

ANNUAL REPORT
2020 | 21

A report for you about us,
our products, our services, and
our responsibility for the future.

FRAUNHOFER UMSICHT
PAVING THE WAY TO A SUSTAINABLE WORLD

More Info



More information about sustainability at Fraunhofer UMSICHT
and our responsibility for the future:


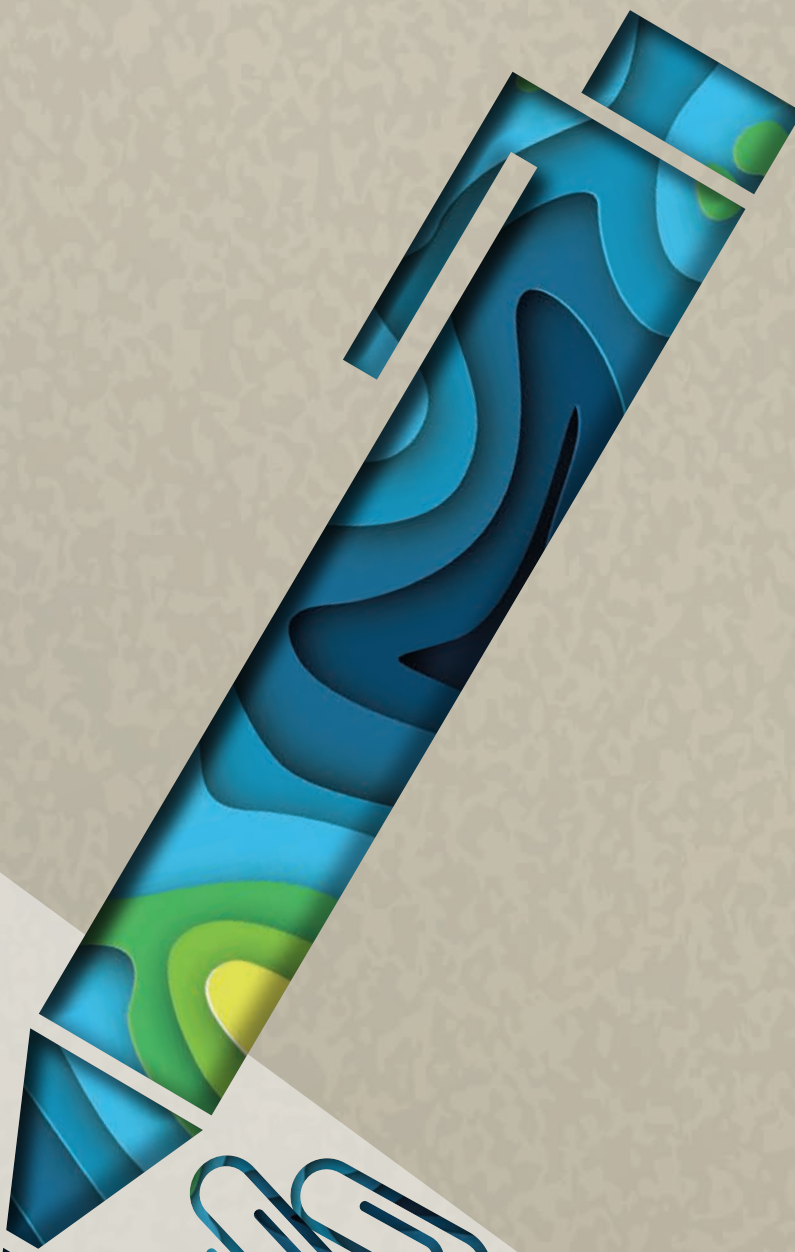
www.umsicht.fraunhofer.de/sustainability 

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EVERYTHING AT A GLANCE.

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PREFACE



WELL-POSITIONED FOR THE COMING YEARS: INTERVIEW ON THE INSTITUTE'S STRATEGY

1 Prof. Dr.-Ing. Gorge Deerberg,
Deputy Director. 

2 Prof. Dr.-Ing. Eckhard
Weidner, Director. 

_____ **Paving the way to a sustainable world: The institute's vision sounds promising.**

Eckhard Weidner: That's how it should be. We are even more committed to sustainability than before. And "we" means the entire workforce – regardless of functions and work areas. After all, our vision was created in a strategy process in which all employees were intensively and transparently involved. We have found this form of involvement to be very positive and are continuing it in four mission teams. People from all areas, ages, and hierarchical levels are represented there to design measures to achieve our strategic goals. And it's great to see how much momentum is created in the process.

Business models are set up that create value for sustainable business. Departments are developing individual team charters that provide the framework for working flexibly in terms of location and time in the context of New Work, adapted to the respective life situation. With a view to our research agenda, there is intensive discussion: What are we working on? Where do we want to build up new competencies? How sustainable are we as an institute?

_____ **Which Sustainable Development Goals (SDGs) does the institute's strategy address?**

Gorge Deerberg: We are above all designing profitable project portfolios in SDG 7 "Affordable and clean energy" and SDG 12 "Responsible consumption and production". But we naturally also cover others of the **17 sustainability goals** with our competencies, and our strategy definitely has the potential to incorporate other SDGs.



____ Sustainability is all-encompassing: How do you approach the topic?

Görge Deerberg: We are pursuing various approaches. For the raw material shift, for example, we are developing technological roadmaps to transform linear economies into circular ones. We are focusing on the bioeconomy as a sustainable economic system that uses biological knowledge to align the resource base within ecological limits. We ask systemic questions and clarify how an industrialized country like Germany supplies itself with resources and energy. For this process of change to be successful, politics, business, science, and society must all pull together. That is why we focus on participation in our projects and provide impetus for new ways of thinking and sustainable technological solutions.

____ What were your highlights of the past few months?

Eckhard Weidner: My appointment as spokesperson for the new **Fraunhofer Group for Resource Technologies and Bioeconomy** springs to mind, which I am looking forward to building up. And, of course, the awarding of the Joseph von Fraunhofer science award two years in a row: for fire-resistant glass in 2020 and for redox flow batteries in 2021.

Görge Deerberg: Another highlight is the positive feedback on the **Carbon2Chem® joint project**, which has entered its second phase with funding from the German Federal Ministry of Education and Research (BMBF). There - using renewable energies – unavoidable carbon dioxide emissions from the steel industry are converted into raw materials for the chemical industry. Incidentally, this is a process that can also be transferred to other industries. Last but not least, despite all the challenges of the coronavirus pandemic, I was particularly impressed by the commitment and team spirit of our employees. Keep it up!

Cordial greetings

Eckhard Weidner Görge Deerberg

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More Info



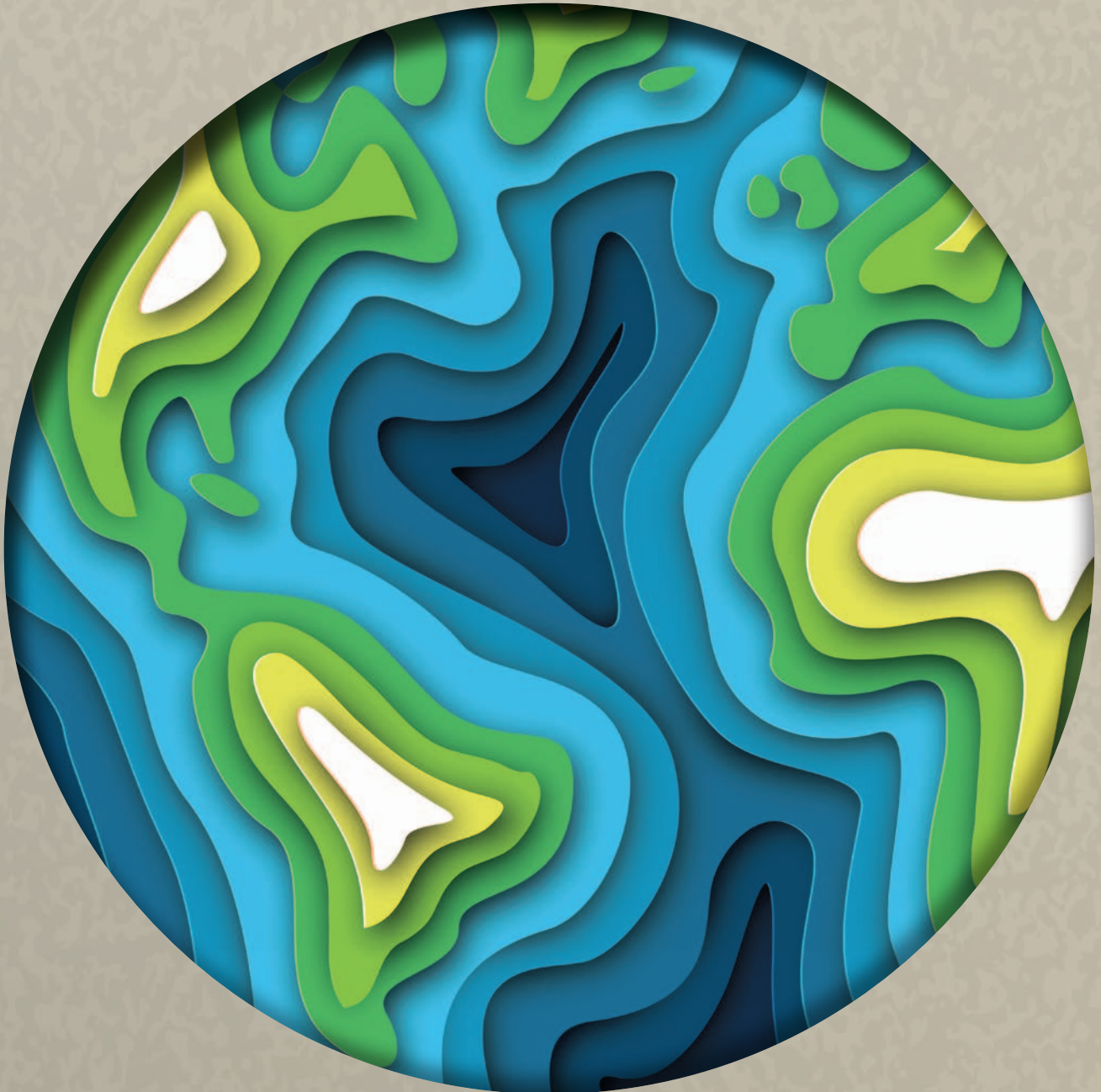
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More Info



OUR INSTITUTE



THE BASIC DATA OF FRAUNHOFER UMSICHT.
Profile, Key Performance Indicators, Organizational Structure.



PAVING THE WAY TO A SUSTAINABLE WORLD


We want an Earth that is worth living on. An Earth where nature and civilization are not mutually exclusive. With our research in the areas of climate-neutral energy systems, resource-efficient processes, and circular products, we are making concrete contributions to achieving the United Nations' 17 Sustainable Development Goals (SDGs).

As a pioneer in a sustainable world, we develop solutions that make decisive contributions to a resource-conserving society and economy. We develop innovative, industrially feasible technologies as well as products and services for the circular economy in the areas of energy, processes, and products and put every effort into bringing them to application maturity.

The focus is on achieving a balance between economically successful, socially just, and environmentally compatible developments. For us, sustainability is an everyday practice.

Discussions about our work are important to us. We want to take a stand on social issues and thus connect players from business, science, politics, and society.

Fraunhofer UMSICHT has a location in Oberhausen, an institute branch in Sulzbach-Rosenberg (Bavaria), and a branch office (plastics technical shop) in Willich. As an institute of the Fraunhofer-Gesellschaft, we are part of a worldwide network. In order to utilize synergies in technology development and to expand scientific value creation, we cooperate with partners all over the world.

More information about our Institute:
www.umsicht.fraunhofer.de/about-us 


Trademarks of Fraunhofer UMSICHT

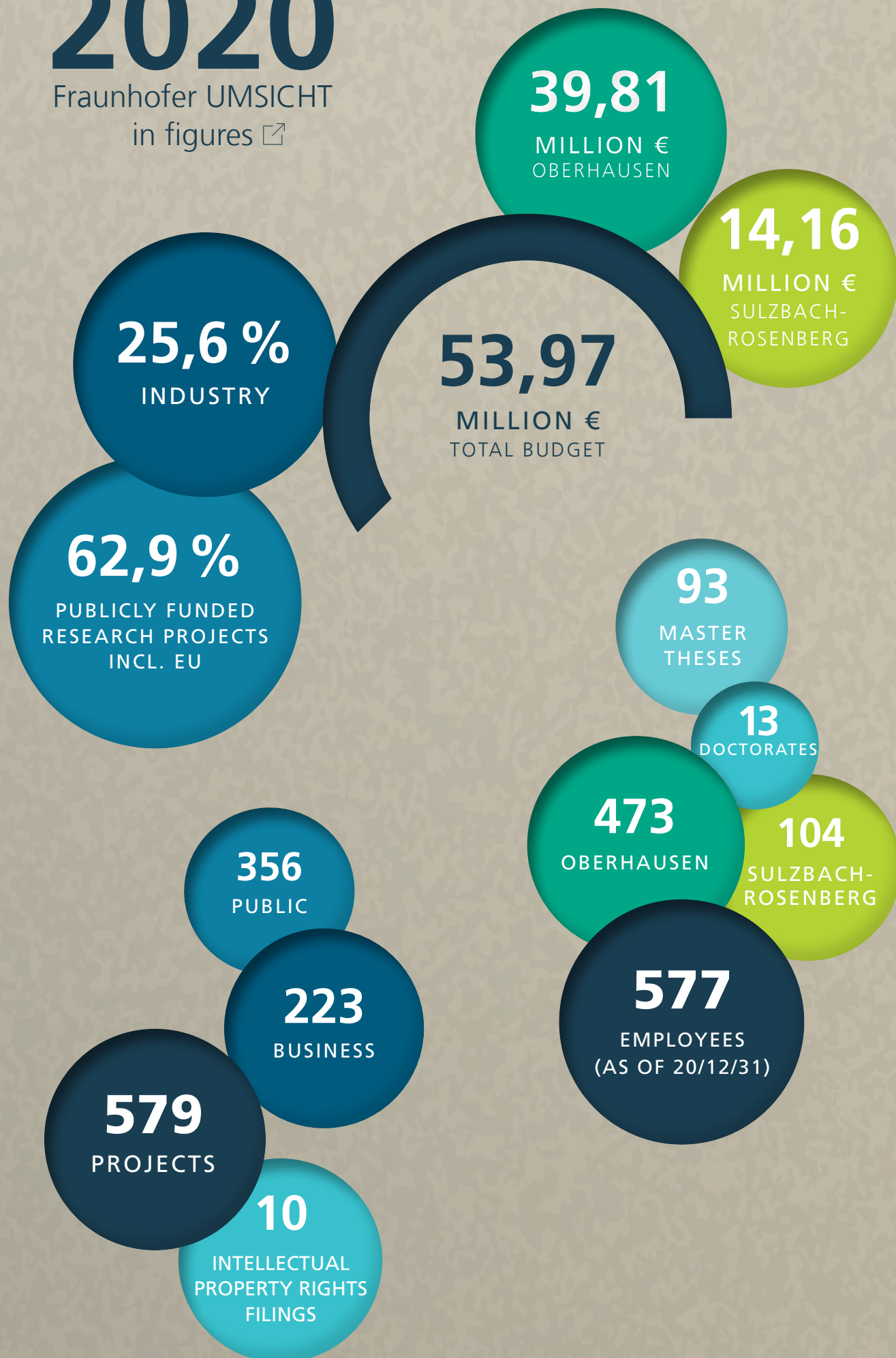
- Expertise in chemical-biological-physical conversion, material development, component development, process technology, product development and product evaluation, energy systems, mathematical and analytical methods and digitalization
- Creativity, quality, and efficiency in idea generation and the implementation in applications and projects
- Market-oriented, long evaluation chains from the idea to the consumer
- Continuous evaluation of the innovations in terms of sustainability
- Contributing to the social discourse on the energy transition and raw materials shift

What we can do for you

- Develop and Improve products (up to small series)
- Market analysis and innovation consulting
- Introduce new technologies
- Licensing and license acquisitions
- Optimizing processes or organizational models
- Characterize, examine, and certify

2020

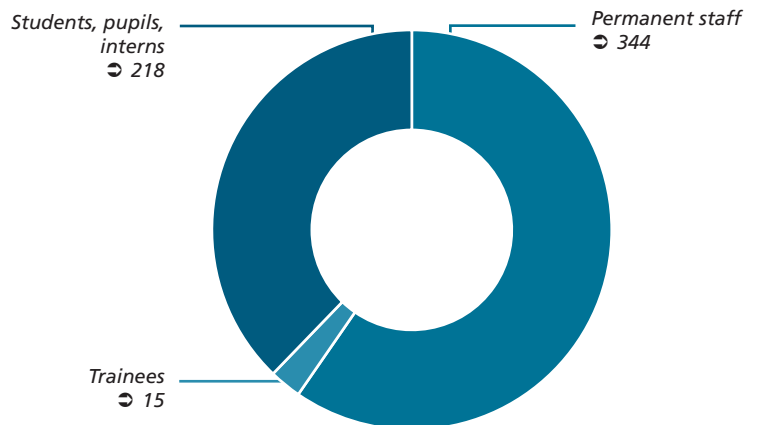
Fraunhofer UMSICHT
in figures 





STAFFING STATISTICS 2020

	OB	SURO *
Permanent staff	287	57
Scientific	218	43
Administrative	69	14
Other staff	186	47
Trainees	12	3
Students, pupils, interns	174	44
Total staff	473	104

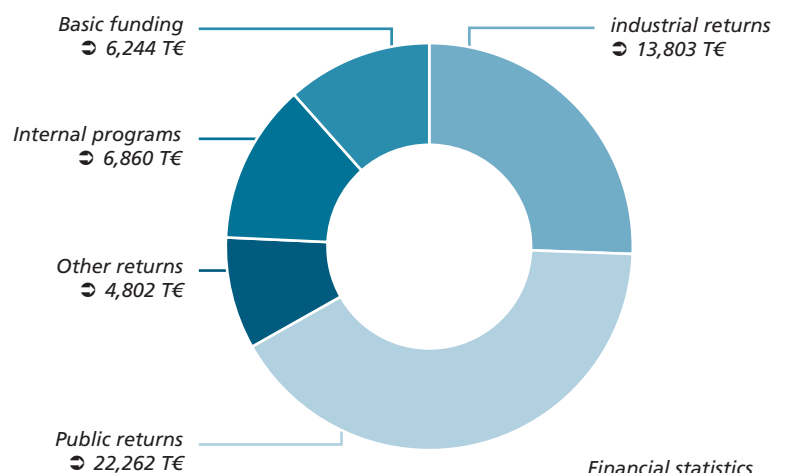


Staffing statistics
Fiscal year 2019; including all sites.

FINANCIAL STATISTICS 2020

[in thousand euros]

	OB	SURO *
Operating budget	36,616	13,671
Other costs	16,576	9,581
Staff costs	20,040	4,090
Investment budget	3,197	485
External project investments	1,960	344
Internal investments	1,237	141
Total returns	39,814	14,157
industrial returns	12,972	831
Public returns	16,204	6058
Other returns	663	4,139
Internal programs	5,794	1,066
Basic funding	4,181	2,063



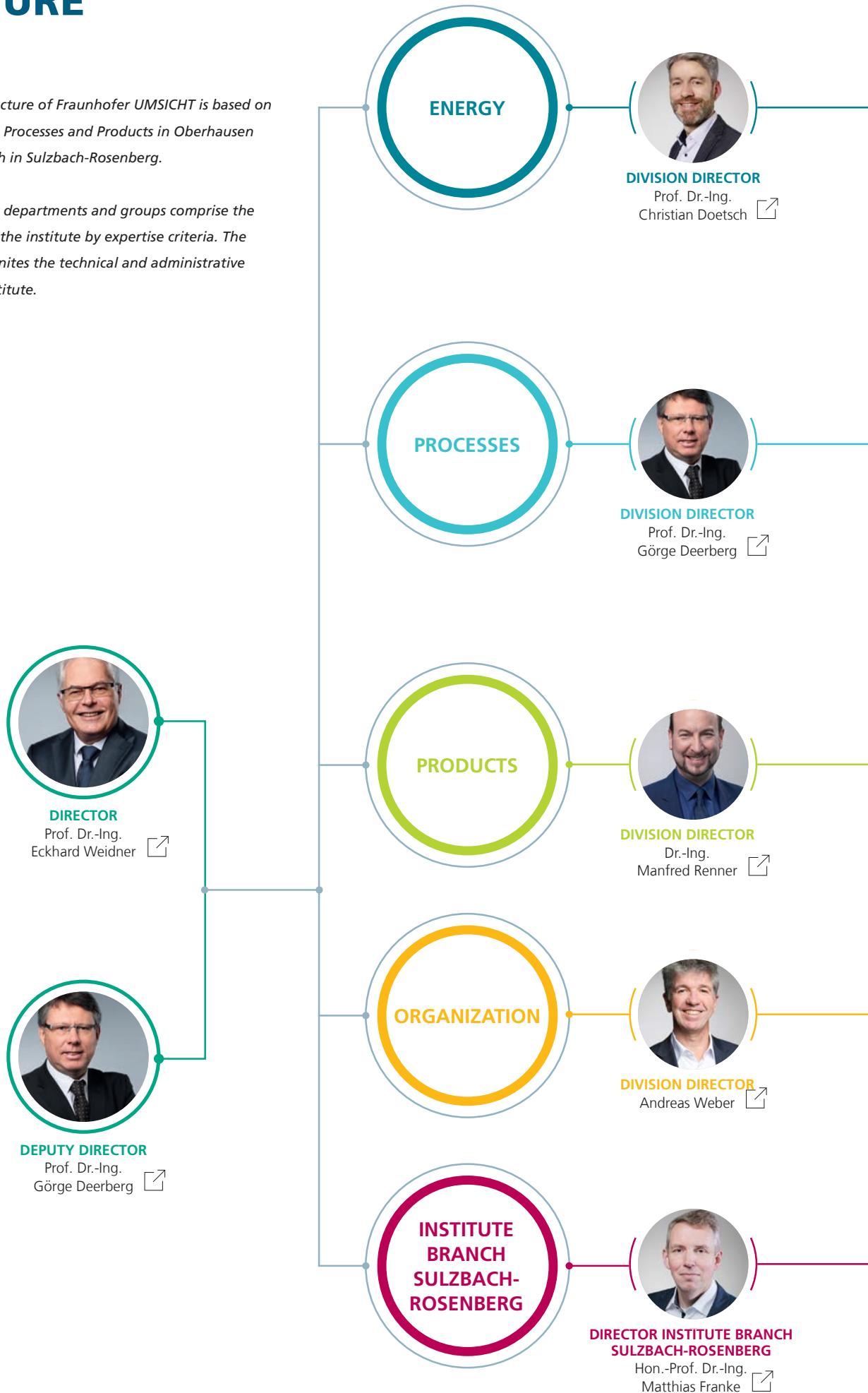
Financial statistics
Fiscal year 2019; including all sites.

ORGANIZATIONAL STRUCTURE

The organizational structure of Fraunhofer UMSICHT is based on the divisions of Energy, Processes and Products in Oberhausen and the institute branch in Sulzbach-Rosenberg.

The divisions with their departments and groups comprise the scientific know-how of the institute by expertise criteria. The division organization unites the technical and administrative departments of the institute.

As of May 1, 2021





ENERGY SYSTEMS ENGINEERING
Dr.-Ing. Marcus Budt



ENERGY SYSTEMS
Carsten Beier



ENERGY SYSTEMS
Dr.-Ing. Annedore Kanngießer



ELECTROCHEMICAL ENERGY STORAGE
Dr.-Ing. Anna Grevé



CHEMICAL ENERGY STORAGE
Dr.-Ing. Barbara Zeidler-Fandrich



ELECTROSYNTHESIS
Prof. Dr. rer. nat. Ulf-Peter Apfel



LOW CARBON TECHNOLOGIES
Dr.-Ing. Andreas Menne



ENVIRONMENT AND RESOURCES
Dr.-Ing. Ilka Gehrke



ENVIRONMENT AND RESOURCES
Volkmar Keuter



PROCESS DIGITALIZATION
Thorsten Wack



PROCESS ENGINEERING
Hans-Jürgen Körner



ENVIRONMENT AND RESOURCES
Josef Robert



STRATEGIC PROJECTS
Dr.-Ing. Esther Stahl



IT-MANAGEMENT
Christian Knermann



CIRCULAR AND BIOBASED PLASTICS
Dr. rer. nat. Inna Bretz



CIRCULAR AND BIOBASED PLASTICS
Dr. rer. nat. Mona Duhme



PRODUCT DEVELOPMENT
Nils Mölders



SUSTAINABILITY AND PARTICIPATION
Dr.-Ing. Markus Hiebel



ADMINISTRATION
Nina Junen



HUMAN RESOURCES
Medi van Rheinberg



PUBLIC RELATIONS
Iris Kumpmann



UMSICHT ACADEMY
Anja Gerstenmeier



ANALYTICS
Dr.-Ing. Edda Möhle



TECHNICS
Richard Sprick



ADMINISTRATION AND SUPPORT
Samir Binder



ENERGY TECHNOLOGY
Dr.-Ing. Robert Daschner

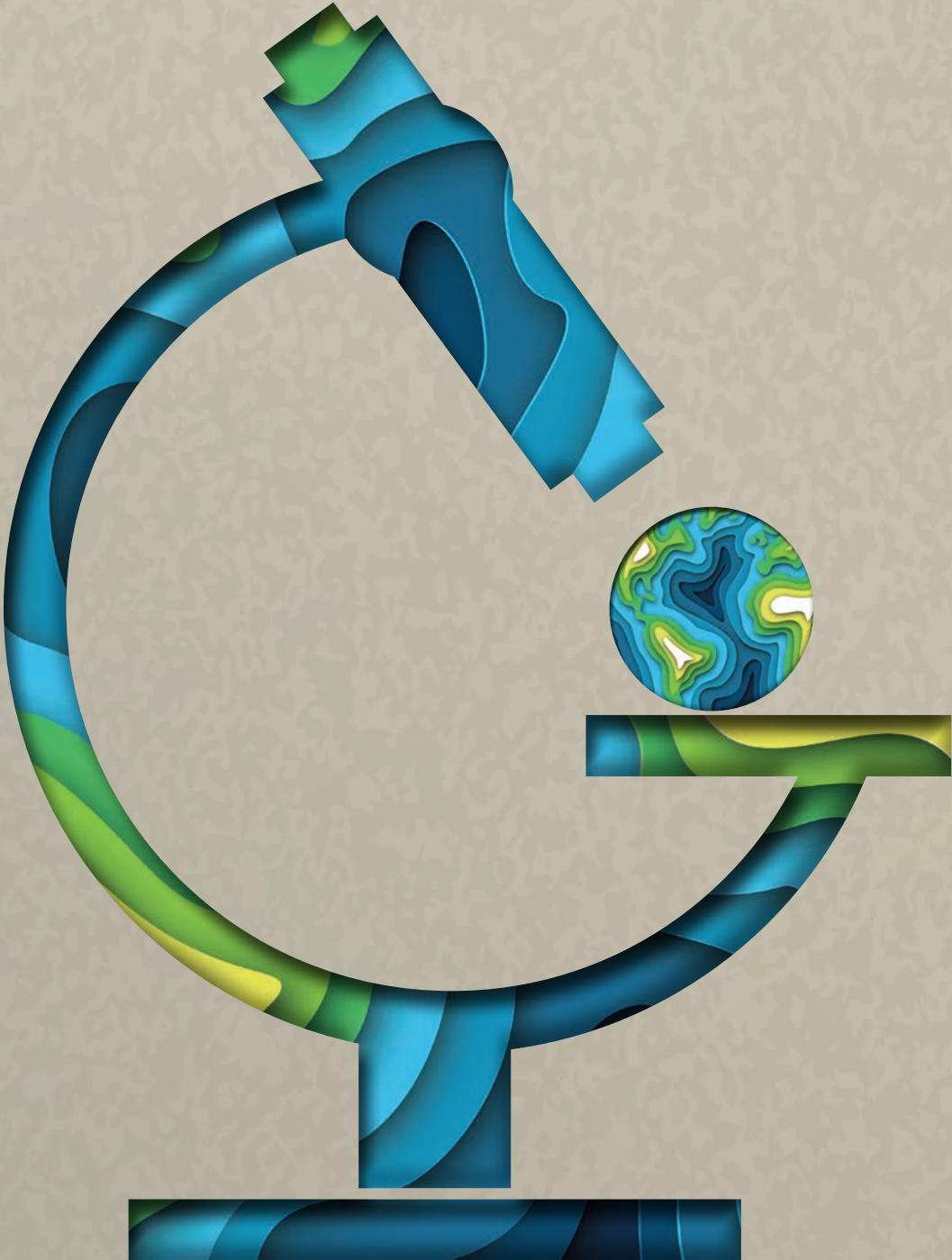


RECYCLING MANAGEMENT
Katharina Reh



RECYCLING MANAGEMENT
Dr. rer. nat. Alexander Hofmann

OUR RESEARCH



OUTSTANDING RESEARCH SERVICES.

Three areas bundle our expertise in the development of technological solutions for sustainable energy and raw materials management.



OUR STRATEGIC ALIGNMENT

In 2019, Fraunhofer UMSICHT started developing a new strategy for the institute – supported by an external consulting firm. In 2020, the new vision of the strategy UMSICHT.2025 was determined: “We are paving the way into a sustainable world. Fraunhofer UMSICHT develops climate-neutral energy systems, resource-efficient processes, and circular products.” The institute is thus strengthening its commitment to sustainability and orienting itself towards the United Nations’ Sustainable Development Goals (SDGs). The individual goals and measures of the strategy are now being developed cross-departmentally and cooperatively by four mission teams, which represent four core goals (mission statements) of the institute that are to be achieved by 2025.

Fraunhofer Institutes update their strategy every five years. To this end, the further development of the respective environment and the institute’s own competencies are first analyzed in detail. Based on this, directional paths and focal points, which are to lead the institute sustainably into the future, are determined. Fraunhofer UMSICHT is now in the process of developing concrete fields of activity and measures in order to achieve the newly set goals, known as mission statements. (S. 24).

Mission Teams and Mission Statements

Mission Team 1: Sustainable Business

Mission Statement: We create value for sustainable business with our partners.

Mission Team 2: Work Environment

Mission Statement: We offer an inspiring, flexible working environment and encourage creativity and scientific freedom. Our organizational development is based on a culture of cooperation.

Mission Team 3: Profitable Portfolios/SDGs

Mission Statement: We stand for research and development with responsibility. To this end, we design profitable project portfolios, especially in the SDGs “Affordable and clean energy” (SDG 7) and “Responsible consumption and production” (SDG 12).

Mission Team 4: Trends and Competence

Mission Statement: We continuously develop our research strategy on the basis of environmental analyses and align our competence development accordingly. This is how we achieve flexibility, a head start in development, and excellence.



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New Work

One result of the UMSICHT.2025 strategy is the introduction of a flexible working model at the institute, which enables flexible working in terms of location and time. Both in science and in the technical facilities, “FlexWork” has led to employees being more productive and being able to work in line with their life situation.

_____ **How is the new work model “FlexWork” received at Fraunhofer UMSICHT?**

Jana Rolshoven: The new model for agile working and flexible forms of work has been very well received by the workforce. We have drawn up a very open works agreement that forms the overall framework and explains how flexible working can function at the institute within the framework of the conditions under occupational health and safety law. Each department defines its own framework in a so-called team charter, which includes key data on communication within the team, availability/service time, or data storage.

_____ **Are there also any problems or challenges?**

Jana Rolshoven: In general, two topics have been identified in which there is a need for consulting: firstly, the removal of boundaries/workload and, secondly, leadership or project management methods at a distance. On the one hand, it is a matter of self-organization, e.g., recognizing stressors and providing preventative assistance in the case of an overload. On the other hand, it involves a new understanding of leadership that gives employees more trust and also scope for decision-making – the keyword being participative leadership. In addition: how managers and teams can shape the relationship level at a distance.



Jana Rolshoven, M. A.

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Diversity

Lived diversity is an important goal of the new UMSICHT.2025 strategy. Fraunhofer UMSICHT would like to better promote the diversity of its workforce. The institute relies on an open and appreciative culture that offers freedom for scientific work and creativity. People are treated without prejudice regardless of gender, nationality, ethnic origin, religion or ideology, disability, age, sexual orientation, and identity, and can contribute their perspectives. In 2020, the working group "Unconscious Bias"/Diversity was founded to develop strategies and measures for achieving more diversity at the institute.

____ **Wich concrete measures have already been implemented and which are planned for next year?**

Annette Somborn-Schulz: Since February 2020, our working group has had the mandate from the institute's Management Committee to address this issue. In the fall of 2020, we brought it to the attention of all managers and worked out ideas together. We gathered input in advance through an internal institute survey in selected departments. We are now trying to find interesting people (including from communities, business, and academia) who can tell us more about unconscious bias from their different perspectives. At the same time, we are also aiming for further training measures and are planning something like "bias awareness campaigns" or days.

____ **What can everyone do to promote diversity?**

Annette Somborn-Schulz: Diversity includes not only the characteristics mentioned above but also physical and mental abilities, appearance, and education. If we at least occasionally question ourselves and our decisions as to why we reject one person or prefer another in an interview, why we – also professionally – absolutely want to go in this direction and not even consider something else, that is the first step towards opening up – and that is the overriding goal of our work on this topic.




Dipl.-Chem. Annette Somborn-Schulz

CONTACT

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More Information on New Work und Diversity:

www.umsicht.fraunhofer.de/en/jobs-career/umsicht-as-employer.html 

SERVICE PORTFOLIO DIVISION ENERGY

Which energy storage systems will be needed in the future and where will this be in the energy system? Which power-to-X technologies will shape the future cross-sectoral energy system? Will digitalization and decentralization turn consumers, but also industry, into prosumers? Research in the field of energy revolves around these questions. We are specifically concerned with the development and optimization of energy conversion and energy storage technologies, as well as technologies for the production of sustainable energy sources and chemical products.



Prof. Dr.-Ing. Christian Doetsch
Division Director Energy

“Efficient energy processes are just as much the focus of our research as new storage technologies and intelligent system solutions. The special thing about this: We work on innovations in an interdisciplinary way and across departmental boundaries!”

Energy Systems Engineering

We develop and optimize energy plants and their applications by means of static and dynamic simulation as well as prototype/pilot plant construction and testing. Our range of services includes the demand-oriented conception, calculation, design, planning, and integration of energy plants as well as the evaluation of technical concepts, the preparation of studies on energy efficiency, and the integration of renewable energies in industry.

- Flow simulation and turbomachinery development
- Energy efficiency and renewable heat in industry
- Energy plant engineering
- Compressed air systems and energy storage
- Non-thermal plasma (NT plasma)

CONTACT

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Energy Systems

In the interplay between energy supply, distribution, storage, and use, we develop and optimize energy-efficient and economical energy systems.



The focus is on both local energy systems and the integration of renewable energies.

- Energy Supply Systems
- Energy Systems Optimization
- Optimized District Systems

CONTACT

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Dr.-Ing. Annedore Kanngießler | Head of Department

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Electrochemical Energy Storage

We develop electrochemical energy storage systems for the on-demand provision of electricity as well as concepts for the coupling of the energy and production sectors.

- Bipolar flow and non-flow energy storage systems
- Functional components and innovative cell concepts
- Energy materials
- Power-to-Chemicals

CONTACT

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Chemical Energy Storage

By developing and applying materials for the chemical storage and conversion of energy and CO₂, we are developing innovative processes for a successful raw materials shift and energy transition. One focus of our work is the development and testing of technical catalysts for heterogeneous catalysis.

- Catalytic Processes
- Thermal Energy Storage

CONTACT

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Electrosynthesis

We are working on the production of hydrogen and the question of how CO₂ can be converted electrochemically into valuable starting materials for industry. Furthermore, we use electricity to carry out organic syntheses – especially hydrogenations – in a targeted manner.

- Electrocatalysis

CONTACT

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More info



More Informationen about our Competencies:

www.umsicht.fraunhofer.de/competencies

SERVICE PORTFOLIO DIVISION PROCESSES

The Division Processes develops and optimizes processes for the climate-friendly use of carbon from residual materials, biomass and carbon dioxide, as well as other resources in cycles. Chemicals and chemical raw materials, water and wastewater, and food are considered. The services offered range from analyzing existing structures to creating concepts and new technologies for practical implementation.



PROCESSES



Prof. Dr.-Ing. Gorge Deerberg
Division Director Processes



Low Carbon Technologies

We supply technologies and innovations in the field of sector coupling to use, avoid or reduce CO₂ emissions. To this end, we develop processes to produce synthetic fuels, chemicals and for gas purification, and carry out system analyses and optimization. In doing so, we make use of process simulation and digitalization tools.

- Chemical Technologies
- Gas Cleaning and Gas Storage
- Cross-industrial Production Systems
- Modelling and Simulation

CONTACT

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“ We work in an interdisciplinary manner and provide solutions using state-of-the-art process engineering and digital technologies in order to sustainably design future tasks in process engineering.”

Environment and Resources

The efficient use and careful handling of water, fresh food, nutrients, and valuable materials are what drive us (SDGs 2 and 6). We think in a sustainable and circular manner! We are pioneers in Germany in the field of building-integrated food production, the process-integrated closure of water cycles, and the removal of trace substances and microplastics.

- Light – structuring and effects
- Water and Adsorption Technology
- Indoor Farming

CONTACT

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Process Digitalization

New business models, combined with the use of precise data analysis and data exploration, are the cornerstones of a successful digital evolution. We use our technologies to support the digital transformation in companies. This makes products smarter, processes faster, more scalable and more intelligent, and companies stronger and more efficient. The focus is on the analysis, design, and implementation of tailored solutions.

- IT Platforms
- Digitalization Technologies

CONTACT

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Process Engineering

We develop concepts for process engineering production. The focus is on the modularization and digitalization of process engineering processes. We offer models for subsequent investigation, modeling, simulation, and optimization in a dynamic overall system. Biotechnology for the environment and energy, bioprocess and fluid process engineering, biomass and residue utilization, membrane and food technology all represent focal points.

- Bioprocess Engineering and Fluid Separation
- Membrane and Food Technology, Biomass

CONTACT

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Strategic Projects

We bundle strategic projects by the Processes division and are contact persons for cross-departmental initiatives within the energy transition and raw materials shift. In the Processes think tank, we take up new technological approaches, evaluate them, and develop them further in an application-oriented manner.

- Strategic Projects
- Think Tank Processes

CONTACT

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More info



More Informationen about our Competencies:

www.umsicht.fraunhofer.de/competencies

SERVICE PORTFOLIO DIVISION PRODUCTS

The Products division can be divided into three research and development priorities:

I. Development of new materials (SDG 12), II. Development of efficient, cost-reduced processes (SDG 12), and III. Evaluation of materials and processes.



Dr.-Ing. Manfred Renner
Division Director Products

“What will the products of tomorrow look like, according to which principles will they be manufactured and used, and how will the products be handled at the end of their lives? We will provide answers to these and other exciting questions!”

Circular and Bio-based Plastics

We develop tailor-made circular and bio-based plastics for a wide range of applications in films, filaments, injection molded parts, and others. Our materials have a specific, and often novel, property profile that matches or exceeds that of fossil-based polymer materials. We cover the entire development chain from polymerization and material development to plastics processing and recycling with accompanying comprehensive material characterization.

Our plastic developments can be processed on conventional machines. Thanks to our many years of expertise, we adapt the materials optimally to suit the application. We attach great importance to low overall costs, good raw material availability, simple processing, and easy recycling. We can provide sample quantities on an industrial scale.

- Polymer Technology
- Plastics Development
- Production Scale-up and Materials Testing

CONTACT

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Dr. rer. nat. Mona Duhme | Head of Department

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Product Development

The core of the department is the product-related development, modification, and functionalization of material systems. The focus lies on plastics and natural materials such as leather, wood, and stone.

Our range of services includes coating and particle technology, as well as compounding, comminution, and additivation of a wide variety of materials. Our long-standing expertise lies in the use of compressed carbon dioxide as a solvent and dispersant. With an eye on industrial feasibility, we assist customers from laboratory scale to industrial scale.

- **Building Materials**
By modifying or incorporating functional additives, we tailor material systems for innovative applications in the construction sector.
- **Functionalized Materials**
We develop and functionalize a wide range of materials from polymers to natural materials such as leather.

CONTACT

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Sustainability and Participation

To ensure that our planet remains livable for current and future generations, we must re-evaluate current production methods, lifestyles, and resource consumption. The goal is to empower our clients to contribute to sustainable development through their actions.

We develop tailored sustainability strategies, help close loops in the circular economy and prepare sustainability assessments for products, processes and services. We support our clients in innovation processes and use stakeholder management and new formats to involve the public. This is how sustainable innovations become possible.


- Sustainability Assessment
- Urban Transformation
- User-centered Technology Design

CONTACT

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More info



More Informationen about our Competencies:
www.umsicht.fraunhofer.de/competencies 

SERVICE PORTFOLIO

INSTITUTE BRANCH SULZBACH-ROSENBERG

The institute branch Sulzbach-Rosenberg develops business-oriented solutions in energy technology and the recycling industry. With a focus on process engineering and plant construction, it supports clients from the project idea through pilot plants and demonstrators to market launch. The Center for Energy Storage (CES) at the institute's branch focuses on integrated, decentralized energy conversion and energy storage systems.



Hon.-Prof. Dr.-Ing. Matthias Franke
Director Institute branch
Sulzbach-Rosenberg

“ We achieve the best solutions for climate and resource protection by using the benefits of synergies between the energy and raw materials sectors. These are the concepts and technologies we are working on. ”

Energy Technology

The Renewable Energy department develops processes and plants for the provision and storage of energy. It provides research and development services for conversion processes such as combustion, gasification, and pyrolysis, for thermal storage, and for the generation of energy carriers such as synthesis gas and fuels. Additional expertise in the areas of process heat, combined heat and power, and emission reduction allow efficient and clean solutions to be developed. The site has facilities for the decentralized energetic use of biomass, biogenic residues, and waste by means of thermochemical processes, mobile and stationary thermal and chemical energy storage systems, as well as modern catalyst test rigs and hydrogenation and distillation units. In the laboratories, test benches and measuring equipment are available to investigate furnaces, filter systems, and energy storage units, as well as for extensive waste gas purification and advanced online gas analysis.

- Thermochemical Processes
- Energy from Biomass
- Thermal Storages

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Recycling Management

The circular economy portfolio includes the creation of waste management strategies, the development of innovative recycling processes and the production of powder materials. In the area of waste management strategies, feasibility and profitability studies, sustainability assessments, resource strategies, and concepts for recycling waste are developed, especially also in an international context. The Recycling Technologies group develops innovative equipment and processes for the recycling of waste, composites, and minerals containing plastic, particularly thermochemical processes for chemical recycling. The development, production, and recycling of materials for additive manufacturing are located within the Powder working group.

- Waste and Resources Strategy
- Recycling Technologies
- Materials for Additive Manufacturing

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More info



Industry Lab

The Industry Lab at the CES Technical Center in Sulzbach-Rosenberg, which opened in 2019, offers companies a digital development, testing, and application environment. The technical focus is on the areas of energy technology, recycling, plant engineering, and process engineering.

The Lab is ideal for agile project teams or corporate start-ups looking for creativity and freedom. Companies can use the mechanical workshop with additive manufacturing, the institute's own digital framework, and laboratories and test areas to develop prototypes. Collaboration with experts from IT and other disciplines leads to fast results in process optimization, the development of new products or services, right through to the digital business model.

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1 *Since July 1, 2012, Fraunhofer UMSICHT has had an institute branch located in Sulzbach-Rosenberg in the Nuremberg Metropolitan Region.*

More Information about our Institute Branch:

www.umsicht-suro.fraunhofer.de/en.html

OUR CONTRIBUTION TO THE SUSTAINABLE DEVELOPMENT GOALS OF THE UNITED NATIONS

We are making concrete contributions to achieving the United Nations' 17 Sustainable Development Goals (SDGs) with our projects in the areas of climate-neutral energy systems, resource-efficient processes, and circular products. Our work focuses primarily on the following six goals, with an emphasis on SDGs 7 and 12.

Goals

- SDG 6: Clean Water and Sanitation
- SDG 7: Affordable and Clean Energy
- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action
- SDG 14: Life Below water


Young researchers provide important impetus with their research work, as some examples show.

- **Felix Thoma** is investigating how high-quality healthy food can be grown sustainably.
- **Sung Youn (Sanja) Suh** is developing catalysts to reduce CO₂.
- **Alina Gawel** is researching the electrochemical conversion of CO₂ to store green electricity in the form of valuable synthesis building blocks.
- **Mohamed Eldakadosi** is optimizing sustainable, cross-sector energy systems in neighborhoods.
- **Lukas Rüller** is working on processing sewage sludge so that important resources such as phosphorus can be recovered from it.
- **Juliane Strobel** is working on various battery designs to make them more recyclable later on.

Our PhD students in the video on YouTube:

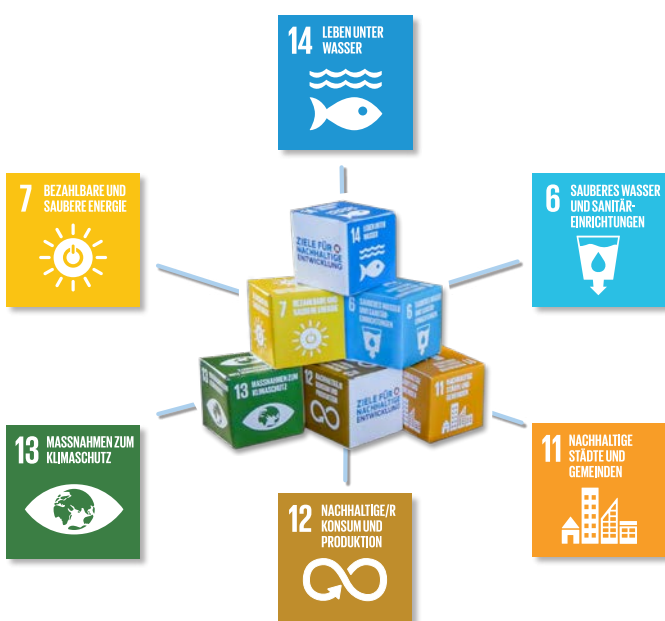
s.fhg.de/z4M 

More information on Fraunhofer UMSICHT as a pioneer in a sustainable world:

s.fhg.de/sustainability 

Further details in our regularly published sustainability report:

s.fhg.de/9GU 



SUSTAINABLE DEVELOPMENT GOALS

The best testimonial for our work are the projects we have worked on and successfully completed. However, many of our projects are subject to secrecy and therefore cannot be presented. Feel free to contact our departments directly if you cannot find your task!

Current Projects

- DigitalFire – Digitalization of biomass furnaces
- ElkaSyn – Energy-efficient electrosynthesis of alcohols
- ELuStat – Iron-air battery as a stationary energy storage system
- Farming the Uncanny Valley – Participatory discourse on bioeconomy
- FlexKaelte – Making refrigeration supply systems more flexible
- FungiFacturing – Fungus-based sound insulation
- Geothermal paper drying
- LowCH4 MDT module – Mine gas utilization
- HESKH – Hybrid energy storage hospita
- HYBKomp bundles system services
- IMOKAT – Precious metal-free catalyst for methane oxidation
- iMulch – Plastics in soils
- inFARMING® - Building-integrated agriculture
- InKa - Intermediates from industrial coffee grounds
- isoSTOR^{Retrofit} - Increasing the efficiency of industrial compressed air networks
- KompEx - Compressed air reservoir for location-independent use
- LUZI - Laboratory for urban future issues and innovations
- Power2C4 - From ethanol to butadiene via catalysis
- PyroMar - Novel fuel components make shipping more environmentally friendly
- SCI4climate.NRW - Climate-neutral industry in NRW
- Single-loop coolant - Heat transfer fluid for spacecraft
- SW.Developer - New strategies for municipal utilities

More Projects in our Overview:

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

Research Lines we present in the Annual Report

- Carbon2Chem® joint project (p. 28)
- Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE (p. 26)
- Sovereign value cycles (p. 33)
- Resource technologies and bioeconomy Group (p. 32)
- High Performance Center DYNAFLEX® (p. 30)
- Fraunhofer lead project ShaPID – Shaping the future of green chemistry by process intensification and digitalization (p. 31)

More Information about our Lines of Research:

www.umsicht.fraunhofer.de/en/lines-of-research.html 

Project Examples you will find in the Annual Report

- FungiFacturing – Fungus-based sound insulation (p. 38)
- PhAt – Environmentally friendly lubricant additives from renewable raw materials (p. 38)
- Geothermal paper drying (p. 34)
- ODH@Bochum-Weimar – Energy-efficient and CO₂-minimized power and heat supply (p. 34)
- BioBrick – Biomass for sustainable brick production (p. 35)
- PyroMar – Novel fuel components make shipping more environmentally friendly (p. 36)
- SUSKULT – Agricultural system of the future (p. 36)
- CARE – Clean electricity from rice husks (p. 37)

This might also interest you

Information about our international projects:

www.umsicht.fraunhofer.de/international 

Information about our competencies:

www.umsicht.fraunhofer.de/competencies 

FRAUNHOFER CLUSTER OF EXCELLENCE CIRCULAR PLASTICS ECONOMY CCPE

In the Fraunhofer Cluster CCPE, research is being conducted for the first time using plastics as an example of how an entire value chain can be designed according to the principles of the Circular Economy – in line with the needs of the plastics industry and society. Six Fraunhofer Institutes – IAP, ICT, IML, LBF, IVV and UMSICHT – have been developing methods, products, processes, and services since the end of 2018 to shape the transformation from a linear to a circular plastics economy.

Cooperation and networking

Around 80 employees conduct interdisciplinary research in the three divisions “Materials”, “Systems” and “Business Models” into technical and social innovations to sustainably transform the entire plastics value chain. Regular networking meetings, a cooperative exchange, and good coordination by the office promote the team’s coalescence and enable successful collaboration.

The Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE has already achieved strong visibility and very good results so far: Since its launch in 2018, 45 industrial projects have been initiated and more than 200 new industrial contacts have been established. 12 scientific publications have been published and 19 patents and 4 trademarks have been registered. The members of the Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE are expanding their network and advancing the circular plastics economy at a national and international level through numerous membership and function sponsorships as well as advisory activities in committees.

More info



More info



In the “Materials” division, plastics are created from a sustainable mix of resources. Here, for example, the CCPE team developed novel bio-based polymers and additives and achieved quality improvements for recyclates. Researchers in the “Systems” division are establishing processes that lead to optimal value creation cycles, e.g., new solutions for chemical recycling on a demonstration scale, processes for recovering plastics from waste mixtures, or design tools for circular products.



Fraunhofer Clusters of Excellence combine the competencies of institutes to investigate relevant topics with scientific excellence. The aim is to establish virtual institutes with international visibility.

How mature is the product for the Circular Economy?

“ Together with Fraunhofer IML, we have developed the self-check tool “Circular Readiness Level® (CRL®)”. This is a web-based tool for companies to self-assess the maturity of products in terms of the Circular Economy. It tests the extent to which a product already addresses the strategies of the Circular Economy in the fields of activity product design, product service system, end-of-life management, and closed-loop recycling, and where there is still potential for improvement.”

The “Business Models” division also offers holistic system services for plastics in the circular economy. For example, the team developed demonstrators for reusable transport packaging and a child car seat.

Different business model scenarios were created for both demonstrators in order to achieve incentive systems and operator models for the use of recyclates in products. All CCPE recycling chains are combined under the brand name “CIRCONOMY®”.

Internationalization and Fraunhofer CCPE Summit

“ Over the past 2.5 years, we have shown that the Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE is the central hub and bundling of competencies at Fraunhofer for researching the fundamentals for the transformation to a Circular Plastics Economy, opening up precisely tailored options for action for industry and society and offering system services on the R&D market. We now want to drive forward internationalization and expand our industrial collaborations. We are currently already starting preparations for the CCPE Summit in summer 2022.”




Anna Schulte, M.Sc.



Dr.-Ing. Hartmut Pflaum

More Information:

ccpe.fraunhofer.de 

www.umsicht.fraunhofer.de/en/lines-of-research/circular-plastics-economy.html 

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CARBON2CHEM® – METALLURGICAL GASES AS A RAW MATERIAL FOR THE CHEMICAL INDUSTRY

Making steel production climate-friendly – this was the objective with which Carbon2Chem® was launched in 2016. The first phase of the joint project, funded by the German Federal Ministry of Education and Research (BMBF), ended in May 2020. The second phase, for which the BMBF is providing funding of up to 75 million euros, is now underway. The focus is on validating developed concepts for large-scale implementation.

Successful completion of the first phase

In the first four years of Carbon2Chem®, process concepts were developed that allow the waste gases containing CO₂ from Germany's largest steel mill to be captured, cleaned, and converted into basic materials for chemicals, fuels or fertilizers using green hydrogen. Almost 20 companies and research institutes were involved – coordinated by the Max Planck Institute for Chemical Energy Conversion, Fraunhofer UMSICHT, and thyssenkrupp.

“ The consortium of basic research, application-oriented research and development and industry behind Carbon2Chem® has proven its worth. The partners work together in a committed and goal-oriented manner. Together, they have made the project a flagship of national energy research. ”

Cross-industry solution

In concrete terms, it was possible to show in phase one that the Carbon2Chem® concepts are particularly characterized by their systemic approach and thus represent a cross-industry solution. The modular structure of the process concepts makes it possible to link them with other industrial CO₂ sources and CO₂ reduction technologies. Due to the availability of the technologies and the modularity of the concepts, Carbon2Chem® can promptly support individual steps in the transformation of industry towards greenhouse gas neutrality.

The building blocks required for this were developed and tested in several subprojects. Among other things, it was shown that the purified hydrogen obtained from process gases in the smelter can be used directly for chemical catalytic processes. Another finding was that alkaline electrolysis can be operated dynamically without aging effects or efficiency losses.



Dr.-Ing. Torsten Müller



JOINT PROJECT

Carbon2Chem®

KEEPING CARBON
IN THE LOOP

New strategies in gas treatment

New strategies were developed and optimized in the central component of gas treatment. A corresponding plant was built in the project's own technical shop in Duisburg and is being operated successfully. It uses pressure swing adsorption, gas scrubbing, and compression. In addition, processes for thermocatalytic and plasma-catalytic oxygen removal (DeOxo process) were developed.

These are examples of significant results that were obtained thanks to the joint work in the project's own laboratory and pilot plant. It was possible to produce target products such as methanol and urea during the project period on the basis of the findings not only from pure gases but also from real gases from the Duisburg smelter. At the same time, an extensive simulation platform was set up for the further development and optimization of concepts and processes for the overall system.

Validating concepts for large-scale implementation

It is highly likely that it will be possible to produce methanol, urea, higher alcohols, and polymers on an industrial scale using process gases containing carbon dioxide before the end of this decade, according to the participants in Carbon2Chem®. This is what they are now working towards in the second phase of the project, according to Prof. Dr.-Ing. Görgе Deerberg. "In the next four years, we want to show that the developed processes also function stably on a large scale and lay the foundation for low-emission steel production," explains the project coordinator and deputy institute director of Fraunhofer UMSICHT.

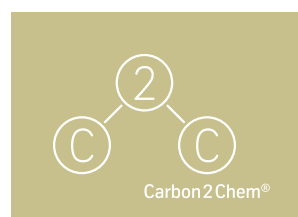
1 The 500 square meter Carbon2Chem® laboratory at Fraunhofer UMSICHT in Oberhausen.

More Information:

www.umsicht.fraunhofer.de/carbon-cycle 

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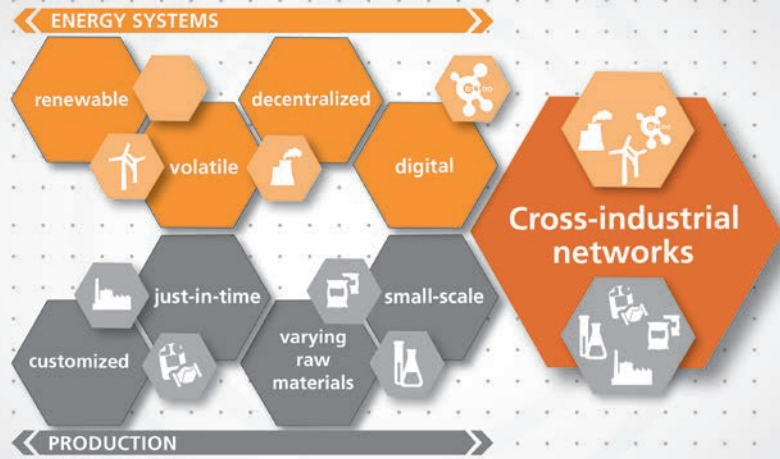
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PERFORMANCE CENTER DYNAFLEX® STRENGTHENING MUNICIPAL INDUSTRIAL REGIONS

The energy transition is a mainstay of structural change and requires a rethink in many areas. Technologies to increase efficiency and avoid CO₂ emissions are increasingly in focus. To ensure that successful innovation and economic ecosystems can continue to grow in a dynamic and volatile environment, coordinated, adaptable solutions are needed at the interface of energy and basic materials management and production.

Cross-industrial networks

Sustainable and environmentally friendly value creation means an adjustment for those involved, yet also offers a competitive advantage. Joint action in regional cross-industrial networks is becoming increasingly important. The High Performance Center DYNAFLEX® quickly transfers research results on the dynamics of technical systems and the design of business cases into application-oriented technical projects. The necessary transfer of research, expertise and technology into industry (with a focus on SMEs) is driven forward by DYNAFLEX® and its environment in the fields of activity sector coupling, cross-industrial production systems, multimodal networks, power-to-X, flexible production, and digitalization technologies, among others.

As a basis for the sustainable development of the High Performance Center, the strategic fields of activity, which are oriented towards market needs and bring innovations onto the market, are being expanded. The transfer to industry, and thus also the safeguarding of its competitiveness, will be driven forward, in particular, by the provision of demonstrators, industrial test environments, and digital platforms for SMEs.

More info



More info



Introducing specialized personnel to innovative technologies

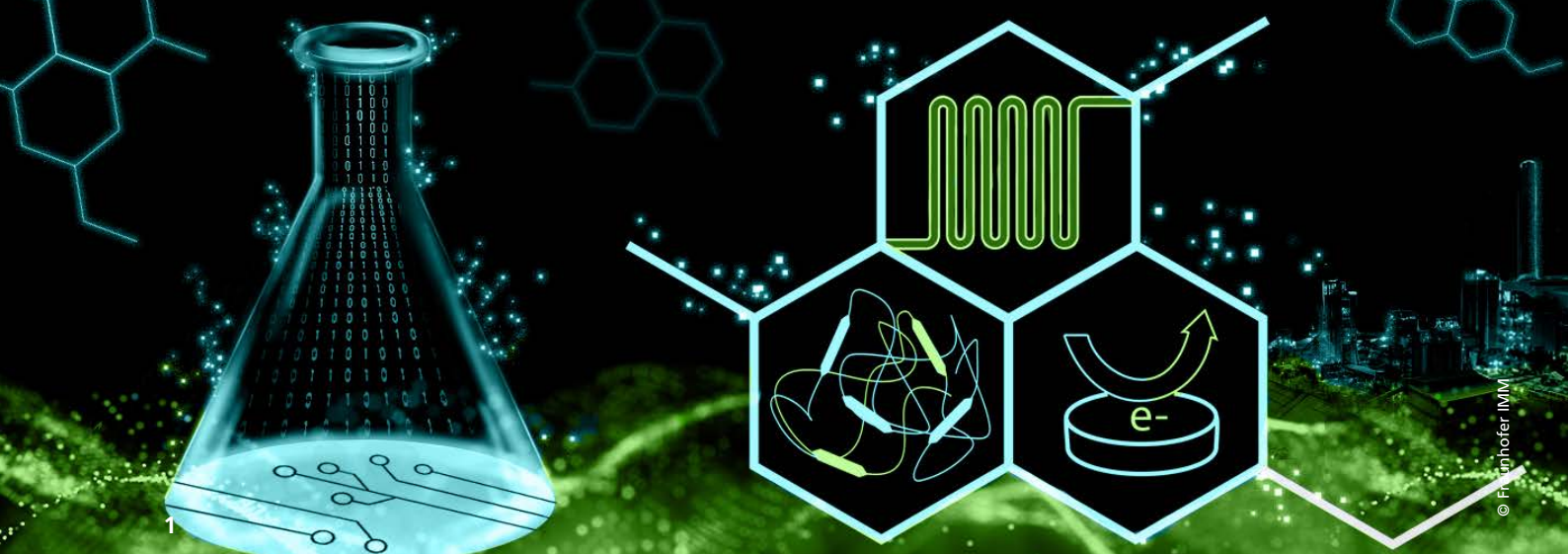
After the successful completion of the pilot phase of DYNAFLEX®, the next phase continues with concrete application and research projects. In order to introduce specialized personnel to innovative technologies at an early stage and to prepare them for future challenges, the DYNERGY course of study was also developed in cooperation with the FernUniversität in Hagen.

More Information about the Performance Center DYNAFLEX®:

www.dynaflex.de  s.fhg.de/5cE 

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FRAUNHOFER LIGHTHOUSE PROJECT SHAPID

Defossilizing production chains and establishing a circular, greenhouse gas-neutral conversion of materials and energy – the chemical industry has set itself ambitious goals in terms of sustainability. Nine institutes of the Fraunhofer-Gesellschaft are providing support: In the lighthouse project “ShaPID – Shaping the Future of Green Chemistry by Process Intensification and Digitalization”, they are pooling their research activities while also strengthening their relations with the industry.

Making the chemical industry sustainable

“ Specifically, we strive to show that sustainable, green chemistry is possible through practical technological innovations. Based on the internationally recognized ‘12 Principles of Green Chemistry’, we want to jointly develop new methods and technologies.”

From green raw material to green product

Researchers are focusing on four complementary areas:

- (1) Synthesis, reaction and catalysis technology
- (2) Continuous process technology and process engineering
- (3) Modeling, simulation, and process optimization
- (4) Digitalization and automation

The application of the new technologies and methods will be demonstrated on a technical scale using three reference processes that address different product areas in chemistry: “Green Plastics”, “Green Monomers”, and “Efficient Building Blocks”.

More information about the Fraunhofer lighthouse project ShaPID:

s.fhg.de/9h5

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Prof. Dr. rer. nat. Ulf Apfel

More info



1 In the Fraunhofer lighthouse project ShaPID, new technologies and methods for a sustainable chemical industry are being developed.



1

FRAUNHOFER GROUP FOR RESOURCE TECHNOLOGIES AND BIOECONOMY

Sustainable development requires the responsible use of resources. The newly founded Fraunhofer Group for Resource Technologies and Bioeconomy implements concepts on resource efficiency, bioeconomy, circular economy and the sovereignty of value cycles. The goal: to contribute decisively to the fulfillment of national, European, and international sustainability goals.

1 *Key visual of the Fraunhofer Group for Resource Technologies and Bioeconomy.*

How can national economies sustainably supply themselves with resources and energy? How do environmentally friendly production technologies and social justice go hand in hand? Fraunhofer develops solutions and combines the concept of the circular economy with that of the bioeconomy.

The goal of the circular economy is to manage the extraction of raw materials from the environment in a way that conserves resources. Managed materials are used efficiently and kept in man-made cycles or fed from renewable sources. The bioeconomy uses biological knowledge to sustainably align the resource base within ecological limits.

The Fraunhofer Group develops biotechnological, process engineering, circular, and systemic solutions to responsibly manage and use natural resources. The focus is on the supply of raw materials and energy, the protection of the climate and the environment, and the safeguarding of nutrition and health.

" We develop responsible and agile 'system solutions' for the sustainable development of the economy and society in cooperative partnerships. "



Prof. Dr.-Ing. Eckhard Weidner
Group spokesperson

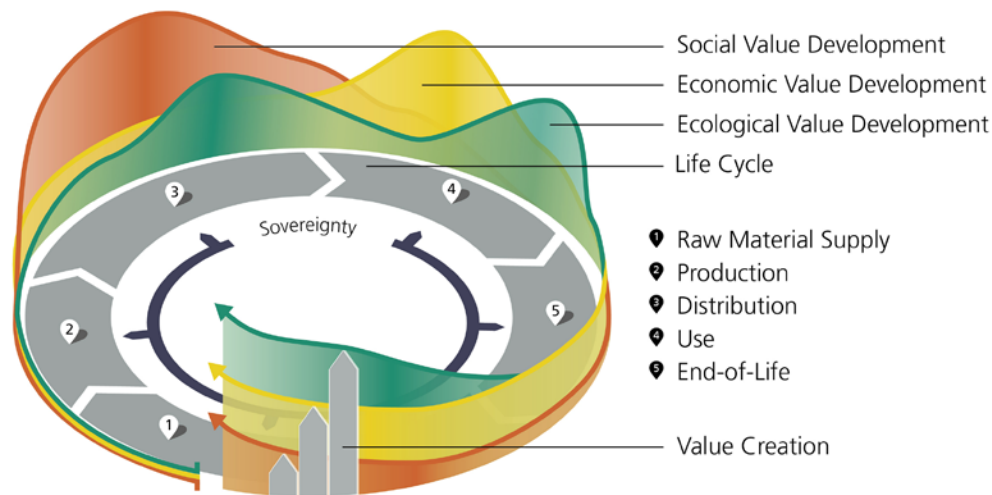
More information about the Fraunhofer Group:
[s.fhg.de/kl7](https://www.s.fhg.de/kl7)

Members | Fraunhofer Institute for

- Interfacial Engineering and Biotechnology IGB
- Molecular Biology and Applied Ecology IME
- Environmental, Safety, and Energy Technology UMSICHT
- Process Engineering and Packaging IVV

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SOVEREIGN VALUE CYCLES

How can companies plan and design their production in a more sustainable, circular, and sovereign way and thus enable sustainable consumption for clients? With the Fraunhofer Charter for Sovereign Value Cycles and a Corporate Sustainability Platform (CSP): 14 Fraunhofer Institutes developed this modular, knowledge-based, digital technology platform, which is made available as a central hub to actors within the circular economy across industries.

The concept of value cycles takes into account social, political, and economic demands for resilient and transparent supply chains, circular economies, and climate protection. Purely fossil-based, linear value creation is being rethought. To this end, Fraunhofer has developed a Fraunhofer Charter with a total of 14 institutes, which sets the framework for an R&D roadmap for research into sovereign value cycles, a new concept of production and consumption.

1 Model for sovereign value cycles.

Follow-up project optimizes practicality

The core of the charter is a Corporate Sustainability Platform (CSP) for physical and digital products. This contains information, using the lead markets of food, chemicals, and energy as examples, on supply chains, production conditions, and requirements for meeting the demands of Sustainable Development Goal 12 (Responsible Production and Consumption) and is also underpinned by business models. This approach will be concretized in the follow-up project "CIRCONOMY® Hub Initial", in which the systemic principles will be implemented, applied, and their practicality jointly optimized in external collaborations.

" Knowledge about the 'sustainability backpack' of products, materials, and services is becoming increasingly important for companies – and with it the possibility or sovereignty to manage the lifecycle. With SVC (Sovereign Value Cycles), we have created an important basis here that will help us identify needs and close gaps."



Dr.-Ing. Esther Stahl

Learn more about circular, sovereign value creation:

s.fhg.de/u32

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CLIMATE-NEUTRAL ENERGY SYSTEMS

The switch to renewable energies requires sustainable solutions to coordinate energy demand and supply. Efficient energy processes, new storage technologies, and intelligent systems are required. This is where Fraunhofer UMSICHT comes in: We research solutions for a sustainable, climate-neutral energy supply. These three examples provide insights into our current work.

Geothermal paper drying

Can the process heat required for paper drying be obtained from deep geothermal energy? Fraunhofer UMSICHT is investigating this question together with Kabel Premium Pulp & Paper GmbH from Hagen and the Fraunhofer Research Institution for Energy Infrastructures and Geothermal Systems IEG in the project "Geothermal Paper Drying". Within this project, UMSICHT is developing the necessary process for the efficient and resource-saving upgrading of geothermal heat to industrially usable steam.

More Information: s.fhg.de/K8E 

"The particular challenge is that the temperatures found underground in Germany are not sufficient for the direct generation of process steam with the parameters required in industry."

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Energy-efficient and CO₂-minimized power and heat supply

In order to initiate the energy transition at a building and district level, the Fraunhofer-Gesellschaft has founded the Open District Hub e. V. (ODH) with 13 partners. A housing estate belonging to the housing company Vonovia in Bochum-Weitmar is one of six innovation districts. An energy-efficient and CO₂-minimized power and heat supply is being created there. Specifically, the "ODH@Bochum-Weitmar" project aims to develop an intelligent and user-oriented ecosystem for information and communication technologies (ICT), which provides the most



Dr.-Ing. Marcus Budt

1 The production of paper requires large quantities of process steam to dry the paper webs.

2 Site visit in Bochum-Weitmar.

3 Process heat and residues from biomass plants are used for industrial brick production.



climate-neutral energy possible in the right place at the right time – at e-charging stations, as electricity in one’s own household, or in the form of heat. The focus of Fraunhofer UMSICHT lies on integral district planning with regard to climate-friendly supply, as well as structural and energy efficiency-improving measures.

More Information (German site): s.fhg.de/XMY 

“ In the future, new demands will be placed on district planning with e-mobility solutions, new business models, interaction with the energy markets, and the desire for climate-neutral living. We want to make this complex task solvable using mathematical optimization and select the most ecologically and economically sensible combination of the numerous technology and efficiency options available.”

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Leander Grunwald, M.Sc.

BioBrick: Biomass for sustainable brick production

The “BioBrick” project focuses on the question of how process heat and residues from biomass plants can be used for industrial brick production. The consortium consists of Fraunhofer UMSICHT, Burkhardt GmbH as plant manufacturer, and Ziegelwerk Ernst GmbH & Co. KG as user. A concept for integrating a wood gasification technology and a combined heat and power plant into the energy supply is first being developed. The use of the gasifier residues as porosification material in the brick is also being considered.

More Information: s.fhg.de/U8k 

“ Under which general conditions would the operator of a brick plant rely on renewable energies? This question was our motivation for the ‘BioBrick’ project. We want to promote the use of biomass in industry, especially in the area of process heat supply, in order to displace fossil energy sources and thus reduce CO₂ emissions.”

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M.Eng. Julian Walberer



RESOURCE-EFFICIENT PROCESSES

Resource-saving and efficient processes are required in order to achieve the UN climate goals and the national targets. Fraunhofer UMSICHT is expanding the spectrum of possible conversion processes, adapting process steps, optimizing them, and developing them anew.

Environmentally friendly fuels for shipping

Worldwide regulations on emission limitation require new ways of producing marine fuels. In the "PyroMar" project, the entire process chain for the production of residue-based blending components is being mapped. First, pyrolysis oil is produced by means of ablative fast pyrolysis. Its acidic components are esterified with long-chain alcohols, which, in turn, are obtained from straw-based ethanol – a process developed at Fraunhofer UMSICHT. The aim is to achieve the best possible miscibility with fossil marine fuels. In addition to the technical development, the "PyroMar" team carries out sustainability assessments and analyzes biomass potential as well as sales markets. The development of approaches for the route into the market is also part of the project carried out together with the University of Rostock and ifeu gGmbH.

More Information (German site): s.fhg.de/v6n 

" The addition of bio-based blending components does not require any modifications to the engine. With 'PyroMar', we want to offer a real alternative to solve the sulfur problem and save CO₂ in shipping. **"**

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Resources in the cycle: Agricultural systems of the future

A central challenge of our time is how to supply the growing population with agricultural products. Especially in urban areas, innovative agricultural systems are needed to meet the trend towards sustainable, local, and high-quality products. "SUSKULT" is a pioneer in this field.



Dr.-Ing. Volker Heil

1 "PyroMar" fuel: alternatives for the more sustainable operation of ocean-going vessels.

2 A demonstration plant is to be built here: Emscher estuary sewage treatment plant on the city border between Dinslaken, Oberhausen, and Duisburg.

3 A look inside a rice mill in Indonesia: rice husks as a valuable source of energy.



What is special about the project is that the resources needed for local agricultural production – nutrients (fertilizer), CO₂, heat, and water – come from a wastewater treatment plant. In order to use these within recycling and to turn pure wastewater treatment plants into resource suppliers (called NEWtrient® centers), the “SUSKULT” project consortium is developing a corresponding modular system. In the next step, a demonstration plant is to be commissioned on the site of the Emscher estuary wastewater treatment plant.

More Information (German site): suskult.de

“ We have a vision that, in 2050, there will no longer be wastewater treatment plants in the sense of a disposal facility, but rather NEWtrient® centers. Resource streams that include all of the nutrients in cities can be treated here.”

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Rice husks provide clean electricity

Around the world, the production of food generates vast amounts of biomass as byproducts. In Indonesia alone, up to 12 million tonnes of rice husks are produced each year. Thanks to their high calorific value and low moisture content, they are suitable as a source of energy. The “CARE” project addresses agricultural recycling in Indonesia with the aim of making local electrification more sustainable. Rice husks are to be pelletized locally and used as fuel in special biomass gasifiers. The gas produced can replace large proportions of the diesel previously used to generate power.

More Information: s.fhg.de/4vD

“ Even for Indonesia’s smallest rice mills, which account for more than 90 percent of the total rice mills in Indonesia, the move toward a bio-based energy supply means a new market and, in turn, a new source of income from the sale of rice husk pellets.”

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Dipl.-Ing. Volkmar Keuter



Dr.-Ing. Esther Stahl



CIRCULAR PRODUCTS

Product development in a circular economy requires the use of sustainable materials and holistic process approaches. The entire value chain must be examined in a circularity and sustainability assessment to identify any conflicting goals. These project examples show how this can be achieved.

1 *3D printed sound absorber based on fungi and plant fibers.*

2 *Biodegradable lubricants help protect the environment.*

3 *The processes are tested in the high pressure technology center.*

FungiFacturing: Schallabsorber auf Pilzbasis

Many raw materials used in the construction industry are becoming scarce, are not easy to recycle, and are therefore not sustainable. In the "FungiFacturing" project, Fraunhofer UMSICHT is conducting research together with the Fraunhofer Institute for Building Physics IBP in order to develop sound-absorbing materials based on fungi. These feed on plant residues such as straw and can be processed into bio-based sound absorbers by means of generative manufacturing.

More Information:

Press Release (German site): s.fhg.de/W5r

Project fact sheet: s.fhg.de/L3W

Project Website (German site): www.fungifactoring.de

"The bio-based building material made from mushroom mycelium is not only resource-saving and sustainable, but can also achieve higher acoustic efficiency. To achieve this, the research team uses the double-porosity process. This means that the pore structure inside the absorber can be determined and planned in advance, with two different pore sizes."

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Julia Kraye, M. A.

"PHAt": Environmentally friendly lubricant additives made from renewable raw materials

In the "PHAt" project, Fraunhofer UMSICHT is developing sustainable thickeners and binders for the lubricant industry in partnership with industry and science, using bio-based raw materials from microorganisms. Lubricants are used to reduce friction and wear in machines. They can also contribute to cooling, are used as sealants, protect against corrosion, or are used in bonded coatings. Within the "PHAt" project, the team is developing environmentally



compatible thickeners and binders based on a class of naturally occurring biopolymers known as polyhydroxyalkanoates (PHA). The PHAs originate from special microorganisms that produce these molecules as storage materials.

More Information:

Press Release (German site): s.fhg.de/7Bb  Project fact sheet: s.fhg.de/A6d 

“ After many optimization steps in PHA production, we have now reached the threshold of producing on a pilot plant scale, which can be carried out economically in the foreseeable future. Since the results are so positive, we are already planning to continue our collaboration after the end of the funding period. ”

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Dr. rer. nat. Inna Bretz

“NuKoS”: Carbon dioxide turns slag into higher-value products

Alongside the cement industry, the steel industry is one of the biggest emitters of CO₂ and produces around 14 million tonnes of iron and steel slag in Germany every year. Slag from steel and metal production contains important elements that currently remain unused. There is a lack of highly specialized methods to make this slag usable as material and to introduce it into an efficient further processing system. The “NuKoS” research project aims to use carbon dioxide from process gases to process slag into higher-value products for the construction, plastics, cement, and paper industries.

More Information:

Press Release (German site): s.fhg.de/9Wa 

“ The project has great potential to broaden the raw material base of the German economy and to expand the resource-efficient circular economy. By incorporating CO₂ into slag-based prefabricated components, it has already been possible to produce test specimens that far exceed the compressive strength of prefabricated components used in the construction industry for comparable applications. ”

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Michael Prokein, M.Sc.

OUR NETWORK



LUCKILY, WE ARE NOT ALONE ON THIS EARTH.

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



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THE FRAUNHOFER-GESELLSCHAFT

The Fraunhofer-Gesellschaft, headquartered in Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for groundbreaking developments and scientific excellence, Fraunhofer helps shape society now and in the future.

Facts and figures at a glance

Research of practical utility is the central task of the Fraunhofer-Gesellschaft which was founded in 1949. Fraunhofer ...

- conducts application-oriented research for the benefit of the economy and to the advantage of society.
- currently maintains 75 institutes and research institutions in Germany.
- employs around 29,000 people, most of whom are qualified in science or engineering.
- develops a research volume of 2.8 billion euros. Of this, 2.4 billion euros is generated through contract research. Fraunhofer generates around two-thirds of this through contracts from industry and publicly financed research projects. The German federal and state governments contribute around one-third in the form of base funding, enabling the institutes to develop solutions to problems today that will be of crucial importance to industry and society in a few years' time.

Contractual partners and clients are: industry companies, service providers as well as the public sector.

1 *The building of the Fraunhofer-Gesellschaft in Munich.*

As of January 2021

Fraunhofer as employer

Fraunhofer offers the opportunity for independent, creative, and, at the same time, goal-oriented work and thus for professional and personal development, which qualifies students for challenging positions in the institutes, at universities, in business, and in society. Students have excellent opportunities to start and develop their careers in companies thanks to their practical training and early contact with clients.

Fraunhofer President

Prof. Dr.-Ing. habil. Reimund Neugebauer

is the 10th president of the Fraunhofer-Gesellschaft and responsible for Corporate Policy and Research Management. He has been heading the Fraunhofer-Gesellschaft since 2012. As the first president of non-university research institutions, he uses the business network LinkedIn as an important channel for digital science communication and provides information on current developments.

More Informationen about Fraunhofer:

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

Go to Prof. Neugebauer's articles on the business network LinkedIn:

de.linkedin.com/in/reimund-neugebauer 



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BOARD OF TRUSTEES

Fraunhofer UMSICHT has been advised by a board of trustees since 2002. People from science, economics, politics, and administration are represented on the board of trustees.

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Hubert Loick

Chairman of the Board of Trustees
Loick AG, Managing Director

Prof. Dr. Ada Pellert

Deputy Chairwoman of the Board of Trustees
FernUniversität in Hagen, Rector

Fraunhofer UMSICHT celebrated its 30th birthday in 2020. There were naturally also congratulations and greetings from the Board of Trustees to mark the anniversary. Here are two examples.



Hubert Loick
© private

“ For me, Fraunhofer UMSICHT, with its dedicated employees, represents an institute that offers sustainable solutions for everyday problems that are present everywhere. The approaches to solutions are always about how the climate and environment can be protected and resources conserved. And, even more than that, it is also always about answering the question of identifying the conditions under which people are willing to support necessary changes. ”



Prof. Dr. Ada Pellert
© FernUniversität in Hagen/Volker Wiciok

“ In my eyes, Fraunhofer UMSICHT is characterized by a prudent view of value chains thanks to its process-oriented approach. This leads to unusual connections and networking, and thus to a wealth of stimulating innovations. ”

More information about the Board of Trustees and its members:

www.umsicht.fraunhofer.de/en/about-fraunhofer-umsicht/cooperation/board-of-trustees.html 



UMSICHT SCIENCE AWARD

For the 11th time, the UMSICHT Friends and Patrons Group presented awards to people who promote the dialog between science and society and communicate complicated issues in an understandable way. Dr. Pattarachai Srimuk convinced the expert jury in the category science, while Adrian Lobe received the award in the category journalism. The award ceremony was held virtually for the first time in 2020.

Award Winner Science Category:

Dr. Pattarachai Srimuk

“ Water consumption is increasing as the world’s population grows. At the same time, problems relating to access to and the availability of drinking water are worsening in many countries. ”

One promising technology for desalinating water is capacitive deionization, or CDI for short. However, the process has so far only worked energy-efficiently with brackish water. As part of his dissertation, Dr. Srimuk has researched new Faraday electrode materials that also desalinate seawater efficiently and effectively. His activities can thus make an important contribution to the global “water turnaround”.

Award Winner Journalism Category:

Adrian Lobe

“ The thought of the negative environmental impact of a search query is probably only present in the rarest of cases when Googling. Even when streaming movies, you’re not always aware that data centers that emit CO₂ are running in the background. ”

In his article, Adrian Lobe highlights the environmental impact of the rapid growth of digitalization through artificial intelligence and cloud computing, and identifies the consequences. He also addresses the self-reinforcing growth spiral on which

certain digital services depend. These include, for example, climate models that multiply their own ecological footprint, which they aim to detect at an object level. Lobe is certain that a new ecology of intelligence is needed alongside sustainable cloud computing.

UMSICHT Friends and Patrons Membership

The members of this group support the institute in the realization of research and development ideas regarding environmental, safety, and energy technology. Furthermore, the group participates in the organization of congresses and seminars, funds promising young scientists and guest scientists, and each year awards the UMSICHT Science Award. **Become a member or a sponsor of the prize yourself, too. Talk to us.**

More information about the UMSICHT Friends and Patrons (German site):

www.umsicht-foerderverein.de 

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infernum
Interdisziplinäres Fernstudium
Umweltwissenschaften

1



INTERDISCIPLINARY DISTANCE LEARNING ENVIRONMENTAL SCIENCES

The successful and scientifically sound fulfillment of complex tasks in the fields of environment and sustainability requires an interdisciplinary approach and way of thinking. The Interdisciplinary distance learning program in environmental sciences infernum imparts the knowledge necessary for this and enables students to understand the “languages” of the different disciplines.

1 *infernum is “Place of Progress 2014” and has been awarded several times as “Network of the UNESCO World Action Program Education for Sustainable Development”.*

infernum is a program offered jointly by the FernUniversität in Hagen and Fraunhofer UMSICHT under the roof of the Fraunhofer Academy. It combines the aspects of economic performance, social responsibility, and ecological compatibility and, in this way, offers students qualified further education in the field of sustainable development.

Since 2000, infernum, as a distance learning program, has been enabling students to work independently in a structured manner, continue their scientific education alongside work and family, and improve their prospects on the job market. Individual learning programs can be assembled from (inter-)disciplinary modules, and entry into the program is possible at any time

The following degrees can be obtained:

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

“ With the infernum degree program, we have succeeded in establishing a scientific course of study that has been providing our students with the knowledge and tools to make the world a little more sustainable for more than 20 years. The motivation, commitment, and idealism of the students are an incentive for us to constantly develop infernum further and to incorporate current knowledge from research and development into the study program. ”



Laura Oehmigen, M.Sc.

More information about the distance learning program infernum (German site):

www.umweltwissenschaften.de 

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1

UMSICHT RESEARCH SCHOOL

The UMSICHT Research School is an accompanying program for the institute's doctoral students. It helps them to work on their doctorate in a targeted manner and acquire additional qualifications for a career in science and research. In 2020, 67 people prepared for their doctorate with a dissertation, 10 of them at the institute branch in Sulzbach-Rosenberg.

Anna Hofmann, PhD student in the Department of Environment and Resources

" For me, the UMSICHT Research School is a platform that unites the community of doctoral students wonderfully 'under one roof' while also providing valuable support throughout the entire doctoral period. Be it through individual (confidential) coaching, interdisciplinary events, or the acquisition of key qualifications."

Lina Sommer, PhD student in the Department of Sustainability and Participation

" The UMSICHT Research School is particularly important for me because it helps you to be honest with yourself. Via the doctoral coaching and the semi-annual status meetings, confronting immature thought processes and to-dos that have been postponed far into the distance is unavoidable."


Lennart Schürmann, PhD student in the Department of Energy Systems

" I find the courses offered by the UMSICHT Research School helpful. If you focus on your individual strengths and weaknesses, you can get real benefit from the courses."

Volker Knappertsbusch, Coordinator of the UMSICHT Research School.

" I think that an essential aspect of the UMSICHT Research School success model is the highly motivated and empathetic team. It consists of an experienced coordinator for regular consultations during the process and confidential discussions, a scientific manager, and two representatives from Human Resources Development who, as strategic advisors, help to further develop the structure and constantly provide the range of coaching and qualification according to the current and changing needs of the doctoral students."

More information about the UMSICHT Research School
www.umsicht.fraunhofer.de/en/jobs-career/promotion.html 

More information about the university connection:
s.fhg.de/5iC 

1 *Lennart Schürmann, Lina Sommer and Anna Hofmann (l. to r.).*

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SPIN-OFFS

With a total of more than 500 technology spin-offs in the last 20 years, the Fraunhofer-Gesellschaft is one of the strongest spin-off research institutions in Europe. There are currently 12 spin-offs at Fraunhofer UMSICHT. Fraunhofer researchers receive support from Fraunhofer Venture, which was founded 20 years ago.

What is Fraunhofer's goal in establishing spin-offs?

Andreas Weber: The goal of the Fraunhofer-Gesellschaft is to transfer valuable technological knowledge into society and industry. One way to develop innovative technologies into market-ready products and to market them is by founding a spin-off. The researchers need a good business idea and must strategically plan areas such as financing, investment, and the business model.

How does Fraunhofer Venture support start-ups?

Andreas Weber: Fraunhofer Venture accompanies researchers from the idea to the founding of a start-up by providing legal and business advice, information on internal funding opportunities, access to seed capital, and a strong network in industry and the start-up scene.

What tip do you have for people who want to start a business?

Andreas Weber: Unfortunately, there is not one ultimate tip. The royal road to a spin-off ideally starts with a new technology that can create a unique selling proposition on the market. In addition, the right team is crucial for success. Ask yourself honestly what each person can contribute to success and check whether all of the important topics (sales, technology, finances) are covered. And, of course, consider for yourself whether you want to start and run a company.

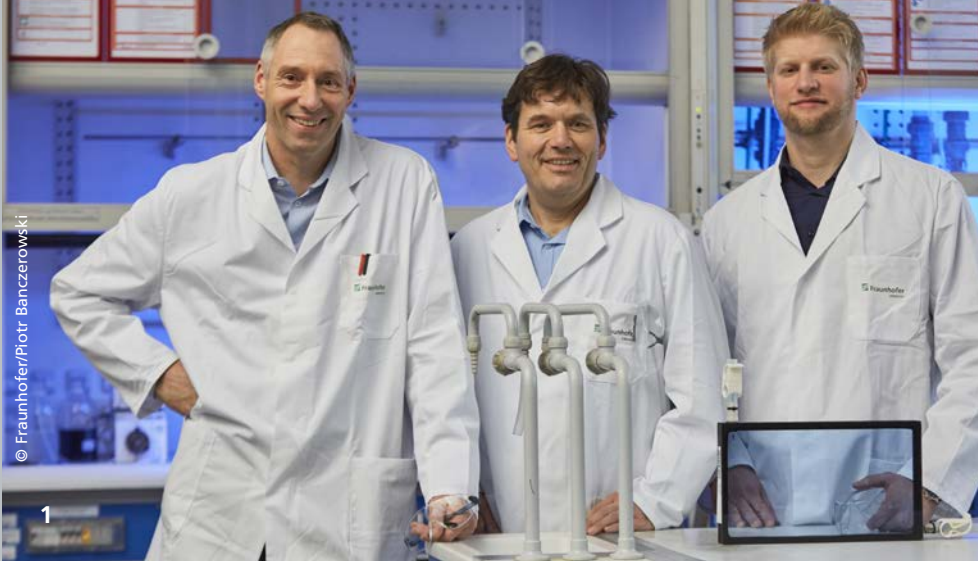
More information about our Spin-offs:

www.umsicht.fraunhofer.de/en/about-fraunhofer-umsicht/cooperation/spin-offs.html



Andreas Weber 

Division Director Organization



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PRIZES AND AWARDS

In 2020, employees of Fraunhofer UMSICHT received the Joseph von Fraunhofer Prize for the first time in the institute's history. But even beyond that, there were several reasons to celebrate and rejoice.

Joseph von Fraunhofer Prize

Fraunhofer UMSICHT and the family-owned company Hörmann have developed a new type of fire-resistant glazing that can withstand even extreme heat – and transferred it from beaker to production within four years. This earned the development team the Joseph von Fraunhofer Prize.

More information: s.fhg.de/9fy

EARTO Award

The team from Fraunhofer UMSICHT and Hörmann KG Glasstechnik also received the European Innovation Award EARTO for the innovative fire protection gel and the production process for fire-resistant glazing.

More information (German site): s.fhg.de/nHL

Project outline funding

Two projects have each been supported with 10,000 euros of start-up funding from the Fraunhofer UMSICHT Friends and Patrons Group. The topics: groundwater remediation (Alina Gawel and Marc Greuel) and plastics recycling (Martin Nieberl and Maximilian Schinhammer).

More information (German site): s.fhg.de/i3r

Promotion of theses

Sonja Witkowski's master's thesis "Development and optimization of various operating concepts for thermal storage units

1 *Delighted with the Joseph von Fraunhofer Prize: Dr. Holger Wack, Dipl.-Ing. (FH) Damian Hintemann and industry partner Thomas Baus M.Sc., Hörmann KG Glasstechnik.*

2 *Honored for her master's thesis: Sonja Witkowski.*

in heating networks for neighborhood supply" was awarded 500 euros by the UMSICHT Friends and Patrons Group.

More information (German site): s.fhg.de/i3r

Nomination for the HR Excellence Awards

The introduction of New Work at Fraunhofer UMSICHT as part of the NewWork@Fraunhofer project was shortlisted for the HR Excellence Awards 2020 – in the category "Large Company New Work".

Science Slam

Alina Gawel won the Science Slam, which took place at the end of 2020 as part of the Energy Research Congress. She presented her research with a twinkle in her eye: working with metal sulfides in the electrochemical reduction of carbon dioxide.

More information (German video): s.fhg.de/6rn

Customer acquisition of the month

Manfred Renner and Nils Mölders acquired 1,125,000 euros from a medium-sized company for the development of a new type of insulating material. This was Fraunhofer's best customer acquisition in the month of October.


Up-to-date information about our research:


www.umsicht.fraunhofer.de/en/press-media.html

BIBLIOGRAPHY/ FUNDING INFORMATION

Fraunhofer Specialized Publications and Patents

The publications and patents that result from the research activity of the Fraunhofer Institutes are documented in the "Fraunhofer-Publica" database.

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

Information regarding specialized publications is available from our specialized information service: fachinformation@umsicht.fraunhofer.de 

Information regarding industrial property rights is available from our industrial property rights officers: srb@umsicht.fraunhofer.de 

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The newsletter is published a maximum of four times a year. If you are interested in the latest news, please register for our press distribution list.


More information about our free online subscriptions (German Sites):

www.umsicht.fraunhofer.de/newsletter 

www.umsicht.fraunhofer.de/de/formulare/presseverteiler.html 

Schedule 2021

Current Information about our events/trade fair participation can be found on the Internet at:

www.umsicht.fraunhofer.de/en/events-trade-fairs.html 



Funding Information

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The Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE is funded by the Fraunhofer-Gesellschaft.

Page 28

Carbon2Chem® (Phase 1 and 2) is funded by the German Federal Ministry of Education and Research (BMBF).

Page 30

Phase 3 of DYNAFLEX® is funded by the Fraunhofer-Gesellschaft.

Page 31

The lead project ShaPID (Shaping the Future of Green Chemistry by Process Intensification and Digitalization) is funded by the Fraunhofer-Gesellschaft.

Page 34

The project "Geothermal paper drying – development of a steam generation system for paper drying based on deep geothermal heat in Hagen" is funded by the state of North Rhine-Westphalia from the European Regional Development Fund (ERDF).

Page 34

The "ODH@Bochum-Weitmar" project is being funded by the state of North Rhine-Westphalia.

Page 35

The project "BioBrick – Biomass as the key to sustainable production of bricks" is funded by the German Federal Ministry for Economic Affairs and Energy (BMWi) under the funding code 03EI5410A.

Page 36

The "PyroMar" project is funded by the German Federal Ministry for Economic Affairs and Energy (BMWi) under the funding code 03EI5412.

Page 36

The project "SUSKULT – Development of a Sustainable Cultivation System for Food of Resilient Metropolitan Regions" is funded by the German Federal Ministry of Education and Research (BMBF) under the funding measure "Agricultural Systems of the Future" as part of the "National Research Strategy BioEconomy 2030" of the German Federal Government under the funding code 031B0728.

Page 37

The project "CARE – Towards Circular Indonesian AgricultuRE" is funded by the German Federal Ministry of Education and Research (BMBF) as part of the "Bioeconomy International" program under the funding code 031B0912A.

Page 38

The project "FungiFacturing" is funded by the German Federal Ministry of Food and Agriculture (BMEL) via the German Agency for Renewable Resources (FNR) under the funding code 22013418.

Page 39

The "PhAt" project is funded by the German Federal Ministry of Education and Research (BMBF) via Project Management Jülich (PtJ) under the funding code 031B0364A.

Page 39

The project "NuKoS – Utilization of Carbon Dioxide in Slags from Steel and Metal Production" is funded by the German Federal Ministry of Education and Research (BMBF) via the Project Management Jülich (PtJ) under the funding code 033RC027.

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We are looking forward to getting into contact with you! If you have any questions, suggestions, and ideas for projects do not hesitate to contact us. You can reach us in many ways.



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