's premises after a construction time of about a year. The test plant MARS® provides an innovative concept of thermal waste treatment: With a thermal capacity of 1 MW, it solves waste problems, and promises economic profits. In the direct proximity of one of our spin-offs, the German carbon teterow GmbH, which begins the production of pelletized activated carbon these days, emerged a "jewel case" of a rotary kiln pilot plant station, in which UMSICHT employees will develop modified activated carbon.

Today, Fraunhofer UMSICHT is an acknowledged partner of medium-sized companies, research establishments, and foreign clients. We complete projects for customers in the U.S., Korea, Japan, Singapore, Chile, and in countries of middle and Eastern Europe. At exhibitions and fairs, among others the E-world of energy, Hanover Fair, and IFAT, the institute's achievements were presented. UMSICHT initialized the regional initiative "Fraunhofer in NRW" which united, for the second time, representatives of several NRW ministries and the state chancellery with the twelve North Rhine-Westphalia-based Fraunhofer institutes in the discussion of

current research and development topics such as micro production technology, smart living, or sustainable development.

In 2002, the institute's employees have developed a lot of commitment and creativity in an unfrugal economic environment in order to acquire partners, generate project ideas, and to complete projects. I have to express my very special gratitude to them, our numerous partners, and supporters. We will make every effort to strategically rearrange the institute's research and development concepts in consideration of the UMSICHT-employees' competencies, successful areas of operation and modern international trends. Well-founded support is granted to us by the institute's board of trustees which was constituted in December 2002 with 17 personalities from politics, business, and science.

We are bound and determined to grow with our tasks. Our future challenge is called innovation, and it is linked with the sciences by a simple sentence George Bernard Shaw once wrote: "Science is always wrong. It never solves a problem without creating ten more."

With all good wishes

Yours



Rolf Kümmel
Director Fraunhofer UMSICHT



In April, Ministerial Counsellor Gabriele Pirstadt (picture below) and State Secretary Jörg Bickenbach (picture on the left, 2nd from right) inaugurated the modular test plant for residue-optimized material treatment "MARS®" in Essen. 200 guests took a close look at the innovative plant concept.



In May, Fraunhofer UMSICHT exhibited at the International Fair for Environment and Disposal, IFAT, in Munich

Highlights 2002

Keen eyes and creative crayons: In June 2002, the winners of the drawing contest written out on the occasion of naming the institute's bus stops "UMSICHT" came to pick up their prizes.



In August, Ernst Schwanhold, Minister for Economic Affairs of the Federal State of North Rhine-Westphalia, and 200 guests got a taste of the energy production of tomorrow during the inauguration of the "PEM-Oberhausen" fuel cell plant



Highlights 2002



"Hands on": In the context of the 10th "Oberhausener UMSICHT-Tage" interested citizens could visit the institute's laboratories and pilot plants in September



In October, the North Rhine-Westphalian Fraunhofer Institutes invited the Ministries MWMEV, MASQT, MSWF, MUNLV, MSWKS as well as the State chancellery to the second "Fall Meeting" of the regional initiative "Fraunhofer in NRW" at Birlinghoven Castle, Sankt Augustin

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.



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

Fraunhofer UMSICHT

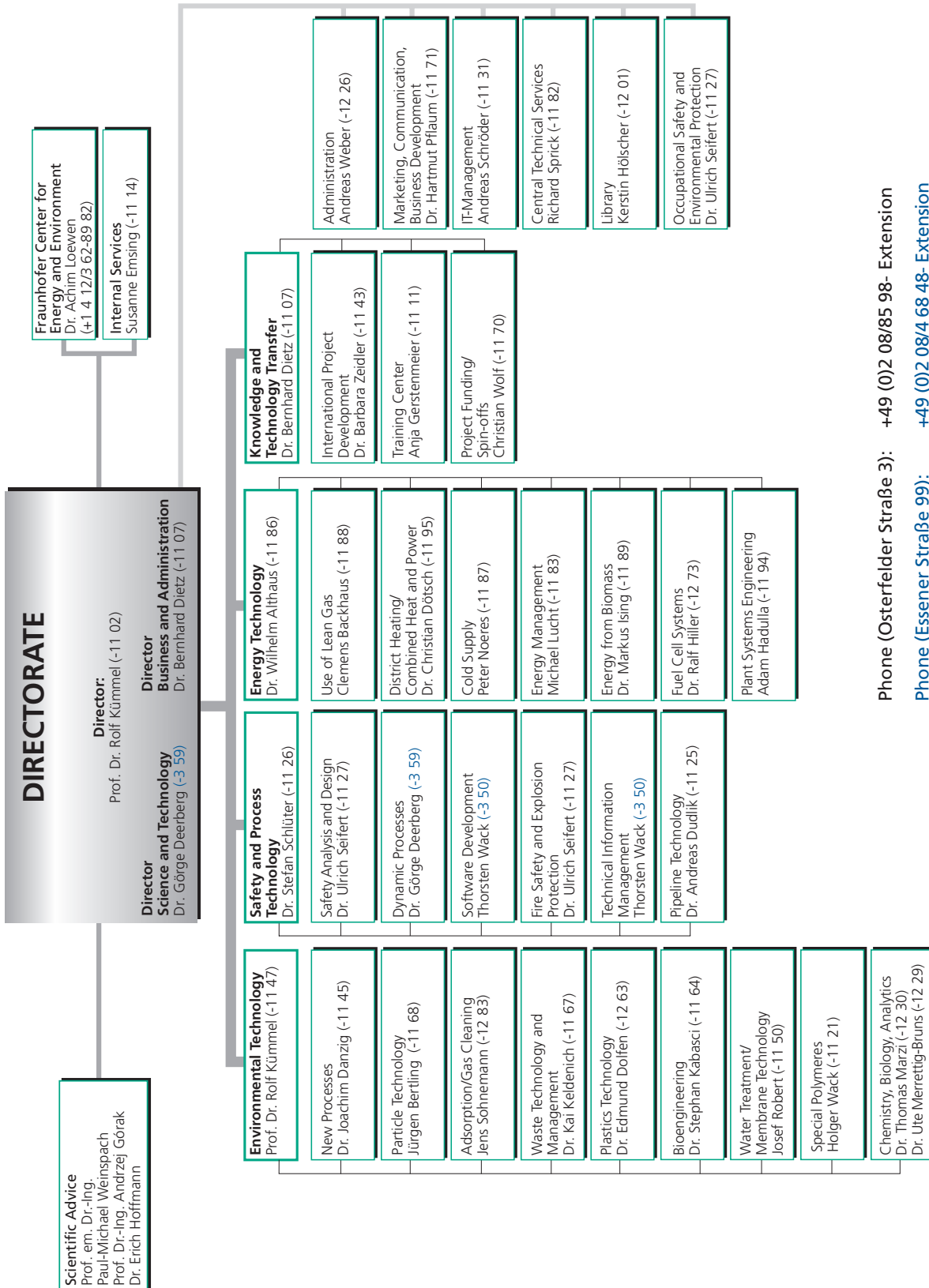
Which makes apparent: Technological progress is the engine for every modern industrial society. Technological innovations help making efficient and safe use of resources and resources and energy carriers. They allow a satisfactory and inexpensive production of innovative goods, create, and secure competitive 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 segments 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 300 employees produced a turnover of more than 24 Mio € in 2002, about 75 % of which stem from mission-oriented research, and more than 50 % from the industry. 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.

Organizational Chart



Phone (Osterfelder Straße 3): +49 (0)2 08/85 98- Extension
 Phone (Essener Straße 99): +49 (0)2 08/4 68 48- Extension

Competencies

Six areas of expertise are the basis of the process-technological operation in the business segments. They find application in the project and theme-oriented areas of expertise.

Main Areas of Expertise

- 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

Departments

Department of Environmental Technology



Head: Prof. Dr. rer. nat. Rolf Kümmel
Phone: +49 (0) 2 08/85 98 -11 47
rolf.kuemmel@umsicht.fhg.de

New Processes



Analysis of conventional production processes; development of low-emission syntheses; crystallization by means of supercritical fluids; micro-reaction technology
Contact: Dr. rer. nat. Joachim Danzig
Phone: +49 (0) 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 (0) 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: Dipl.-Ing. Jens Sohnemann
Phone: +49 (0) 2 08/85 98 -12 83
jens.sohnemann@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 (0) 2 08/85 98 -11 67
kai.keldenich@umsicht.fhg.de

Plastics Technology



Plastics Technology; automobile recycling concepts; product development; material and recycling-oriented design; injection molding; extrusion; plastic testing technology; Finite Elements Method analyses (FEM); market and technology studies; material development/compounding; fiber-reinforced and bio-degradable materials; new areas of application
Contact: Dr.-Ing. Edmund Dolfen
Phone: +49 (0) 2 08/85 98 -12 63
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 (0) 2 08/85 98 -11 64
stephan.kabasci@umsicht.fhg.de

Water Treatment/ Membrane Technology



Development of new areas of 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 (0) 2 08/85 98 -11 50
josef.robert@umsicht.fhg.de

Special Polymers



Temperature sensitive/hydrophilic gels, superabsorbers, thermochromate; syntheses; product characterization; analytics; application technology

Contact: Dipl.-Ing. Holger Wack
Phone: +49 (0) 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 (0) 2 08/85 98 -12 30
thomas.marzi@umsicht.fhg.de

Contact: Dr. rer. nat. Ute Merrettig-Bruns
Phone: +49 (0) 2 08/85 98 -12 29
ute.merrettig-bruns@umsicht.fhg.de

Department of Safety and Process Technology



Head: Dr.-Ing. Stefan Schlüter
Phone: +49 (0) 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 (0) 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 (0) 2 08/4 68 48 -3 59
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 (0) 2 08/4 68 48 -3 50
thorsten.wack@umsicht.fhg.de

Fire Safety Engineering, Fire and Explosion Protec- tion for Technical Plants



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
Phone: +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 (0) 2 08/4 68 48 -3 50
thorsten.wack@umsicht.fhg.de

Pipeline Technology



Pipeline test area (temperature up to 200 °C, pressure up to 80 bar); water and cavitation hammer; layout of pipeline systems

Contact: Dr.-Ing. Andreas Dudlik
Phone: +49 (0) 2 08/85 98 -11 25
andreas.dudlik@umsicht.fhg.de

Department of 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 (0) 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/ geothermal energies; local heating; refrigerants (ice-slurry); expert reports; energy trading; efficiency; energy policies
Contact: Dr.-Ing. Christian Dötsch
Phone: +49 (0) 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 (0) 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 (0) 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 (0) 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 (0) 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 (0) 2 08/85 98 -11 94
adam.hadulla@umsicht.fhg.de

Department of Knowledge and Technology Transfer



Head: Dr.-Ing. Bernhard Dietz
Phone: +49 (0) 2 08/85 98 -11 07
bernhard.dietz@umsicht.fhg.de

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 (0) 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 (0) 2 08/85 98 -11 11
anja.gerstenmeier@umsicht.fhg.de

Project founding/ Spin-offs



Combined and single project founding; implementation of pilot and demonstration projects; financial support; consulting services to spin-off enterprises; finding business partners
Contact: Dipl.-Ing. Christian Wolf
Phone: +49 (0) 2 08/85 98 -11 70
christian.wolf@umsicht.fhg.de

Administration



Human resources; project monitoring; research contracts; budgeting; purchasing; accountancy; business trips; infrastructure; controlling
Contact: Dipl.-BW Andreas Weber
Phone: +49 (0) 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 (0) 2 08/85 98 -11 71
hartmut.pflaum@umsicht.fhg.de
Contact: Dipl.-Chem. Iris Kumpmann
Phone: +49 (0) 2 08/85 98 -12 00
iris.kumpmann@umsicht.fhg.de



IT-Management



Support of the IT infrastructure; user help desk; high-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 (0) 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 (0) 2 08/85 98 -11 82
richard.sprick@umsicht.fhg.de

Library



Information systems; online literature research; document supply; Fraunhofer Publica updating; UMSICHT newsletters
Contact: Dipl.-Bibl. Kerstin Hölscher
Phone: +49 (0) 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 (0) 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 treatment and sewage; power generation from biomass; integrated energy supply concepts
Contact: Dr.-Ing. Achim Loewen
Phone: +1 4 12/3 62 -89 82
loewen@engrng.pitt.edu

Laboratories and Workshops

Analytical Laboratory

The analytics laboratory handles environmental tasks, performing analyses on solid materials, gaseous and aqueous samples as well as on materials from process engineering plants. Our spectrum ranges from the analysis of soil, dust, and waste over the analysis of sewage sludge and waste water to landfill and purification gases. Where no standard analytical procedures exist, the lab team develops new methods and applications tailored to specific needs such as pilot tests. The staff also provides consulting to customers in the planning and evaluation of examinations. Our objective is the development of comprehensive solutions to technological problems using analytical measuring methods.

Special emphasis is placed on the analysis of combustion and decomposition processes and the identification of siloxanes in sewage and landfill gases. Further area of expertise is the detection of isomers of DDT, PCP, and HCH in highly contaminated wood materials.

Among others, the range of the analyzed standard parameters includes:

Inorganic substances

- anions and cations
 - quantitative and qualitative analyses of heavy metals and anions
- summary parameters
 - total nitrogen (Kjeldahl)
 - organic and inorganic carbon contents (TOC, TIC)
 - water hardness
 - acid and base capacity
 - tensides (MBAS, BIAS)

Organic substances

- hydrocarbons
 - aliphatic hydrocarbons
 - benzene, toluene, xylenes (BTX)
 - polycyclic aromatic hydrocarbons
 - various solvents
- halogen compounds
 - pentachlorophenol (PCP)
 - γ -hexachlorocyclohexane (HCH) and other isomers
 - highly volatile chlorinated hydrocarbons
- GC-MS-screenings

Physical-chemical analytical measurements

- analyses of chemical reactions in reaction calorimetries
- thermal analyses
- rheological analyses
- laser-optical determination of particle sizes in solid materials
- analyses of combustion and degradation reactions (also equipment according to DIN 53436)
- BET-surface analyses
- pore volume investigations



Equipment (selection)

- Fourier-transform-infrared spectrometer (FT-IR)
- elementary analyzer
- differential scanning calorimeter (DSC)
- gas chromatographs including mass spectrometer (GC-MS)
- high-performance liquid chromatograph also with mass spectrometric detection (HPLC-MS/MS)
- atomic emission spectrometer with inductively coupled plasma as initiating unit (ICP-AES)
- reaction calorimeter (RC1) including 2-liter-reactor, temperature range 0 °C to 200 °C, 0 to 50 bar excess pressure
- thermal analysis system for combined thermal gravimetry (TG) and differential thermal analysis (DTA resp. DSC), temperature range from -150 to 1 500 °C
- rheometer, regulated by shearing stress with air bearing technology
- equipment for laser optical particle size analysis (3-laser-technique, size range 0,1 bis 700 µm)
- ion chromatograph (IC)
- graphite tube atomic absorption spectrometer (AAS)
- BET-surface analysis equipment
- solid and liquid matter TOC
- mercury porosimeter

Biotechnological Laboratory

The biotechnological laboratory specializes in solutions for the clarification of contaminated media (soil, water, air), performing analyses on potentials of inherent biodegradability and biological production, and developing novel microbiological processes in laboratory and technical scales.

New biotechnological methods and systems are developed, designed, and tested step by step in order to ensure technical feasibility at a high efficiency and operational safety. In many cases, the traditional methods existing have to be completed by specific processes tailored to the customers' needs. In close cooperation with the analytics department and experts from the engineering staff, the biotechnological laboratory advances the development of novel and efficient solutions.



Laboratories and Workshops

Services

- analyses of compost materials in compliance with BGK methods (Fraunhofer UMSICHT is an accredited testing laboratory of the „Bundesgütegemeinschaft Kompost e. V.“ (Federal association of compost quality standards))
- microbiological examinations in compliance with DIN, ISO and OECD methods
- analyses of the biological degradability of chemical substances (aerobic und anaerobic)
- investigations on bio-degradable materials in compliance with DIN V 54900
- isolation of mixed and pure bacterial cultures with specific degradation potentials
- development of microbiological processes
- scaling-up of biotechnological processes (performance, support)
- sensitivity analyses of biotechnological processes
- consulting and analyses in hazardous incidents or optimization demand in biotechnological plants (e.g. sewage treatment or composting)
- R&D projects: e.g. aerobic and anaerobic treatment (fermentation or composting of organic residues)
- license for handling pathogenic agents in compliance with § 19 Abs.1 Nr. 2 BSeuchG of the German Federal Law on Epidemic Control

Equipment

Additionally to the standard equipment for microbiological research up to security level 2, the following instruments are available:

- bioreactors (2-20 l) with modern measuring and control equipment
- BOD apparatus (Sapromat), inhibitor test for bioluminescent bacteria (sampling equipment for airborne organisms)
- anaerobic work bench involving an anaerobic breeding reactor

Laboratories and Workshops



Workshops

The institute's workshops comprise

- electric and electronics workshops, and
- mechanic workshops.

The service range of the electric and electronics workshops covers the maintenance and operation of the in-house power supply system, of the technical plants and the laboratories, as well as the planning and construction of new plants in the low voltage and in the high voltage range up to 1 000 V, consistent with VDE guidelines. Small units ranging from measuring and control equipment, comprehensive control modules to complete measuring and control systems are developed and constructed.

Our service range also includes, in addition to the design and drawing up of wiring diagrams, also the installation and implementation of structural units. Our solutions designed for internal use support the engineering and researching staff in the performance of measuring, control, and monitoring works, and in the delivery of innovative technology.

The manufacturing facilities offer both services in cutting production (drilling, abrading and polishing, lathe work, milling) as well as non-cutting processing (welding) of plastic materials and metals.

The workshops, thus, offer the possibility both to set up complete plants and to manufacture specific scientific instruments or custom-made analytical equipment. As a result, custom-made parts and solutions are ready for use without delay. Furthermore, small-scale serial production of work-pieces or small tools is also available.

Laboratories and Workshops



Marketing, Communication, Business Development

IT-Management

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.

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!

- 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

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:



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.

Library

The in-house technical library currently comprises approx. 6,900 monographs, 91 scientific journals, 44 permanently updated loose-leaf editions, 31 information brochures (among them publications by ministries, associations, boards and organizations), and bulletins issued by government boards in various research disciplines.

In addition to literature research through the Fraunhofer wide library data network STAR, professional literature and patent research through online data bases is available.



Additionally, research on enterprises is made available to staff through the Hoppenstedt data base from every work station.

Necessary interlending of required materials is carried out by the library staff.

The library documents and collects publications made by Fraunhofer UMSICHT scientific staff to be included into the FhG Publica, a world-wide accessible Fraunhofer data base.

The responsibilities of the library include the editing of the UMSICHT publications, ranging from advisory support to the authors to the delivery of the printed copies to the Technische Informationsbibliothek (TIB, Technical Information Library) in Hanover.

Occupational Safety and Environmental Protection

The work group "Occupational Safety and Environmental Protection" (AU) acts as coordinating and organizing board for issues related to occupational safety and environmental protection, through consulting of executives and staff, and through continuous promotion and upgrading of the AU-related organization.

The scope of duties includes the organization and coordination of occupational injury prevention and health protection, emergency and risk management, emergency precaution, and occupational injury notification. Qualification courses and on-the-job training in the field of occupational safety are offered to AU-administrators and decision-makers.

Core projects in 2002 were:

- fire prevention organization
- safety coordination for building projects
- occupational safety in outposts

Library

Fraunhofer UMSICHT offers access to the major electronic data base providers (STN International, FIZ Technik, DataStar) as well as inquiries via in-house data bases such as the Chemical Engineering and Biotechnology Abstracts data base, supported by DECHEMA. Further online information sources are KOWI and ECHO data bases, reporting continuously on current and future activities in the European Union member countries.



Occupational Safety and Environmental Protection

Fraunhofer Center for Energy and Environment, Pittsburgh

Fraunhofer UMSICHT operates the Fraunhofer Center for Energy and Environment (CEE) in Pittsburgh, Pennsylvania, USA. The Center, which cooperates with the University of Pittsburgh, serves a variety of purposes. One of them is to offer the services and technologies of UMSICHT to the U.S. market. Project work is carried out both in Germany and in America. In addition, a close tie to

technological developments in the U.S. is ensured, which is supported by cooperation with leading institutions in the Pittsburgh region. This leads to increased reputation and competence and, thus, enhances competitiveness in Germany. Furthermore, German companies are supported in their efforts to develop and offer products for the American market. Finally, the Center also serves as a tool for human resources development and recruitment.

One area the Center works in is the treatment of process and wastewaters. For instance, in a cooperation project with the University of Pittsburgh micro-filtration membranes are employed to treat Combined Sewer Overflows (CSO). CSO occur during heavy rain events when rain infiltrates sewer lines in excess of system capacity and overflows to surface waters causing severe water pollution. In two membrane modules, a variety of membranes were tested under varying operating

Fraunhofer Center Pittsburgh



Meadville, the town for which CEE is developing an energy supply concept

conditions. Different bacteria were used as indicator organisms to determine pathogen retention efficiencies. Removal of these organisms to non-detectable levels was achieved. The results suggest that there is commercial potential. As a next step, field trials and additional tests to obtain more data on specific membranes will be carried out before commercial design can be commenced.



Cross flow membrane module for wastewater treatment

In the field of energy technology, CEE is investigating the economic feasibility of decentralized energy supply systems. Mainly focusing on Pennsylvania, where "green power markets" are emerging, background information on price structures, measures to stimulate green energy like tax incentives etc. was collected. In order to carry out economic calculations for specific sites, a computer model was developed that correlates this information with data on different components of decentralized energy generation plants. The program delivers financial assessment indicators such as net present values and payback periods. It also allows to carry out sensitivity analyses on the influence of critical parameters like APRs (annual percentage rates) or electricity reimbursements.

The Center is evaluating how renewable energy sources can contribute to an economically feasible and environmentally beneficial decentralized energy supply. Pennsylvania is a rural state characterized by agricultural and wood processing industries.



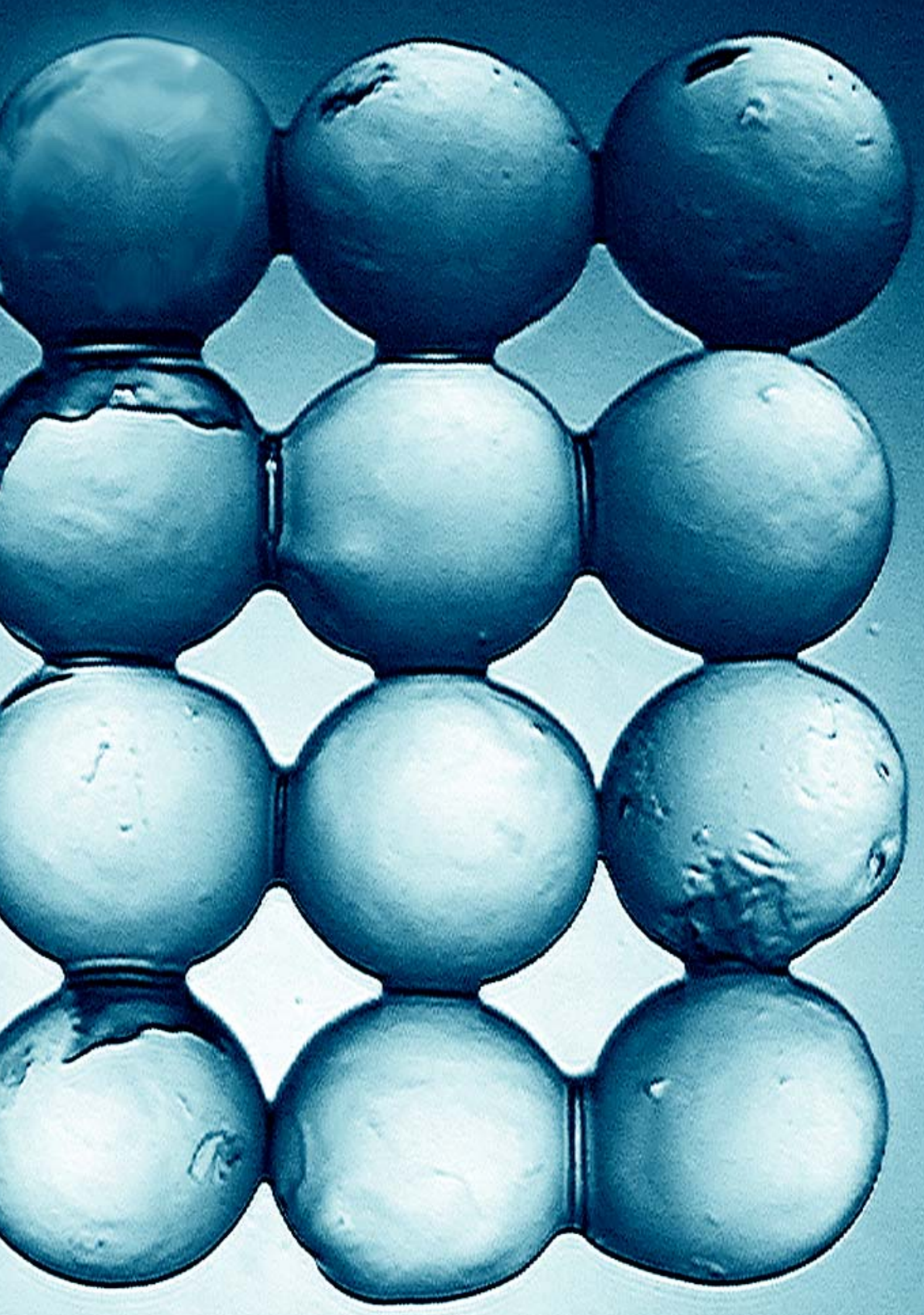
Farm in Pennsylvania



Switchgrass, an energy crop to use as renewable fuel for energy generation

Therefore, particularly the application of technologies for digestion and gasification of biomass such as liquid manure or waste wood is being investigated. In order to find potential sites for biomass based generation plants, CEE is currently carrying out feasibility studies for different locations in Pennsylvania. In Meadville, a town in Northwestern Pennsylvania, CEE investigates which options for energy generation are best suited to cover the demand for electricity, heat, and cold of different industries and other consumers based on local resources.

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Modern environmental technology develops means, methods, and techniques designed to improve the eco-efficiency and to reduce ecological damages. Thus contributing to the reduced emission of ecologically hazardous substances and their minimized introduction into environmental compartments, it provides a direct economical benefit through cost-effective use of natural resources.

The department of environmental technology offers a repertoire of competencies and qualifications, able to perform the tasks of conventional as well as preventive environmental protection. Since the institute's

foundation, an explicit accentuation towards integrated environmental technology, intelligent material flow management, and identification of added value potential has occurred.

Separation processes, functional micro-particles, adsorption processes, bio-technological transformations, functional polymers, and thermal processes are impressive examples of how intelligent solutions lead to the reduction of ecological damages and create material value. Mathematical modeling and process simulation are appropriate tools to simplify the transfer into pilot or demonstration plants.

Department of Environmental Technology



Decontamination for art treasures

Supercritical carbon dioxide gently rids wooden pieces of art off contaminants such as lindane, DDT, and pentachlorophenol. Instead of having vanished into the "poison cabinet", this figure from the 16th century again decorates the epitaph of the village church at Döben, Grimma district, Saxony, right after the treatment.

© Roland Punge

The Fate of Hazardous Materials in Wastewater Purification Plants and Membrane Technology for the Conditioning of Pickling Acids

German wastewater purification plants excel by a far reaching elimination of COD, BOD₅, nitrogen and phosphorus. There are, however, constraints to comply with limit values for halo-organic compounds (such as AOX), metals and their compounds and for toxic effects on fish. Wastewater also contains a number of interesting, synthetically produced and ecologically relevant trace materials, the elimination of which is currently hardly considered in municipal wastewater purification. Fraunhofer UMSICHT is involved in a project conducted in collaboration with the DPU Deutsche Projekt Union GmbH on behalf of the University of Dortmund, and funded by the North Rhine-Westphalian Ministry of Environmental Affairs, performing studies in-situ at two municipal sewage plants on the behavior of the above substances, which are included in the list of priority materials, part of the EU Water Framework Directive (appendix X of the guideline 2000/60/EG).

On the basis of literature research and first measurements, the list of the materials to be examined in the inflow and outflow of the wastewater treatment plant was specified and supplemented.

In a follow-up project, methods of a more efficient and nearly complete elimination of these hazardous materials by the balancing of selected substances through the operation steps in the sewage plant will be presented.

A further project is conducted aiming at an increased added value in the metal-surface-treating industry through the development of membrane procedures preferably based on nanofiltration and reverse osmosis. To date, waste acids, a by-product in this application, are subjected to a low-grade utilization, re-concentrated thermally or discharged directly or indirectly after neutralization. The skilful choice of suitable chemically stable membrane materials allows to remove impurities from the process solution down to the size of metal ions. The ions are subsequently refed to material recovery so that the life cycle of the solution is markedly increased.

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Quite versatile – mobile membrane plants recover the acids flexibly exactly where they accrue

The Development of a Novel, Biodegradable Packaging Film Using Renewable Raw Materials



Can bear a lot and vanishes quickly – granules and film bag made from biodegradable material. When composted degradation reaches 70% already after 43 days.

The lack of discharge systems for conventional packaging materials and their disposal on landfills cause considerable ecological problems. The use of packaging materials from renewable, biodegradable polymers may help save resources with the bio-dustbin in Germany and other industrial countries, and consequently, costs may be cut down considerably.

In the research project, a new material formula was developed using polylactic acid and aliphatic-aromatic co-polyester, for a stiff, contact-clear film, which displays similar properties compared to the LDPE film.

The haptic properties of the film are pleasant and lack the latex-similar qualities of pure or polyester-films filled with thermoplastic starch. These properties were attained through a development of a new system of compatibilisers. The binding of the inorganic fillers in polymer could be improved and the compatibility between polylactic acid and co-polyester could be increased.

Manufacturers of LDPE film are highly interested in this material, since it can be processed on conventional blow molding lines, avoiding expensive adjustments to screws, nozzles or take-offs. At the present moment, the films are manufactured and tested by numerous companies. Film blowing tests have revealed that the film is stretchable to 8 μm and has similar shrinking properties as LDPE. Several projects with different partners are currently conducted being in the implementation phase or in the practical testing phase of the film products.

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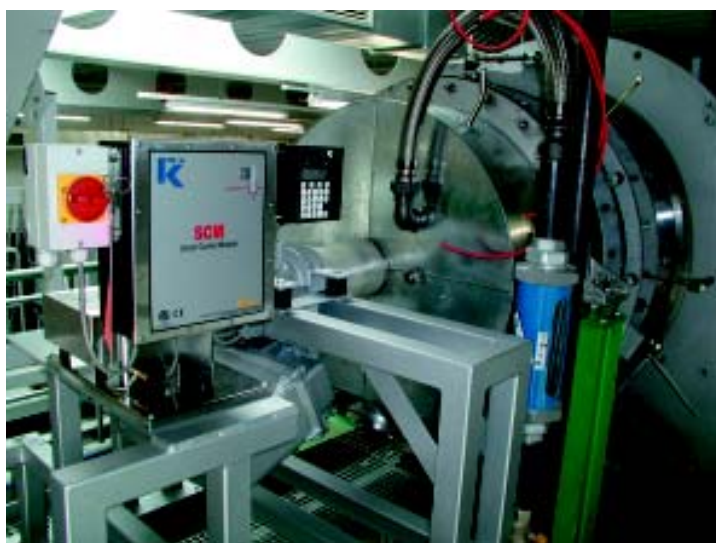
Processing of the biodegradable material on a blow film plant

Task Force Teterow – Research Laboratory for Activated Carbon Technology

Close collaboration in research, production and application fields is required for the development of activated carbon to be employed in promising new industrial branches such as materials recovery, automotive engineering, and life sciences. A showcase joint research and development project is the cooperation between German carbon Teterow GmbH and Fraunhofer UMSICHT. For the optimized performance of projects, a task force was established at Teterow, Mecklenburg-Western-Pomerania.

In July 2002, five employees started research work in the Biomedical Laboratory Teterow (Biomedizinisches Technikum Teterow BMTT). Facilities comprising 60 m² of office area and 308 m² of laboratory area were provided with support from the municipal council of Teterow. As early as two months later, in September, the bench-scaled production unit designed by Fraunhofer UMSICHT was commissioned, the ceremony was attended by State Premier Harald Ringstorff. The plant is operated continuously and is designed to produce 5 kg/h high-quality formed activated carbon.

This process excels by high flexibility in production flow. It allows for as many degrees of freedom as possible, resulting in flexible process investigations, both optimum research conditions and the stand-alone or combined operation of instruments. Consequently, tailor-made activated carbon can be produced.



Material feeder of the carbonizer



Biomedical Laboratory Teterow
(Biomedizinisches Technikum
Teterow BMTT)

Additionally to the development of product recipes and products in gram to kilogram scale in a discontinuous operation mode, the continuous production of samples in larger quantities of 120 kilogram per day is possible. Standard methods and specific techniques to investigate chemical, physical and adsorptive parameters are provided in the laboratories in Teterow and Oberhausen, and permit the identification of material data necessary for designing the process equipment. The expertise in downstream processing of activated carbon products is currently being extended. The acquired technological competencies allow Fraunhofer UMSICHT to offer all-in-one services in the field of activated carbon production.

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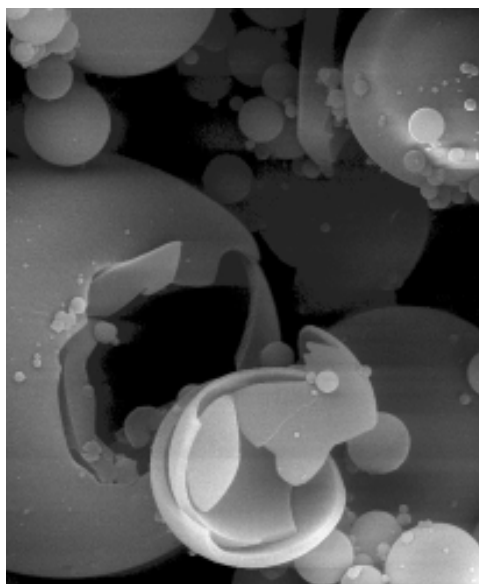
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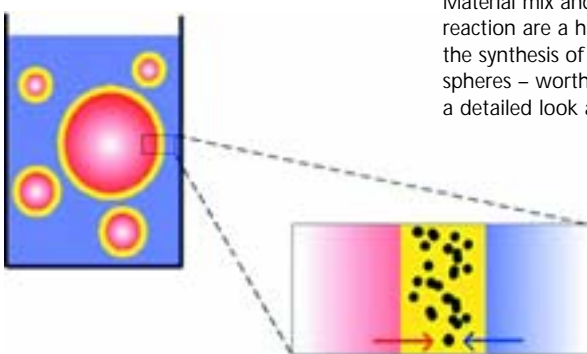
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Hybrid Hollow Micro Spheres

The properties of polymers may be altered widely by using additives and fillers. In this respect, hollow spheres, consisting of a polymeric or inorganic wall enclosing a gas as a core material, are promising materials for the creation of "intelligent products". Hollow spheres are used to reduce the weight of structural parts without decreasing their mechanical properties. Additionally, they can be used to increase the impact strength, to change the thermal and electrical properties as well as to manufacture foams.



Tailor-made without needle or thread – hybrid amino resin hollow spheres are microscopic beauties



Material mix and precipitation reaction are a highlight in the synthesis of hybrid micro spheres – worthwhile having a detailed look at

- reactant solution A
- reactant solution B
- polymer wall
- precipitate AB

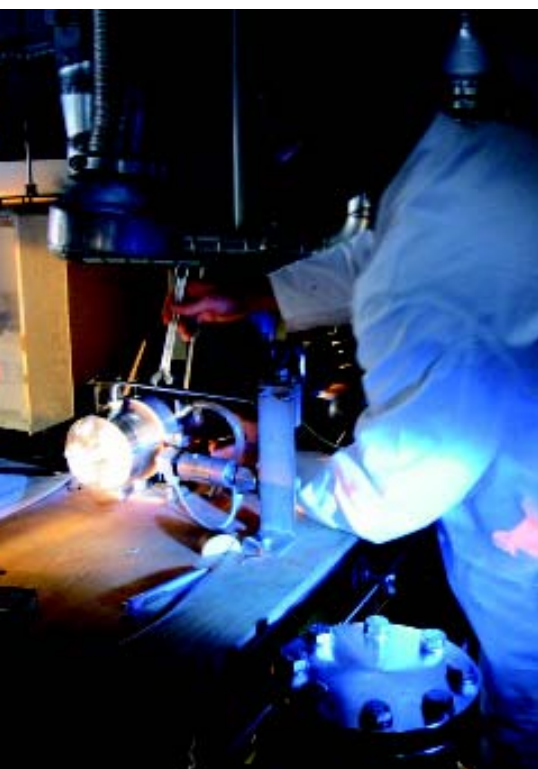
Pure inorganic or polymeric hollow spheres often only partially meet technical requirements regarding strength, toughness, chemical stability, etc. Hollow spheres of composite materials, structurally inspired by biological mineralization processes, seem to be more promising in this respect. In biological structures, high strength and low weight are realized by using organic-inorganic hybrid materials. In the case of bones, a matrix of collagen is reinforced by small inorganic crystals, yielding superior strength compared to the pure organic material.

In the current project, polymeric microcapsules are combined with ceramic materials to synthesize hybrid hollow spheres. In a first step, one reactant solution is encapsulated in microcapsules, to be fed subsequently into a second reactant solution. The reactants get into contact with each other through diffusion of the reactants through the permeable wall, and the inorganic material is formed by chemical reaction. Interpenetrating networks of the inorganic crystals in the organic matrix are formed consequently. The microstructure of these hybrid hollow spheres can be controlled by changing the permeability which influences the mass transport through the capsule wall.

In the first phase of the project, different salt solutions were encapsulated as reactants to examine the wall permeability. Additionally, inorganic layers of titanium oxide, using a synthesis at low temperatures, on capsules of polyamide and amino resin have been precipitated in order to obtain pure inorganic hollow spheres through dissolution or burning out of the organic core.

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Under pressure – enzymes in an innovative process.
Precise assembly – preparing the high pressure plant for experimental use

Enzymatic Reactions in Supercritical Fluids

Enzymes are natural catalysts accelerating chemical reactions in biological systems. Used in technical processes they permit the targeted production of various substances.

Separated from their natural environment, enzymes are able to keep their catalytic activity in different solvents and reaction conditions. Innovative processes are enzyme-catalyzed reactions in supercritical fluids. The preferential use of e. g. compressed carbon dioxide (CO_2) as a solvent is due to an enhanced solubility for hydrophobic compounds compared to water and from the low mass transfer resistance in the reaction medium.

Used in enzyme-catalyzed reactions, CO_2 can be recycled. Products are separated by variation of pressure. This process is examined for the production of aroma compounds for the food or the cosmetics industries and other fine chemicals.

A lab-scale high pressure plant was constructed for the experimental investigation of the described process. A high pressure pilot plant will be used for the production of large scale test batches.

The use of immobilized enzymes allows for the easy retention of the enzyme preparation in the reactor. Additionally, immobilized enzymes show a higher stability compared to free enzymes.

As a scientific foundation a mathematical description of the process is developed. Experimental studies and model calculations will be performed to identify suitable process parameters as pressure, temperature and concentration of substrates. The theoretical model elaborated is validated using the experimental results.

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MARS® (Modular Incineration Plant with Reduced Flue Gas Cleaning Residues)

Fraunhofer UMSICHT operates a decentralized incineration plant (MARS®) in co-operation with specialized small and medium sized plant engineering and construction companies and the Chair for Environmental Process Engineering and Plant Design (LUAT) of the University of Essen. The test plant is designed to encourage the positioning in the market of small incineration plants allowing for an on-site energy recovery of different fuels. The plant can be operated with different fuels since the single modules of the plant may be readily combined (e.g. the arrangement of the aggregates of the flue gas cleaning).



These properties are significant in case the operator intends to recover derived fuels (RDF) with high calorific values. These fuels can be produced by mechanical-biological waste treatment plants. The energy recovery ensures the steam, heat and power supply of industrial areas.

Technical parameters of the test plant are:

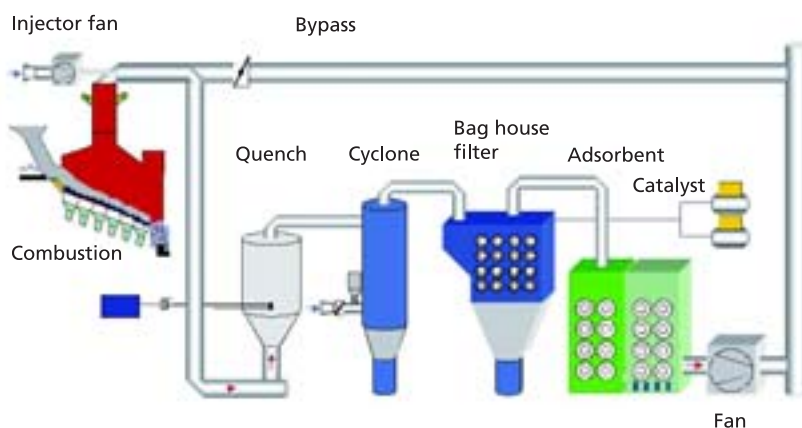
- Water cooled forward-moving grate and direct current combustion
- Throughput of approximately 450 kg/h
- Calorific value of the fuel ranging from 8 000 to 16 000 kJ/kg; thermal capacity of approximately 1 MW
- Quasi-dry flue gas cleaning with:
 - Quench
 - Cyclone and fabric filter
 - Catalyst (applicable at low temperatures) with additional ozone generator and mercury sorption

Market introduction of the MARS® plants is planned for 2003. Currently, the plant is tested under operational conditions. The planned standard plants will display the following characteristics:

- Modular constructed plant with 5, 10 and 15 MW_{th}
- Single modules will fit into normal sea containers
- Water cooled grate (adjustable to the calorific value of the fuel)
- Energy recovery (power, heat or steam generation)
- Simple plant assembly by combining the modules
- High technical standard (compliance to EU requirements).

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Fire and water – the panoply of safety technology is enormous. Ranging from secure “playing with fire” over the improvement of fire prevention, all the way to the research of currents in pipelines, a crucial prerequisite for the secure and economic process flow in process plants

Department of Safety and Process Technology

The safe and optimal operation of industrial plants and processes, and the reliable control of technical processes are fundamental for modern enterprises. By these means, the economic operation as well as the compliance with safety requirements for staff, the neighboring area and the environment are ensured.

The department of safety and process technology specializes in process engineering design, in the optimization of operation processes, and in safety assessment of industrial equipment and processes. The prime objective is to support our customers in the development and operation of economical

processes which at the same time meet the currently valid environmental and safety requirements.

Services in the areas of plant safety, fire and explosion prevention, process analytics and dynamic modelling, information and pipeline technologies are offered. The development of environmentally friendly software systems to be applied in safety and process engineering for the process simulation serve as technical and legal information systems representing an intelligent tool combining the varying fields of expertise.

Electrolysis as an Alternative Process for Pool Water Disinfection

Operators of public swimming-pools have to comply with specific requirements that are embodied in the Federal Epidemic Law. Currently, chlorinating the water is the only legally allowed disinfection method for the production of hygienic pool water. The disinfection chemicals used so far are based on gaseous chlorine or inorganic chlorine compounds, which make extensive industrial safety and safety precautions necessary.

An innovative process for pool water disinfection is based on the electrolysis of aqueous sodium chloride solution. To this end, brine is added to the swimming pool water. The salt concentration amounts to approx. 0.4 %. The electrolysis cells are integrated into the pure water pipe of the pool. Thus, the production of the chloric disinfectant takes place directly in the pool water. The use and storage of chloric hazardous materials is no longer necessary.

Electrolysis is another method to produce elemental hydrogen. However, this formally conflicts with existing rules and regulations, according to which hydrogen must not escape from the electrolysis chlorine gas production plant into the environment. At normal conditions, hydrogen is a transparent, odorless, nontoxic gas, and is easily inflammable. It is particularly here, where a high degree of danger by the explosiveness of hydrogen/air mixtures is observed. The lower explosion limit (LEL) is reached at approximately 40,000 ppm.

The process was analyzed theoretically and measurements were performed to estimate the hazard risks. The mass balance of the process as well as the measurements revealed that under normal operation conditions, the hydrogen concentration in the air is about two orders of magnitude below the LEL. Consequently, the formation of explosive atmosphere can be excluded. A safety analysis demonstrated that the protection targets defined in legal rules are met. Further recommendations regarding the reliable monitoring of the process were developed.

The study conducted by Fraunhofer UMSICHT has met with considerably improved acceptance of the process described from authorities, federations and operators. For the development of the process, a partnering medium-sized enterprise was awarded the German Hazardous Material Protection Prize.

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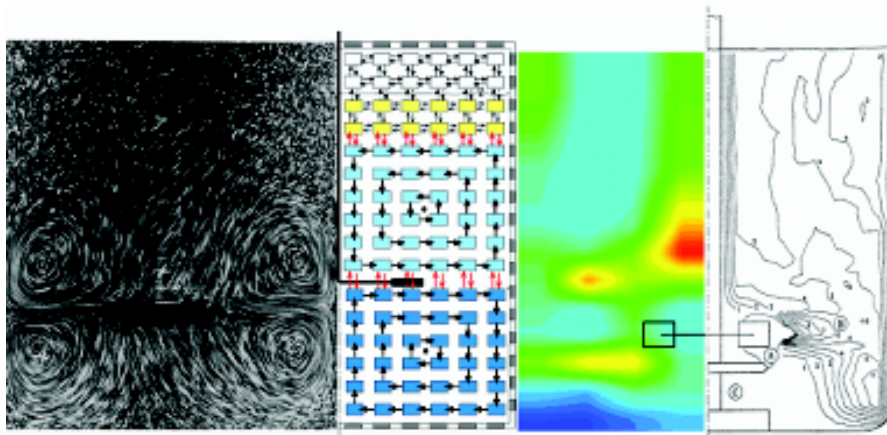


Electrolysis for water disinfection at the public pool at Lünen

Simulation by Cell-Networks: Complex but Clear

Simulation systems support operators of process engineering plants during the entire life cycle of their plants: from the first planning to the production through the entire process chain from the incoming orders to the distribution of products. Appropriate models and software must comply with highest requirements regarding integrative capacities, for the optimal description of the processes in the industrial context, including today's most complex technological aspects.

In the age of the Supply Chain Management (SCM) and Computational Fluid Dynamics (CFD), relevant influences on the most diverse levels of production are taken into account and looked into in a holistic way - ranging from superordinate logistic aspects to reaction technology of multi-phase processes.



Caught in the net – modeling of a stirred tank reactor (disk stirrer radially) using simulated cell-network

(Source: Handbuch der Rührtechnik, EKATO-Rühr- und Mischtechnik GmbH, Schopfheim (left picture); MVK Medienverlag Köhler, Tübingen (right picture))

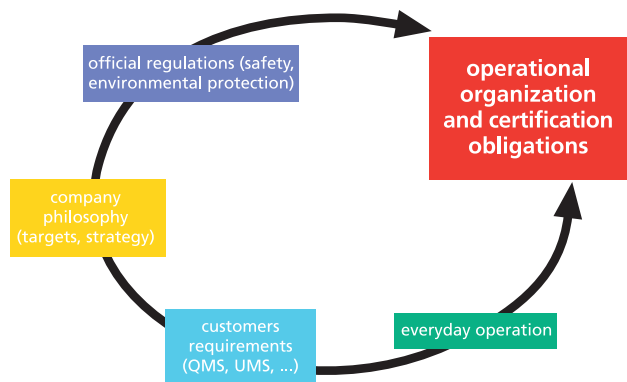
A modeling strategy is needed that meets these various requirements. Simulation by cell-networks offers this in an outstanding way. Offering rough local discretization including simplified physical effects of several phases, cell-networks are capable to supply approximated information on the flow and excel by both complexity and modeling depth. Besides, their clear and simple mathematical structure permits the integration into different software systems.

Using the cell net approach, Fraunhofer UMSICHT develops models for the simulation of micro-reactors, stirred tank reactors in reaction calorimeters, lab scale plants and pilot plants. Additionally, models for continuous dryers for food industries, as well as plants equipped with complex multi-phase stirred tank reactors are simulated successfully. In addition to the application of the models, suitable simulation programs can be developed on demand, possibly coupled with logistics simulators.

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Measured variables on the operational organization for the fulfilment of relevant environmental and safety requirements



Graphically supported control of the determination process in the program LAGERguide

Information Systems for Operational Safety and Organization

Anyone who plans and operates process engineering plants, has to consider numerous legal regulations of occupational safety and environmental protection. Permanent availability as well as fast and problem-specific access to the required up-to-date information are decisive for competition. Without expert knowledge and suitable procedures neither the legally demanded measures can be determined nor converted into practice and be interspersed demonstrably on all staff levels.

Modern information and communication technologies make concepts and systems practicable for the automatic generation of higher-ranking knowledge. They help to master operational tasks safely and within a short time in order to protect humans and the environment. Analysis and restructuring of the relevant information lead to results in the developed system approaches relative to problem-specific data concerning duties to obtain a licence requirement, condition, equipment, marking, list, operational procedures etc. Intuitive access mechanisms and interactive manuals enhance knowledge transfer and ensure a reliable result by high user-friendliness. The knowledge-based systems are independent and usable as an internet/intranet solution.

Beyond the editing of information for the pure determination process, the intelligent cross-linking of more available in-house and third-party information via intranet and internet wins increasingly in meaning. Based on operational data from risk assessment, documentation of plants, operating instructions etc. linked with externally available sources of information and the competencies in the enterprise – e.g. the fulfilment of the operational organization obligations can be proven.

Examples are the program LAGERguide, an interactive manual for the storage of hazardous substances and wastes, as well as the information network DUBAnet[®] concerning the integrated management of occupational safety and environmental protection.

Enterprises using such system approaches save time and labor-consuming searches as well as long information paths. Uncertainties regarding the valid legal position of the enterprise are omitted and liability claims can be excluded in case of damage.

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Fire Protection Guidelines – Concise and Comprehensible

There are about 200,000 fires in German households each year, which equals 550 fires a day. These fires cause a death toll of 600 victims per year, leaving 55,000 persons injured. Despite these figures, fire protection at home is often neglected, and due to a lack of risk awareness, typical hazards are often not identified or are simply ignored.

Most people will luckily never experience a real fire scenario at their homes. Their »knowledge« about fires and adequate reactions in a fire situation will usually be taken from movies and similar sources. For reasons of entertainment, however, movie fires in many cases are presented in a fashion which is far from real, and adequate behavior in a fire situation is rarely as spectacular as the action of movie stars. In order both to prevent the outbreak of fires and to prevent people from becoming fire victims, a realistic and concise information of the public on fire protection is mandatory.

On behalf of the Landesinstitut fuer Bauwesen NRW (State Building Institute), Fraunhofer UMSICHT has developed Guidelines for Fire Protection at Home. The guidelines presented aim at providing basic information to interested persons and may help identify potential fire hazards, realistically assess the related risks and prevent unnecessary risks.

The principles of fire development and spreading are described and illustrated. Using checklists, the reader may better identify potential hazards in different rooms of his home. Additional information is presented on safe rescue paths and the use of technical devices such as smoke alarms.

Finally, the reader is given advice on how to deal with a real fire situation, including measures of fire extinguishing, on how to alarm the fire brigade and some basic rules on whether to "stay or escape?".

The Guidelines have been designed to present basic information about fires and fire prevention in a technically

correct, easy and comprehensible manner. Valuable advice and additional information has been supplied by the expert members of the advisory board, to which we are indebted.

The "Guidelines for Fire Protection at Home" will be published in 2003 by the Landesinstitut fuer Bauwesen.

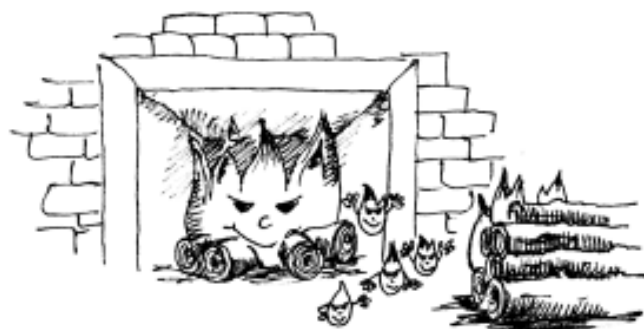
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"She lit a match, it was so nice! It crackled so, it burned so clear, – exactly like the picture here."
 (Extract from Heinrich Hoffmann 's "The Dreadful Story of Pauline and the Matches")

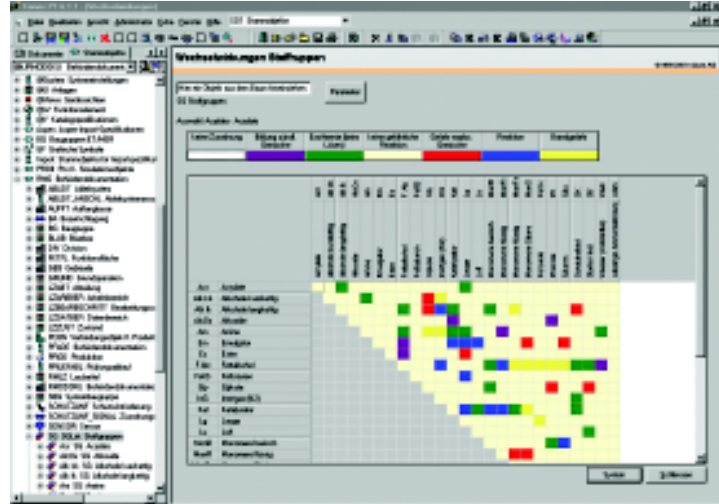
Not only at Struwwelpeter 's times illustrations helped to memorize the advice given.



Plant Documentation – The Operator’s View on Legal Security

With the information system RMO (regularization management operator of modules) of the Trisium AG, which is based on the plant documentation system Comos PT of the company Innotec, the plant operator can use an ergonomic tool for the plant lifecycle management. In this system the from the operator’s view essential fields of plant documentation and process documentation merge. With conventional tools they must be regarded separately and serviced. Outstanding characteristics are:

- Storage of plant, material and process data in a central data base to avoid data redundancies
- Separated examination of plants and processes followed by a flexible linkage, by which in particular plants in batch processed operation fitting (multi-product plants) can be documented efficiently
- Support of systematics for investigation of danger in any required detail depth, demanded by the Hazardous Incident Ordinance
- Flexible analysis mechanisms including visual feedbacks on R+ flow sheets



Material/material reciprocal effect matrix in dependence of the temperature

Fraunhofer UMSICHT develops further RMO detail components with the Chair for plant design and safety technology of the Technical University Cottbus (BTU). It concerns:

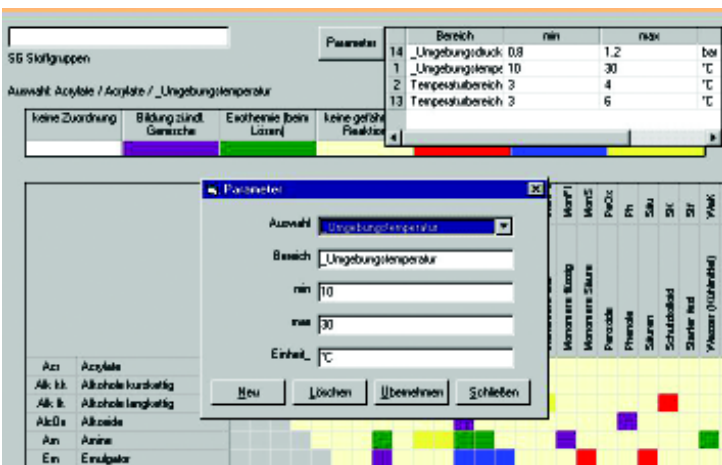
- Reciprocal effect stencils for the collection of the material/material and material/process material behavior and
- Interfaces to simulation programs for the observation of leaking out and propagation behavior.

Reciprocal effect stencils are realized in existing software products as two-dimensional relations structures, this is why an analysis of material combinations is not possible as a function of process conditions. The RMO system, however, offers the possibility of illustrating the dimensionality of the reciprocal effects in the complexity wanted by the user e.g. material/material reciprocal effects in dependence of arbitrarily defined temperature ranges or pressure ratios. This quantitatively and qualitatively free designation of reciprocal effects permits an individual description of the environment conditions and its connections. The entire analysis is carried out on the basis of a plant-related tree structure.

The user surface offers comfortable drag&drop support and makes possible a spontaneous overview of potential weak and danger spots in a plant. Furthermore it can be inserted smoothly into the structure of the market-established system Comos PT/RMO.

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Setting and selection of the condition parameters

ABS and KAVITAS for Safety Pipelines

Transient flow in pipeline systems (pressure surges) may lead to dangerous operating conditions that put a risk on human life and environment. Depending on the industrial branches, different operation conditions as contact condensation of steam and water (power stations), sudden changes of liquid velocity (water, chemical industry) or plug flow (oil and gas) can lead to so-called water, cavitation and condensation hammer. This is why calculations of pressure surges in pipeline systems should be integrated into the design of process plants. The advantages are: improved design for safety aspects, capacity and availability of the complete system. In many cases, cost-effective measures can be taken in the early design stage

to obtain an optimum plant construction. The use of bladder accumulators, surge tanks, or the new Fraunhofer developments ABS-Armatur® or KAVITAS for preventing or attenuating pressure surges, can considerably increase safety conditions in already existing plants.

Furthermore, fluid and structure dynamic processes which are significant for the construction of pipelines in process plants can be predicted by using suitable simulation codes.

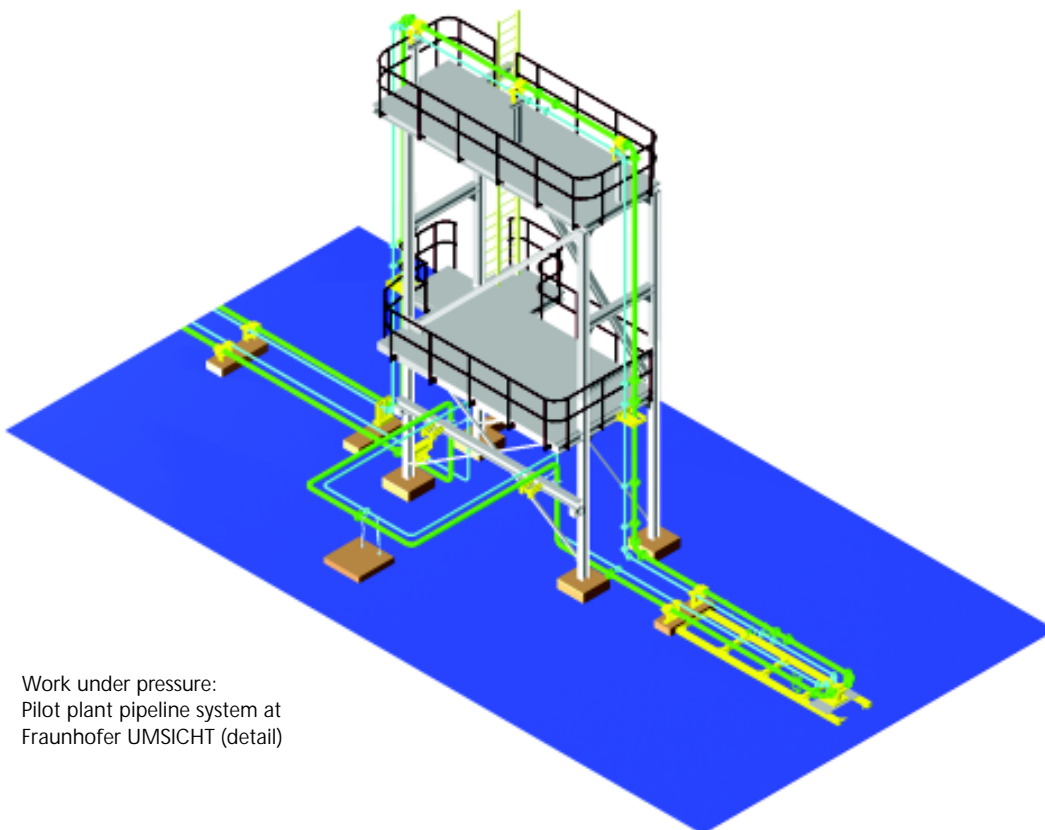
The entire service range of Fraunhofer UMSICHT comprises planning, calculation (static, dynamic), design and optimization of pipelines, valve tests, leakage detection and on-site measurement of pressure and force (pressure

surge detection), and prevention of pressure surges using ABS-Armatur® (prevention of pressure surges) and KAVITAS (prevention of cavitation hammer). Expertise studies for the safety and availability of pipe-lines complement the offer.

Using a large test rig PPP ($P_{\max} = 140$ bar, $T_{\max} = 180$ °C), software calculation can be evaluated and validated. Thanks to the close collaboration with other research institutes and industrial partners, research and testing work can be performed using the most modern measurement and analysis equipment.

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Work under pressure:
Pilot plant pipeline system at
Fraunhofer UMSICHT (detail)



Department of Energy Technology



Descending for innovative energy technology – the sea bottom is where you can find them: gas hydrates enclose gases at high pressures and low temperatures in a crystal cage structure, and store twice as much carbon as all other fossil fuels together

Fraunhofer UMSICHT supports businesses in successfully positioning themselves on the converted energy market. Efficient system solutions are the center of application-oriented activities in an innovative combined heat-power-cold generation (CHCP). Here, Fraunhofer UMSICHT concentrates on smart energy technology: efficient, local, customer-oriented, and flexible.

New technologies (e.g. fuel cells, micro-turbines, gas processing), renewable energies (e.g. biomass fuel, solar and geothermal recovery), as well as non-standard fuels (e.g. refuse derived fuels (RDF), special gases) are being applied in modular local power generation plants: And in the future, our know-how in the area of combined heat-power-cold supply will be expanded by technologies for the prevention and reduction of emissions harmful to the climate.

Based on its market and costs know-how, Fraunhofer UMSICHT offers energy analyses and concepts, IT consulting, and design engineering.

Customized studies and policy studies round off our profile. Already today, we develop emission trading projects, and furthermore, Fraunhofer UMSICHT is able to provide energy consumption measuring, and CAD, GIS, and CFD applications according to our customers' needs. We are involved in creating information portals and develop tools for the support of the operational business of energy supply companies: an integrated energy management software is being launched onto the market at present, and new products for the risk protection and portfolio optimization, as well as the strategic generation planning are in the state of creation.



Production modules in the demonstration project PEM-Oberhausen

Fuel cell: 212 kW_{el}
 PQ-Unit: 100 kVA
 Gas production: 75 Nm³/h
 Micro turbine: 100 kW_{el}
 Engine CHP: 469 kW_{el}

www.pem-oberhausen.de



Smart Technology, Intelligent Communication and Control

Smart energy technologies are characterized by high efficiency (e.g. CHP) and various applicability. Their modular structure allows for multiple linkage via both physical nets (power, heating, cold supply etc.) and IT networks and for the cooperation of manufacturer and customer groups to elaborate a timetable and risk management.

Active demand side management, peak shifting, peak shaving and virtual power stations are varieties of modern energy management. Fraunhofer UMSICHT develops new applications and system solutions and is particularly dedicated to the development, demonstration and market introduction of decentralized heat-cold power-cogeneration (CHP) such as fuel cells, micro turbines, micro thermo chiller and small-scale steam power and ORC processes. The service range also comprises the supply and processing of special fuels (e.g. special gases, refuse derived fuel).

Fuel Cells and Micro Turbines in System Solutions

Commissioning the demonstration plant of the PEM-Oberhausen project in August 2002, constructed in a cooperation project with industrial partners, Fraunhofer UMSICHT has gone over to powering the institute's entire facilities by using power-heat-cold cogeneration, based on natural gas and renewable mine gas. The power supply system comprising PEM fuel cell, micro turbine and a gas engine cogeneration unit, provides the power and heat supply. A power quality unit is capable to meet highest quality requirements in power supply and permits conceptual investigations. The control and IT system comprises convenient visualization, remote control and the testing of most diversified modes of operation (e.g. heat/power-oriented, timetable) through to isolated operation.

Fraunhofer UMSICHT develops solutions for the fuel preparation using regenerative special gases in fuel cells. Based on efficient gas analysis technology for the submicron range, portable gas purification modules and MCFC test status preliminary investigations, tailored to specific customer needs, can be performed.

In the field of micro turbines, R&D work focuses on the stable operation with lean gases, promising applications using high temperature level of low emissions exhaust gases, and the development of virtual power stations powered by micro turbines.

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Solar Driven Refrigeration

Thermally driven refrigeration systems supply cold energy using heat as motive energy. This heat can be obtained from solar energy, combined heat and power systems or waste heat sources.

Fraunhofer UMSICHT optimizes the design and the operation of refrigeration systems focusing on innovative processes which are run through vacuum tube or parabolic through collectors, and promotes the development and standardization of new thermally driven processes as the steam jet ejector chiller.

Since August 2002, a solar driven H₂O-LiBr-absorption chiller has been run at the premises of Fraunhofer UMSICHT, providing the cold energy for air conditioning and process application. Extending the cold supply systems by an ice-slurry refrigeration and steam jet ejection chiller is being planned.

Guiding Beams – not only well-known and popular from StarTrek and similar movie pictures: in refrigeration technology, laser beams ensure the correct mixing in the Ice Slurry plant. Only this way the coolant CryoSol® can efficiently store the cold and reduce load peaks

Utilities of Refrigeration

In addition to an economical heat production and an efficient refrigeration, thermally driven cold supply systems require optimized utilities for refrigeration (in particular re-cooling, process water), an optimized control concept and operation (for example power management, free cooling). Fraunhofer UMSICHT offers suitable engineering and consulting services founded on analyses, in addition to new processes.

Phase Change Materials and Advanced Fluids

Storage and distribution innovations are required particularly for energy-intensive cooling. Fraunhofer UMSICHT examines the use of advanced fluid and phase change materials for storage and transport of cooling energy. Further studies are conducted on the use of paraffin for latent cooling storage from 6 to 12 °C and the production and use of ice slurries for the cooling distribution from -10 to 0 °C. An ongoing study is dedicated to the conceptual analysis of new logistic distribution systems for cooling on the basis of mobile cooling storage. Currently, the laboratory of Fraunhofer UMSICHT is being equipped with an ice slurry cooling system for the air supply.

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Steam jet cold and parabolic through collectors for innovative cold production (Source: DLR Köln-Wahn)

Finalization of the Process Development and Novel Applications

Supported and sponsored by the German Federal Ministry of Consumer Protection, Food, and Agriculture in cooperation with industrial partners, a technology for biomass conversion based on fluidized bed gasification has been developed for a study initiated in 1994. The integration of proven process components for the conceptual design, as well as the development of the appropriate gas conditioning system and accurate optimization work were the road to success. Several continuous test runs at a pilot plant on the institute's premises have approved the performance and efficiency expected of the process.

The required gas quality may be achieved without wet scrubbing through catalytic reforming of inherent tars, which also increases the heating value. The combination of the CFB-gasifier's appropriate operation, the catalytic reformer and a fabric bag filter guarantee a constant level of residual inherent tars in the gas below the critical value of 50 mg/m^3 (s.T.p.). A 4,000 hour-test run with the catalytic reformer is currently prepared to be carried out at a commercial gasification plant.



Pre-commercial demonstration plant with 5.0 MW fuel input, corresponding to $1.45 \text{ MW}_{\text{el}}$

The gasification technology is predominantly designed for uncontaminated biomass feedstocks such as wood chips, tree bark, lumber shavings etc. The fluidized bed technology yields a very constant gas generation. The target power range for commercial application is 10-15 MW fuel capacity which equals 14,000-21,000 t/a bio mass consumption. This yields a 3-5 MW power output. Economic assessments reveal attractive potential bio fuel prices for this technology if the green power revenues may be completed by significant heat sales. Further testing and demonstration work is going to start in 2003 when launching the construction of a pre-commercial plant.

Applications Development

Fraunhofer UMSICHT will focus future activities on novel applications for fluidized bed gasification such as sewage sludge or RDF gasification and combination of gasifiers with kilns. Micro turbines might be another suitable application.

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Modern Processing of Energy Data

EnergyDataManagement aims at decision support in a complex techno-economical field. Modeling in optimization, prognosis and simulation is based on data acquisition, analysis and aggregation. These tasks are integrated in the software system "EnergyManager", which has been successfully implemented at the DREWAG Stadtwerke Dresden in 2001. "EnergyManager" provides resource planning tools in scheduling, contract management and trading. Currently, this tool is extended by a method for the automatic optimization of energy portfolios.

In the field of district heating, an algorithm for the aggregation of network structures has been developed, which allows for the optimal control of dynamic processes like heat storage in the network.

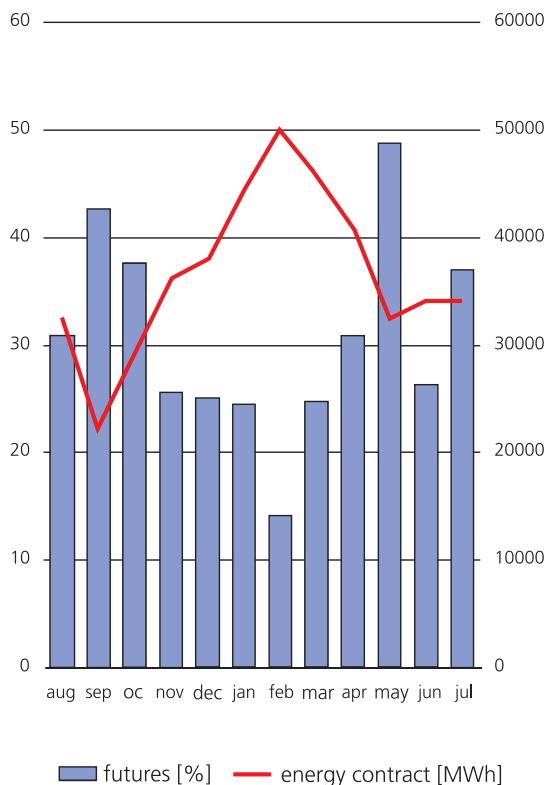
GIS and Energy Information Portals

Fraunhofer UMSICHT actively designs energy information portals for partners from the energy industry (e.g. energie.de, nahwaerme-forum.de) and elaborates geographical information systems (GIS) using data systems presenting space-oriented energy information.

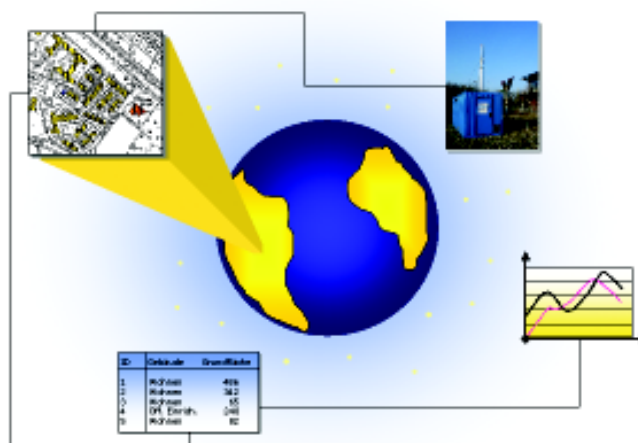
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Schedule of energy contingents and futures



Portfolio-Optimization – optimal application of energy supply contracts and futures



Evaluating energy data and represent them for "points of interest" in maps

Energy Management, Concept Evaluations, Gas Separation

Active climate protection requires the reduction or removal of environmentally hazardous emissions. Carbon dioxide separation and attachment contribute to the emissions reduction equally as economical energy use, efficient application of existing utility systems, decentralized couple supply, regenerative energies as well as efficiency optimization using innovative energy engineering technologies. Fraunhofer UMSICHT develops and examines processes, operation and control measures for the decrease and prevention of greenhouse gas emissions. Studies are performed on the applicability of substitute fuels, including the evaluation of new processes and sub-processes as well as the development of gas separation process technologies.

Increasing Use of Coal Mine Gas (CMM) in the Ruhr Area

Coal mine gas derived from hard coal pits contains methane which has a high relative global warming potential (GWP) of 21. Fraunhofer UMSICHT has initiated the use of coal mine gas from abandoned mines, which was expanding significantly after

Support in allocation/stock-taking, screening of technical processes for emissions reduction and support in emissions trading (source: DBU)



Emission Trading, joint implementation und clean development mechanism – emissions reduction by using flexible mechanisms of the kyoto-protocol (source: DBU)



the Act on EEG came into force (EEG = Erneuerbare Energie Gesetz = Renewable Energy Law, which guarantees prices for power production).

In late 2002, there was an installed power supply of around 58 MW in the Ruhr area. Greenhouse gas emissions equaling around 1.7 million tons of CO₂ p.a. could thus be prevented. Future revenues from emissions trading will enable even small projects to yield major benefits. Inquiries from throughout the world, in particular from Eastern European countries, demonstrate the international interest in this technology. Fraunhofer UMSICHT supports the "Landesinitiative Zukunftsenergien NRW" (Governmental institution for developing future energy projects) and the "Interessenverband Grubengas e.V." (Association of Coal Mine Gas).

Emissions Trading

Fraunhofer UMSICHT is a founding member of the Bundesverband Emissionshandel (German Emissions Trading Association) and offers consulting services for the start-up, development, approval, and trading of emissions reduction projects. This includes the economical and ecological assessment of the projects as well as the preparation of baseline studies and applications for project certification on customers' order.

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Energy Consulting, Energy Analysis and Innovative Energy Supply Concepts

Innovative power supply concepts bring added value to the customer. Environmental protection, cost reduction, optimized operation and capital investment grants are the predominant objectives of consulting services offered by Fraunhofer UMSICHT. Project evaluations are performed to ensure security for project initiators and funding parties, concentrating on feasibility studies, expert auditing reviews, and risk assessments on energy, economical and process technology aspects.

Early integration into current planning and assessment of conventional and innovative solutions open large optimization potential. Power-heat-cold co-generation (CHP), heat pumps, thermal cooling, geothermal potentials, line-bound heating and cold supply as well as waste heat recovery are among the core competencies of Fraunhofer UMSICHT.

Another benefit is the co-operative work among UMSICHT departments which facilitates the elaboration of all-in-one concepts, covering the fields of energy, water, wastewater, and waste technologies through safety at work and fire protection.

For special-contract customers and large-scale, decentralized production plants such as wood power stations, tailor-made concepts on demand have yielded optimized results both in economical and technological respects. Fraunhofer UMSICHT will continuously

adjust its services to the requirements of specific energy customers (e.g. recreational centers, sports stadium operators, hospitals, zoological parks, planners of restructuring projects).

More than Consulting: Innovative Technological Services

Thorough and well researched information on time, place and causes of energy demand, compiled in energy analyses is needed for transparency and for optimized operation. The range of Fraunhofer UMSICHT comprises leakage search during operation, pipeline simulation, a pressure surge simulation, and GIS mapping for water and long-distance heating pipelines.

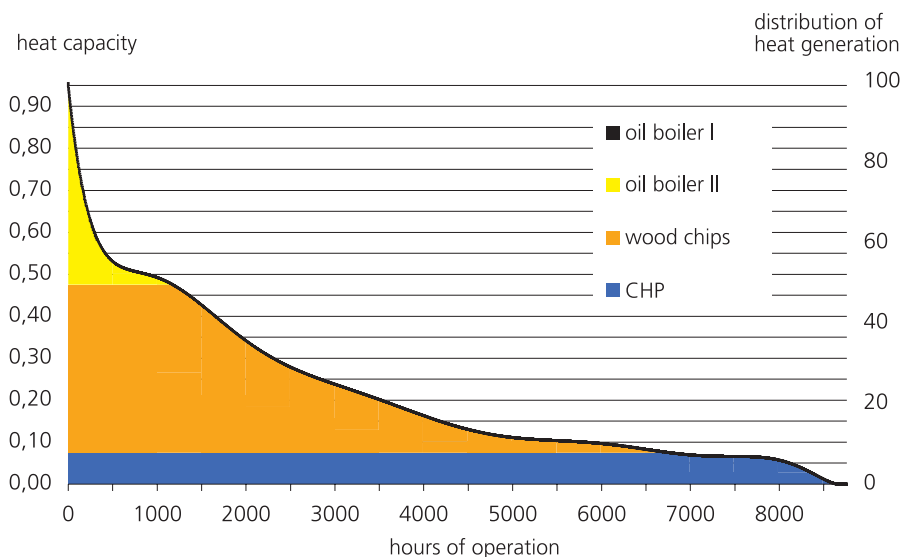
Starting from the results of energy analyses, follow-up planning is performed project-specifically. Specially trained engineers at UMSICHT elaborate the detail planning and control the testing and supply of innovative systems.

In 2002, Fraunhofer UMSICHT cooperated in the construction of four additional biogas plants and could thus significantly participate in encouraging biogas utilization in power supply.

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coupling of two local heat networks



Optimized energy costs through efficient application of conventional and regenerative boilers



The department of knowledge and technology transfer is dedicated to bringing the broad range of innovations elaborated at the Institute to the market.

The distribution to the market is performed through the transfer of know-how (vocational training), through technology transfer across the national borders (international project development) and through application of our know-how and experience in spin-off enterprises. On request, direct consulting services are offered to customers in the areas of R&D projecting and the implementation of innovative techniques.

Department of Knowledge and Technology Transfer



On the path to
transnational and
interdisciplinary
knowledge transfer

Globalization and the growing international competition represent the challenge of today's economic and cultural activities. Scientific establishments as well are subject to the competition resulting from the positioning and asserting in an international environment. Establishing the department of "International Project Development" at Fraunhofer UMSICHT in 1997 has been one measure to respond to this development.

The department focuses on internal and external services in the fields of scientific and economical co-operation responding to the requirements of the scheduled enlargement of the European Union. The German-Polish Research Network INCREASE and the North Rhine-Westphalian Initiative for Foreign Economy are networking platforms to ministries, scientific and economic organizations providing assistance to internal and external customers.

Over the past few years, activities at Fraunhofer UMSICHT have been focusing on regions in Central and Eastern Europe, whereas now these activities are being expanded to other countries.



3rd INCREASE-seminar
in Warsaw, June 2001
(left to right: Prof. Górak,
Prof. Buzek, Doc. Buzek,
MR Schlicht)

INCREASE

"Addressing current environmental problems and contributing to the improvement of German-Polish relations through co-operation in collaboration projects". This is the guideline of INCREASE (**I**nternational **C**ooperation on **R**esearch in **E**nvironmental Protection, **P**rocess **S**afety and **E**nergy Technology), established at Warsaw in 1997. Today, over 30 scientific institutions of both countries are incorporated in the INCREASE network.

A variety of projects in co-operation or on behalf of the industrial partners from both countries have been carried out by the INCREASE members. The topics are mainly related to the environmental protection and energy technologies sector. Two head offices – under the direction of the chairmen of the Steering Committee, Prof. Dr.-Ing. Andrzej Górak (University of Dortmund), and Prof. Dr.-Ing. Stanislaw Ledakowicz (TU Łódź) – are coordinating the INCREASE activities.

Fraunhofer UMSICHT is involved in a variety of German-Polish collaboration projects and is the German Head Office of INCREASE. The Polish Head Office is based at the Polish Academy of Sciences in Gliwice.

North Rhine-Westphalian Action Program for CEEC countries

The North Rhine-Westphalian Action Program for CEEC countries is a bilateral initiative between political institutions and industrial enterprises in North Rhine-Westphalia (NRW). Work is realized in public-private-partnership (ppp) structure, so far unique, which serves as the networking platform for enterprises in the environmental, transport and energy technologies sectors based throughout NRW which collaborate closely with the Ministry of Economic Affairs, Energy and Transport (MWMEV) of the State of NRW.

The objective of the initiative is facilitating the initiation of projects in the CEEC countries Hungary, Czech Republic, Romania, and Poland, to support the IN.NRW AG partners, as part of the ppp structure. The shareholders are supported in a project group, consisting of four enterprises, and co-ordination agencies hosted in the target countries. The main working areas are environmental and energy related sectors, transport and funding issues as well as issues related to political implementation.



Representatives of the Moravia Silesia region, (Czech Republic) visiting the UMSICHT institute:

Dipl.-Ing. Wantula, Vice Regional President (3rd from the left),
 Doc.RNDr. Ing. Mrázek (5th from the left), Chairman of the
 International Committee of the Region Parliament; Mayor of
 Opava, and Dipl.-Ing. Tosenovský, President of the Region of
 Moravia-Silesia, Mr Helmut Czichy, Head of the Environmental
 Protection Board of the City of Oberhausen (at the right)

The political basis of the CEEC initiative is the "Agreement on Mutual Economic Co-Operation" that is being issued jointly from the State of NRW and the target countries or regions. Since the launching of the initiative in January 2001, a couple of agreements have been signed. According to the requirements outlined therein, early project information is being researched and made available to the IN.NRW AG members. Additional practical support to the enterprises is supplied through the provision of qualified local project partners. The shareholders may profit from many competitive advantages.

In spite of the relatively short time which has elapsed since this CEEC initiative was created, work has already shown substantial success. One of the IN.NRW AG members, a well-known engineering agency, succeeded in placing a large order in one of the target countries. Other shareholders expect first offers as a result of an application submitted jointly with local business partners – first successes that are well suitable to demonstrate that the program has been well introduced. As a result, 14 new enterprises could be won to buy shares in the IN.NRW AG to profit from the many advantages offered.

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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 Pfinzthal. 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. Interdisciplinary working groups are formed among students to work on process engineering related problems set by the industrial partners. The workshops are co-

ordinated by UMSICHT and tutored by the Institute's experienced engineering and research staff.

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.

In March 2002, the first official TheoPrax® project was organized jointly by Fraunhofer UMSICHT, the Chair of Environmental Technology at the University of Dortmund, the Elsa-Brändström-Highschool in Oberhausen, and the Babcock Borsig Energy GmbH. The project was performed in a two week in-house workshop at UMSICHT: seven students enrolled at Dortmund university and three junior students of the Elsa-Brändström-high school collaboratively worked out a Germany-wide overview of biogas processing plants and biogas technologies currently available.

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TheoPrax®



Senior and junior students are taught to comprehend real world work

In collaboration with the FernUniversität Hagen (Open University), a German distance learning institution, 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 as well as for scientists, economists and graduates from humanities and law. The students are trained in interdisciplinary skills, which are indispensable for solving complex environmental problems.

From the winter term of 2002/2003, the "Master of Environmental Sciences" degree is being offered to students. Infernum is to date the only Master study in the field of environmental studies available in Germany.

infernum

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.



Interdisciplinary cooperation is a prerequisite for sustainable environmental protection



In-house seminars that are regularly conducted at Oberhausen offer the opportunity to meet fellow students and teaching staff, and to deepen the knowledge gained through interdisciplinary workshops and lectures. In 2002, a total of six meetings were held and have been met with great success among all participants.

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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Project Funding

In addition to the classic services offered in research and development, the procurement and access to funding resources is a rather newly emerging field of activity.

However, the term project funding here is not to be regarded in the narrow meaning of the word, describing the direct participation of a sponsor in a project to ensure the credit granted via the cash flow. As a matter of fact, the range of capital procurement, that may be required to perform research and development services encompasses a wide variety of activities, such as venture capital, public funding or loans granted by banks that have to be provided in order to make project work start.

Besides the "economical" rates of return, future project work will be influenced increasingly by ecological criteria (as formulated in the Kyoto Protocol). This is reflected already now in the specialization of some banks or in the increase of relevant funds.

Successfully realizing both technologically and economically challenging projects in collaboration with Fraunhofer UMSICHT thus means to face the rising demands. To this end, we offer solutions tailored to the needs of our R&D customers, meeting requirements such as energy efficiency, production-integrated environmental protection and the safe management and implementation of industrial processes.

Additionally to public and private sponsoring, numerous contacts to banks, "Business Angels" as well as to investment and venture capital companies have been established for the joint provision of capital with customers, which will essentially benefit the realization of projects.

Project Funding



Projects and ventures to become building blocks and not stumbling blocks – Fraunhofer UMSICHT offers consulting services in transnational project funding solutions

For a showcase European project, targeted at the generation of renewable energies, the provision of capital has to be realized through participation of an investment company. The actual revenues of the project may only cover the operating costs. Consequently, additional income has to be achieved, in particular by the creation and marketing of emission certificates, in order to make a potential investor participate in sponsoring. Multilateral meetings to discuss these issues are currently under way.

Spin-offs

The support of spin-offs from research institutions is a core objective of the Fraunhofer Society. Complementary to the classic activities of contract research, this is to pave new paths for the transfer of know-how and the marketing of research results.

The measures to facilitate spin-off enterprises range from raising special funds for first equipment to the procurement of capital to co-finance further training for spin-off enterprises in the fields of business planning or market research.

The outsourcing of know-how or scientific results from Fraunhofer institutes is of significance, and also necessary, in those cases where a marketable product has been achieved. The marketing of products in serial production may not be executed in-house, as given by the Fraunhofer rules and regulations.

Spin-offs with industrial partners are realized in those cases where common research results are to be brought to the market.

Currently, there are 10 spin-off enterprises from Fraunhofer UMSICHT which are present on the market.



"Congratulations" – The idea is excellent, business plan and financing are perfect – everything is ready for launching the enterprise

Spin-offs

The most recent spin-off enterprise is the DataPool Engineering GmbH company in Oberhausen, which is dedicated to software development, system analysis, and the related IT consulting services.

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Issued Patents:

Process for the production of nano-scale solid materials in powder form (Weber)

Arrangement for Preventing Undesirable Pressures when Blocking off or Throttling the Transport of Liquid in a Pipeline (Prasser, Schlüter, Dudlik)

Diaper with a pH-sensitive super-absorber (Groß, Wack, Althaus)

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DataPool Engineering GmbH, Oberhausen

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ENR – Energiegesellschaft nachwachsende Rohstoffe mbH, Dorsten

Planning and set-up of biogas plants, including consulting, concession, and funding; agricultural nutrient balances and area management; commissioning and management

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Innovative solutions concerning plastics and recycling; comminution technology; extrusion, injection molding; elastomer recycling; material analyses; test technology; recycling concepts

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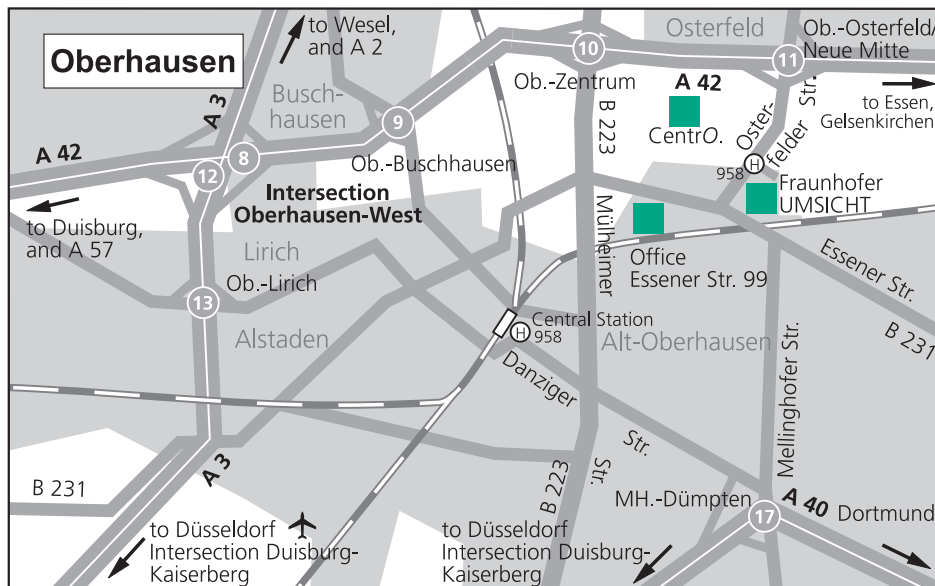
Product development and optimization of plastics components with numerical analyses; FEM structure analyses, injection molding analyses; construction

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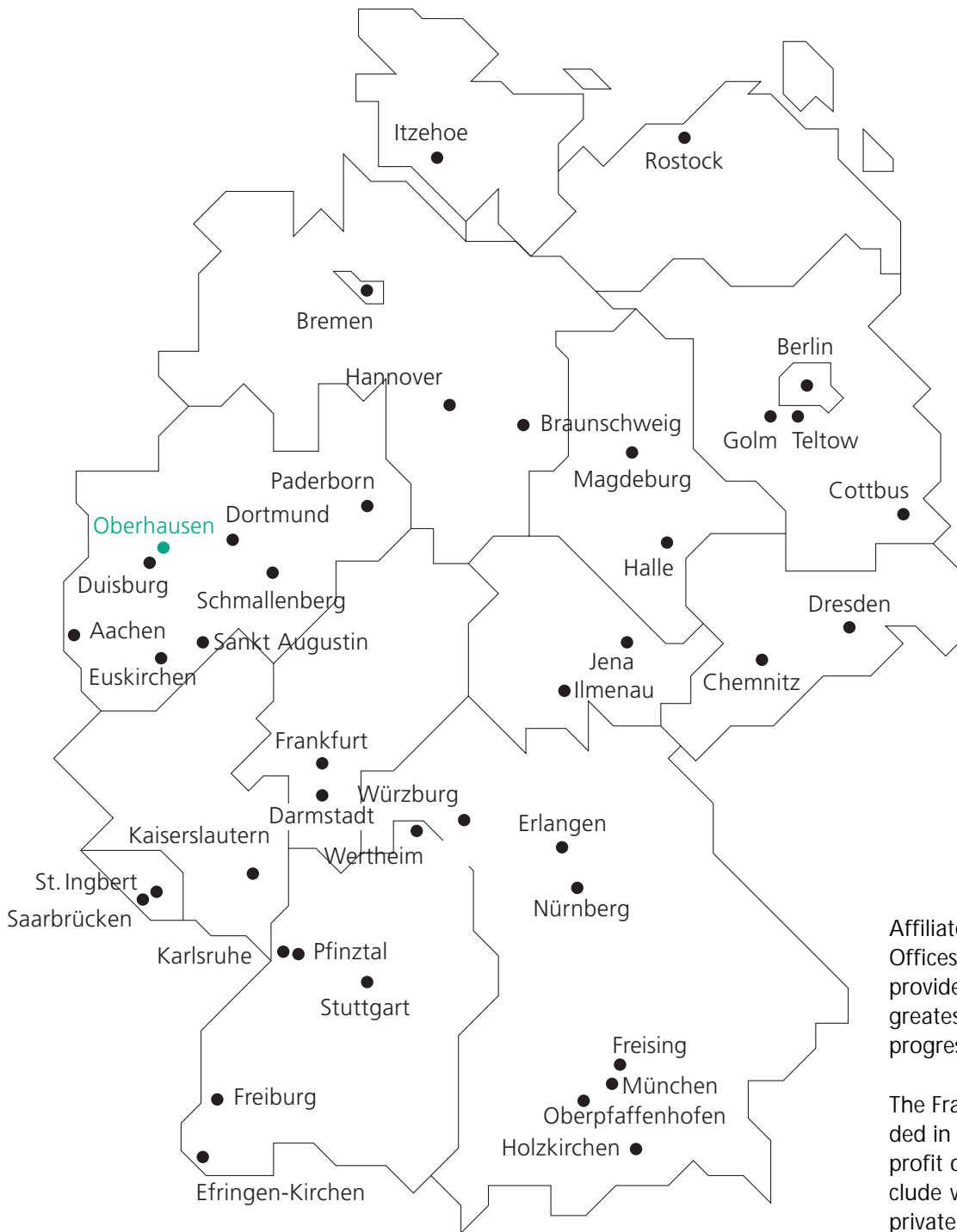
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