



Fraunhofer

UMSICHT

FRAUNHOFER INSTITUTE FOR ENVIRONMENTAL, SAFETY, AND ENERGY TECHNOLOGY UMSICHT



**TECHNOLOGY
THAT PAYS!**

FRAUNHOFER UMSICHT



Fraunhofer UMSICHT develops applied and custom-made process engineering technologies. Assuming a leading position in the fields of environmental and material technologies, process engineering and energy technology, Fraunhofer UMSICHT is committed to sustainable economic development, environmentally friendly technologies and innovative approaches designed to improve the standard of living and to promote the innovation capacity of the national economy.

Four key research areas

To strengthen its position in the research landscape, the institute has focused its activities on four key research areas, these are:

- “Biorefinery – Products from Renewable Resources”,
- “matfunc – Particles, Materials and Membranes with Functionality”,
- “Modular Energy Technologies – Flexible Solutions for Sustainable Energy Systems”,
- “Information Networks for Process and Energy Technology – Utilizing Dispersed Knowledge in Value Added Chains”

This thematic scope is designed to give interdisciplinary scientific impulses across the business units. It is in these key areas that the institute’s profile is adapted to the rhythm of social and economic changes and focused on promising new lines of research.

Eight specialized business units represent the precisely tailored combination of products and R&D services responding to today’s challenges of the market segments addressed. Modern project management methods are used to successfully realize innovation projects. The key research areas are thus continuously adapted to changing demands in a “bottom up” way.

Together with industrial and public customers, Fraunhofer UMSICHT develops and researches the latest know-how and transfers it into industrial applications and marketable products. No matter whether the customer is a small or medium-sized enterprise, a major enterprise or a public institution, UMSICHT can guarantee a one-stop-shop service.

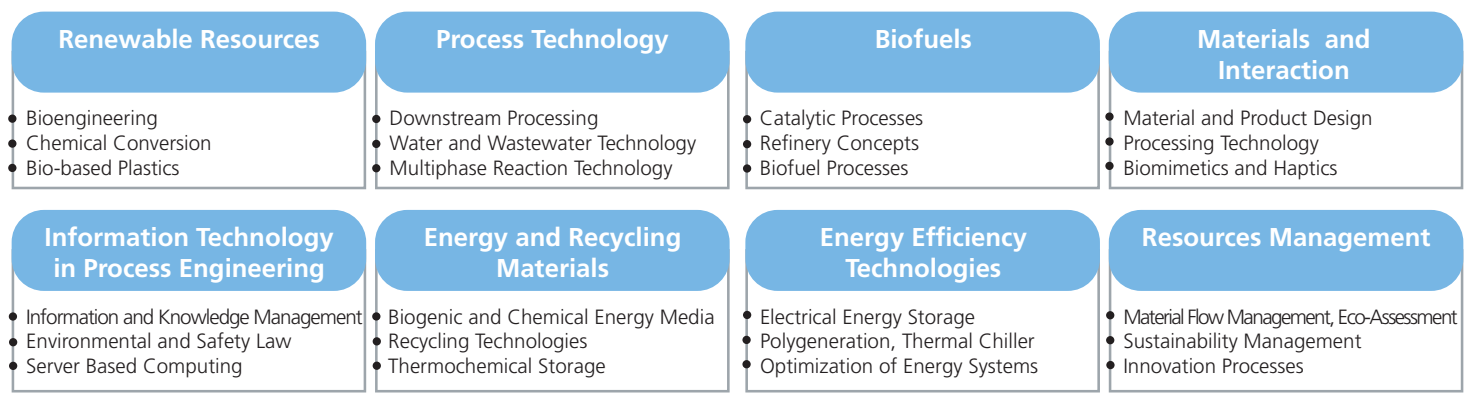
Starting from the project idea over proposal procedures to the development and market introduction, Fraunhofer UMSICHT offers its clients R&D expertise and thus provides them with competitive benefits and opens up international markets for them.

As a member of the Fraunhofer-Gesellschaft, the institute follows the line of applied, cutting-edge research and development.

Since its foundation in 1990, Fraunhofer UMSICHT has been engaged in the structural change of the city and the region acting as a catalyst for science and economy. This has been done through technology transfer, spin-offs and the set-up of R&D networks. The institute’s international activities presently focus on European countries.

BUSINESS UNITS

Business Units



Willich Branch

At its site in Willich, Fraunhofer UMSICHT offers broad customer and future-oriented services in the areas of compounding and development of materials. Biodegradable plastics, polymers from renewable resources, nanocomposites and recycling plastics are developed systematically and produced in pilot and small-scale series. Process optimization, analytics and test engineering, round off the portfolio of this branch.

You will find the contact data of our branches on the back of this brochure.

Training Center/Fraunhofer Academy

We qualify specialists and business executives with the aim of strengthening Germany's innovative potential. The interdisciplinary distance learning program for environmental sciences infernum – "official project of the decade of the united nations for the education for sustainable development 2005 - 2014" – imparts environmental know-how from more than 10 disciplines and qualifies its students – who are mainly enrolled in the program parallel to their job – to think and act in interdisciplinary ways. The master's degree infernum is offered in co-operation with the FernUniversität in Hagen (Open University) and is part of the Fraunhofer Technology Academy. "www.academy.fraunhofer.de" or »www.umweltwissenschaften.de"

University Cooperations

As an institute active at the interface between university research and industrial practice with application and market-oriented services and products, we focus on strategic partnerships with universities and technical colleges of applied science in Germany and Europe.

This way we effectively include basic research in our projects.

Competence center for hydraulic turbomachinery, "Pump Center", Bochum

The first competence center for hydraulic turbomachinery in Germany, sponsored by the Mechanical Engineering faculty of the Ruhr University of Bochum and Fraunhofer UMSICHT, is active in networking and concentrating know-how from the areas of process and energy technology, materials science, production technology, electrical motor power engineering, water-resources technology, measurement and control technology, and computer science. The objective is to establish the subject of hydraulic turbomachinery as an attractive studies major in mechanical engineering in order to provide the market with highly qualified specialists in the future.

RENEWABLE RESOURCES

Inspired by nature



Focal points

- Bioengineering
- Chemical Conversion
- Bio-based Plastics

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+49 208 8598-1227

Industrial sectors and target groups

- Agriculture
- Energy suppliers
- Recycling and waste disposal industry
- Chemical industry
- Food industry
- Plastics processing industry
- Packaging industry
- Automotive and automotive supplier industry

The primary objectives of sustainable development are the reduction of environmental pollution and the conservation of finite fossil fuels. These goals can be achieved by using renewable raw materials. Only by understanding and preserving nature, we will be able to benefit from its resources in the long run.

Our Competencies

We develop and optimize technical processes for the production of materials and for the generation of energy from renewable resources and biogenous residues. Our strengths lie in the application of biotechnological processes and chemical conversion steps as well as in plastics technology.

We focus on environmentally compatible generation of power, heat and cold, on sustainable production of platform chemicals and on the development of novel materials and products. Our laboratories and pilot plants allow us to scale-up from first samples of new materials to small scale production.

Our R&D-services

- Projecting and scientific consulting for biogas plants
- Development and optimization of biotechnological processes, downstream processing
- Research of new chemical synthesis pathways and production of new polycondensates
- Material and product development
- Pilot and small scale production of polymer compounds and products
- Material characterization for polymer materials
- Analysis of biodegradability of substances, materials and residues
- Market and feasibility studies, technological assessments

PROCESS TECHNOLOGY

Our theory is practice



The various disciplines of process technology are increasingly linked. The need for integrated technologies and processes which perform not one but many different tasks simultaneously is growing due to technical, economical, and ecological reasons. Especially where the utilization of renewable resources in biorefineries and in white biotechnology is concerned efficient processes are gaining in importance.

Our Competencies

We develop and realize system solutions for process technology using pilot plants in the laboratory and the technical shops as well as model-based simulation software. In doing so we look at the process chain as a whole: from the idea to the commercial process and from the raw material to the utilization of residues at the end of the product life cycle.

Our strengths lie in membrane, separation and reaction technology as well as in pipeline technology. Our technical services range from closing of water cycles, wastewater treatment, resource recovery from process flows and thermal process engineering up to an extensive know-how in the areas of multiphase systems and downstream processing for white biotechnology and biorefineries.

Our R&D-services

- Development of microsieve and membrane processes
- Process development for white biotechnology and biorefineries
- Process design for downstream processing
- Extraction of phyto-materials
- Water, wastewater and pipeline technology
- Reaction calorimetry
- Analysis, development and optimization of multiphase chemical processes
- Process modeling and simulation, computational fluid dynamics (CFD)

Focal points

- Downstream Processing
- Water and Wastewater Technology
- Multiphase Reaction Technology

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Industrial sectors and target groups

- Food industry
- Metal processing industry
- Pharmaceutical industry
- Chemical industry
- Agriculture
- Biotechnology

BIOFUELS

Sustainably mobile



Focal points

- Catalytic Processes
- Refinery Concepts
- Biofuel Processes

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Industrial sectors and target groups

- Agriculture
- Energy industry
- Biofuel producers
- Chemical industry
- Automotive industry
- Plant construction

The discussion about the reduction of CO₂-emissions and limited sources of fossil raw materials leads to an intensified search for economical ways of producing fuels from renewable resources, from biogenous wastes and within the context of multiple usage of raw materials (cascade utilization). A major objective is the comprehensive and sustainable utilization of biomass through the integration of biofuel production into biorefinery concepts.

Our Competencies

We develop and optimize production processes for biofuels. This includes biodiesel as well as second generation biobased diesel, gasoline and biobased fuel derived from waste or left-over fats and oils like used frying oils.

We develop strategies to safeguard the future supply of fuels, chemicals, and energy in a sustainable and competitive way. We participated in the Biofuels Research Advisory Council (BIOFRAC), and are also an active member of the European Biofuels Technology Platform.

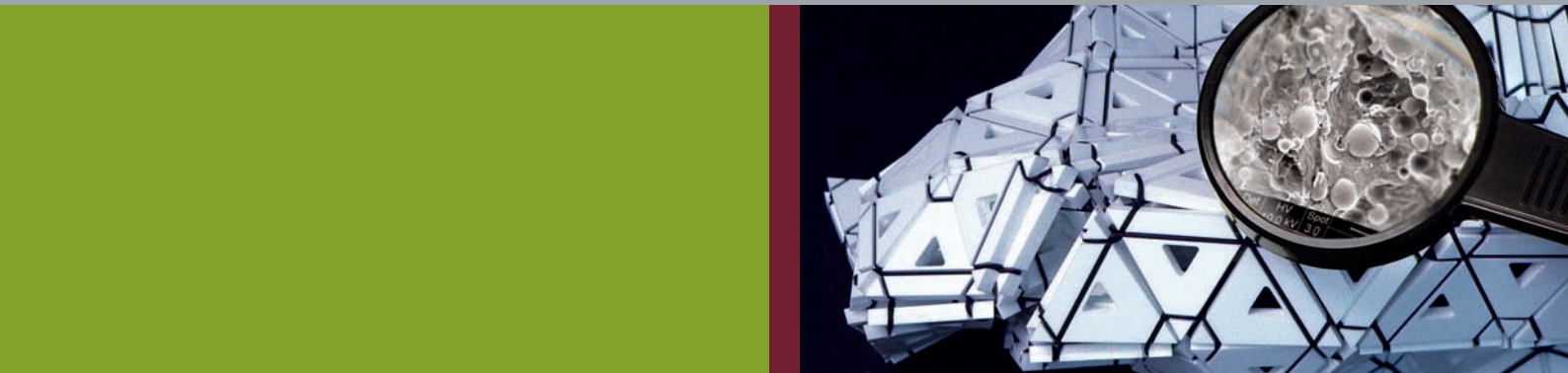
Our services cover the entire range from basic research to process-technological concepts of plants and cost estimations. Our contribution to sustainable mobility and flexibility is founded on comprehensive expertise in the field of catalytic synthesis of chemical products and fuels from renewable raw materials.

Our R&D-services

- Chemical process development on mini-plant and pilot plant scale (also under pressure)
- Catalyst screening and catalyst prototype development
- Integrated concepts for utilization of biofuels (refinery and biorefinery)
- Economic assessment of processes
- Optimization of reaction engineering and separation processes for biofuels and related by-products
- Development of analytical methods for the characterization of reactants, intermediates and final products
- European networking and support of project development (e.g. FP7)

MATERIALS AND INTERACTION

From the idea to perception



Plastics and biomaterials can be customized in many different ways. A wide range of functions can be implemented by furnishing such materials with intelligent additives and particle systems. The environmentally compatible yet simultaneously user-friendly formulation of the material system poses an important future challenge.

Our Competencies

Based on customer-specific requirements, we develop concepts for new materials, products or machine technologies, and test their industrial feasibility with regard to ecological and economical considerations.

Special focus is on the features and functions of plastics, wood, and leather with additives and particle systems. Apart from the functional properties of the materials, we also consider their sensory and aesthetic perception to the user. We develop efficient process and machine technologies for further processing materials. Based on innovative materials, we create novel products and applications, and test them with virtual and actual prototypes.

Our R&D-services

- Strategies for biomimetic and sustainable material innovations
- Development of additive, particle, and material systems
- Product development and industrial design (building construction, automotive, consumer products)
- Component design and rapid prototyping
- Sample production and process optimization in the fields of compounding, comminution, micro-encapsulation, impregnation, spray coat methods, and generative manufacturing
- Use of ultra-critical fluids as auxiliary process aids
- Simulation, testing, and analysis of plastics, wood, leather and functional materials

Focal points

- Material and Product Design
- Processing Technology
- Biomimetics and Haptics

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Industrial sectors and target groups

- Plastic processors
- Product developers, industrial designers
- Materials and additives manufacturers
- Sealing and surface technology companies
- Manufacturers of processing technologies

INFORMATION TECHNOLOGY IN PROCESS ENGINEERING

Using informations intelligently



Focal points

- Information and Knowledge Management
- Environmental and Safety Law
- Server Based Computing

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Industrial sectors and target groups

- Operators of waste treatment plants
- Operators of wastewater treatment plants
- Manufacturing companies
- Chemical industry

Every five years the world-wide accessible knowledge doubles. Intelligent target group-oriented information management can help to quickly separate relevant from non-relevant information and thus plays a central role in today's production value added chains.

Our Competencies

According to forecasts of the EU Commission 80 % of technologies applied today will be substituted by new technologies within the next 10 years.

Value added chains in companies are closely connected to the supply of information. Often, optimizations cannot be realized without a sufficient data pool.

The close linking of operational processes to specific organizational and technical information in connection with ergonomic user interfaces bridges existing information gaps. For this purpose service-oriented architectures (SOA) are created and provided in form of application service providing (ASP) which enables the access from any location and from any client.

Our R&D-services

- Data extraction
- Data consolidation
- Data visualization
- Customer-specific system analysis and software development
- IT-mapping of organizational structures and workflow management

ENERGY AND RECYCLING MATERIALS

Resources for our future



Growth of population and economy, rising prosperity and global competition result in a scarcity of energy and resources and a rise in price. Thus, in the future it will be essential to use fuels more effectively and to utilize renewable energies. It is also important to find ways to store energy or to show alternatives for using secondary materials for resource recovery.

Our Competencies

The main objective of our work is to develop methods for energy and chemical transformation. The exploitation of new energy sources and resources is one of our key competencies.

Our expertise lies in different fields such as biomass, synthesis, sorption, catalytic processes, chemical heat storage, characterization of fuels or in the application of geographic information systems.

Sorptive and catalytic gas processing, catalytic conversion of synthetic and biogases as well as the development of methods for chemical energy storage and for the recycling of "critical materials" are primary focus points of our work. New processes are always developed with regard to economic and ecological aspects as well as sustainability aspects.

Our R&D-services

- **Biomass to energy/waste to energy**
 - Mechanical conditioning of biomass and alternative energy sources
 - Thermochemical conversion (combustion, gasification, pyrolysis)
 - Biogenic gases (chemical analysis, conditioning, feed-in and usage)
 - Sampling and chemical analysis of biomass, wastes, residues and slags
 - Characterization of fuels
- **Catalytic processes**
 - Cleaning and chemical conversion of synthetic gas
 - Conditioning and cleaning of biogenic gases
- **Thermochemical storage**
 - Product and process development
- **Development of recycling systems**
 - Process development and evaluation

Focal points

- Biogenic and Chemical Energy Media
- Recycling Technologies
- Thermochemical Storage

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Industrial sectors and target groups

- Energy supply
- Recycling and waste management industry
- Plant construction
- Chemical industry
- Sewage treatment plants, landfill sites, fermentation plants
- Municipalities
- Small and medium enterprises

ENERGY EFFICIENCY TECHNOLOGIES

Smart energy supply



Focal points

- Electrical energy storage
- Polygeneration/ORC
- Thermal cold generation and storage
- Energy system optimization

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Industrial sectors and target groups

- Power supply companies
- Operators of renewable energy plants
- Complex energy consumers
- Manufacturing industry
- Companies in the innovation process
- Architects, building planners, technical building services equipment

The objective of our work is the development of new technologies to increase energy efficiency and the integration of such technologies into existing energy systems. We combine the experience and research results from our own laboratories and test benches with simulative tools, with a practical focus always on the market and value added.

Our Competencies

We focus our technological expertise on electrical energy storage, which is required to compensate for fluctuating consumption and discontinuous feed of renewable energies; Organic-Rankine-Cycle (ORC) plants, which can profitably convert hitherto unused exhaust heat into electricity or feed power plants from biogas; cooling plants which provide cold from solar heat or exhaust heat, from the one-family house to district cooling network.

Apart from these key technological areas of development, the entire energy supply concept is systematically optimized. We strive to develop the best possible supply structures for electricity, heat, and cold with an effective operating management.

Our R&D-services

- **Electrical energy storage**
Development of Redox-Flow batteries; testing of Li-batteries and optimization of CAES plants, integration and usage optimization of accumulators in the network
- **Polygeneration/ORC**
Development, optimization, construction of ORC facilities for biogas power plants, solar-ORC or wood-ORC in the performance class 50-200 kW_{el}
- **Thermal cold generation and storage**
Steam jet ejector (SJEC) technology (exhaust heat, solar) and absorption-type refrigeration; solar cooling; cold storage (PCM/PCS)
- **Energy system optimization**
Modeling and optimization of central and decentral energy systems to supply electricity, heat, cold; LowEx

RESOURCES MANAGEMENT

Using potentials



Resources flow into products and services which we need to live, which raise our standard of living and lay the foundation for the future. All resources, no matter whether finite or renewable, must be used in a sustainable way. We offer you the adequate instruments and services to enable an optimal control of materials and energies, knowledge and ideas.

Our Competencies

We investigate the use of materials, energies, goods and knowledge within processes, process chains, and value-added networks. We optimize according to economic, ecological, and technical-infrastructure criteria. Production systems, locations, and regions are the objects of our research and development services. Our objective is to make use of resources so that they lead to profitable progress and innovations.

We combine modern management instruments with knowledge and expertise on resources and technologies. The results flow into strategic studies and consulting services. We calculate contributions to sustainable development of products, processes, services and entire company sites for you and your clients.

Our R&D-services

Research, development, optimization and implementation in the sectors:

- Resource management (e.g. CO₂ balances, carbon footprints, water footprints, and ecobalances, Life Cycle Management)
- Material flow systems (e.g. energy potential analyses, bioenergy plants)
- GIS applications for planning and analyses (e.g. optimization of regional biomass use, site development)
- Roadmaps for strategic decision-making processes (e.g. research agendas)
- Management of research and development projects (national and EU)
- Target-oriented innovation and knowledge management (e.g. technology integration, trend analyses, strategies)

Focal points

- Material flow management, eco-assessment
- Sustainability management
- Innovation processes, networks

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Industrial sectors and target groups

- Waste management industry
- Energy industry
- Water and wastewater industry
- Industry and manufacturing
- Public sector (planning authorities, federal government, state governments, municipalities)
- Banks and insurance companies, investors
- Professional associations and societies, policy-makers

The Friends and Patrons Group (UMSICHT-Förderverein)

The Friends and Patrons Group (UMSICHT Förderverein) supports the applied research in the areas of environmental, safety and energy technology. The objective of the Friends and Patrons Group (UMSICHT Förderverein) is to initiate innovative research and development projects – ideally and by monetary means – at an early stage to open up the access to sustainable technology developments. The focus is on project ideas for environmental, safety, and energy technology in the research areas “biorefinery”, “materials and membranes with functionality”, “decentral, modular energy technologies” and “networks for process and energy technology”.

Join the group! The Friends and Patrons Group (UMSICHT-Förderverein) is open to new members!

You support the local research and development, strengthen their scientific and technical renown and invest in the next generation of economy executives. You will benefit from services which are offered exclusively for members of the Friends and Patrons Group.

UMSICHT Science Award to promote industry-relevant environmental, safety, and energy technology

To promote innovative, sustainable thinking and acting, encourage the fruitful dialogue between science and society, and improve mutual understanding: these are the objectives of the UMSICHT Science Award conferred by the Friends and Patrons Group (UMSICHT-Förderverein) in the rubrics Science and Journalism. Patron of the award: Prof. Dr. med. Dietrich H. W. Grönemeyer as Chairman of the Wissenschaftsforum Ruhr e.V.

www.umsicht-foerderverein.de

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