



Fraunhofer
UMSICHT

FRAUNHOFER INSTITUTE FOR ENVIRONMENTAL, SAFETY, AND ENERGY TECHNOLOGY UMSICHT

For the years 2014 and 2015

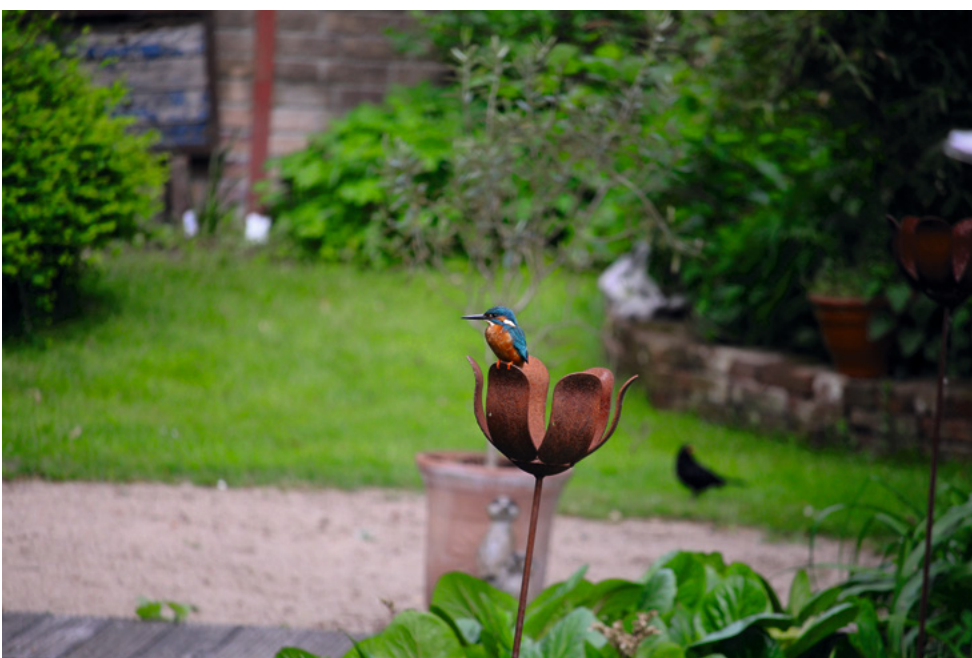
SUSTAINABILITY REPORT

Our Responsibility for the Future



PHOTOS

Fraunhofer UMSICHT has existed in Oberhausen for the past 26 years. We would like to pick up on the rooting of the institute in the "cradle of the Ruhr industry" in the heart of the Ruhr region and our connection to the city in the illustrations in our sustainability report. This is why all of the photos used in this report – with the exception of the photos of our institute branch in Sulzbach-Rosenberg – show scenes from Oberhausen or the local Ruhr region. They were either taken by employees of the institute or by their friends and acquaintances.



Cover Photo: Michael Zippel, kingfisher in Oberhausen, Schmachtendorf

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This report was prepared in accordance with the guideline for gender-sensitive writing of the Fraunhofer-Gesellschaft.



*Prof. Dr.-Ing. Gorge Deerberg, Deputy Director of the institute, Prof. Dr.-Ing. Eckhard Weidner, Director of the institute
Photo: Fraunhofer UMSICHT/PR photography Kohring*

Dear readers,

We are delighted that you are currently reading the fifth sustainability report, which was once again created according to the G4 standard from the Global Reporting Initiative.

We strive to further strengthen our pioneering position in terms of sustainability – also because important milestones in overcoming major global challenges were achieved in 2015: The UN Summit in New York resulted in the adoption of the "Agenda 2030 for Sustainable Development", of which the 17 sustainable development goals link the principle of sustainability to economic, ecological and social development. Following on from the Kyoto Protocol, a global climate agreement was concluded in Paris. In the Paris Agreement, the countries set themselves the aim, among other things, of limiting the global temperature increase to 1.5°C where possible and promoting climate resilience.

Both initiatives are very ambitious – their realization can only succeed if everyone works on them together. As a research institute, we consider ourselves particularly committed to this. This view is shared by the people who recommended in our second stakeholder dialog that we should assume a position, be a pioneer for sustainable development, exhibit research responsibility and academic excellence, and highlight the importance of the institute for the region. These recommendations are prudent – just like our institute. We have been diverse and multifaceted ever since we were founded in 1990. As a trailblazer in sustainable energy and raw materials management, we are convinced that above all the diverse nature of our knowledge and our experiences are of benefit. This opens up numerous opportunities for researching and developing innovative products, processes and services.

We invite you to better get to know the diversity of Fraunhofer UMSICHT and some of our contributions to sustainable development, and hope you find this report an interesting read.

Best regards,

Eckhard Weidner

Gorge Deerberg

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SUSTAINABILITY AND APPLIED RESEARCH

Motivation behind the report and global developments

Sustainability has also become one of the central topics in global politics. The United Nations adopted the UN Sustainable Development Goals (SDGs) in 2015, marking an important milestone in international sustainability policy. The Fraunhofer-Gesellschaft also feels called upon to support the achievement of these goals with its expertise wherever possible and in close interaction with politics, business and society.

As part of organization-wide portfolio management, it was thus analyzed for which of the 17 sustainable development goals the scientific and technological developments of the Fraunhofer-Gesellschaft are particularly relevant and how its expertise can contribute to facing these societal challenges in the future. The research contributions for six of these global challenges (health, water, cleaner energy, sustainable industrialization, sustainable cities, and sustainable production) are described in the [online sustainability report](#) of the Fraunhofer-Gesellschaft.

Other radical developments occurred in the field of sustainability reporting. Directive 2014/95/EU of the European Parliament and of the Council on financial reporting was amended in October 2014. The new Directive stipulates that certain large companies of public interest with over 500 employees must, besides financial reporting, also report on topics relating to corporate social responsibility (CSR), i.e. the voluntary social responsibility of companies. The companies have been committed to also disclosing information about strategies, risks and results on the following topics since December 2016: Environment, social and employee matters, human rights, combatting corruption and bribery, diversity in management and control bodies. The aim of this directive is to increase the transparency of social and environmental reporting by companies from all industries in all EU Member States to a similarly high level.

Sustainability reporting in accordance with GRI-G4

With the help of sustainability reporting, companies and organizations show what effects – both positive and negative – their activities have with regard to business, environment and society. The standard by the Global Reporting Initiative, which is also followed by the Fraunhofer UMSICHT sustainability report – in the version G4 – is a globally established standard used as a guide by numerous companies. The guidelines developed by the Global Reporting Initiative using participative methods together with numerous stakeholders support the companies during reporting and create a certain degree of

comparability between the reporting companies. At the same time, they are used by the companies to help set and track sustainable development goals.

In order to reduce reporting to the essentials, companies only have to report things that are really of crucial importance for themselves and for their stakeholders. The GRI-G4 standard thus stipulates that the reporting companies engage with their internal and external stakeholders when ascertaining the material aspects for reporting. These can be illustrated in a

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SUSTAINABILITY AND APPLIED RESEARCH

materiality matrix (p. 9). The term 'aspect' refers to the list of topics covered by the GRI guidelines. All of the aspects listed in the guidelines comprise various indicators.

There are two types of GRI-G4 reporting: "In accordance – Core" and "In accordance – Comprehensive". If reporting is in line with the "comprehensive" option, all indicators for the identified material aspects must be reported. If the "core" version is chosen, at least one indicator must be reported per identified material aspect. Fraunhofer UMSICHT reports in line with the option "In accordance – Core".

A sustainability report in accordance with GRI-G4 is divided into general and specific standard disclosures. The general standard disclosures for the option "In accordance – Core" comprise information on strategy and analysis, the organizational profile, identified material aspects and boundaries, stakeholder engagement, report profile, governance, and ethics and integrity. In the specific standard disclosures, the identified material aspects are listed along with generic disclosures about the management approach and the indicators reported under the respective aspect.

The GRI content index for the sustainability report (p. 36) gives the reader a quick overview of which aspects and indicators are reported by the organization and on what pages of the report the respective details can be found.

What have we already been able to implement since the last report?

Since the last sustainability report was published in 2014, Fraunhofer UMSICHT has consistently pursued its sustainability activities. The UTOPIA Changemaker Progress Report was thus presented in February 2015, which took stock with regard to the goals set in 2013 as a UTOPIA Changemaker. The subscription of the German Sustainability Code (DNK) in 2012 should not remain a one-time activity. In September 2015, a declaration of conformity with the DNK was submitted for the second time. Valuable feedback from the office of the German Council for Sustainable Development with regard to specification opportunities was incorporated into this second declaration. Fraunhofer UMSICHT has also been a DNK mentor since November 2015. DNK mentors are proven users who provide support to interested parties and other DNK users and present their experience with the DNK in training sessions.

In December 2015, Fraunhofer UMSICHT was asked to take part in the innovator program KlimaExpo.NRW. The presentation of the contribution made to climate protection by the procedures and products developed by the institute impressed the jury, and so inclusion as an innovator was confirmed in April 2016.

In 2014, Fraunhofer UMSICHT undertook the first stakeholder dialog, where it gained many suggestions for future involvement. For instance, the stakeholders requested that Fraunhofer UMSICHT should increasingly get involved in transformation processes as a credible and independent expert. An initial contribution to this has been made by the institute since November 2015 with the new map service "Maps4use" (www.maps4use.de). The website offers people



Fraunhofer UMSICHT building complex

who are interested in the energy transition a wide range of freely available maps of the output of energy plants. The map service was opened with a set of maps on the Germany-wide power distribution and energy generated from the utilization of wind energy. From March 2016, maps for all renewable energy sources have been made available, and maps of fossil energies and energy consumption have followed.

A further request was that UMSICHT should adopt the role of a neutral opinion leader. Implementation has also begun here, too. The public is to gain assessments by Fraunhofer UMSICHT regarding topics that currently concern society, science and business. These topics are looked at in the series "Fraunhofer UMSICHT takes position". In this way, a contribution to objectivity is to be made in emotional debates. At the same time, it is intended to show whether and where the institute can make a contribution to resolving societal challenges. An initial position paper on the topic of microplastics was published, and further statements are set to follow.

Feedback on the previous report and amendments

Our commitment to sustainability is open to continuous improvement. We thus requested feedback on the previous report, among others from cooperation partners and renowned institutions, who are experts in sustainability management themselves. We are delighted that our request was willingly accommodated and we have received valuable input with a great depth of detail and numerous constructive suggestions. On the basis of this feedback, we have made the following improvements:

- Clear allocation of goals and measures for the key fields of action (see chapter 9).
- Addition of an introduction to GRI (see info box p. 4).
- Placing a greater focus on research results and their societal impact (from p. 25).
- Goals to reduce energy consumption were demanded. However, our energy consumption continues to depend significantly on our R&D activities, which is why we are unable to set specific goals. For instance, the lighthouse project "Electricity as a Resource" is currently working on developing new electrosynthesis processes to use excess electricity from renewable energy sources in a sensible way. This requires increased electricity consumption for our current research activities, although it will lead to significant electricity savings at other points in the industry later on in implementation.

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SUSTAINABILITY AND APPLIED RESEARCH

Mission, strategy, and research projects

The greatest influence of the institute in terms of sustainability naturally lies in its research activities and in their strategic orientation. Our mission is:

Fraunhofer UMSICHT is a pioneer for sustainable energy and raw materials management by supplying and transferring scientific results into companies, society and politics. The dedicated UMSICHT team researches and develops, together with partners, sustainable products, processes and services, which inspire.

During the reporting period, the foundation stone was laid for a range of large-scale projects, which will help to further implement this mission. The aim of the Fraunhofer lighthouse project "Electricity as a Resource" is to develop and optimize processes that allow low-CO₂ electricity to be used in order to synthesize important basic chemicals. The energy transition and the regenerative electricity associated with this offer the opportunity to establish electricity-led production. Ten Fraunhofer Institutes, coordinated by Fraunhofer UMSICHT, have come together to lay the foundation stone for this and develop electrochemistry as a technology platform and export article. The aims are the development of new electrochemical processes and their technical demonstration and integration into the German energy system. The institutes want to permanently set up established exploitation chains on the market so that Fraunhofer covers the entire breadth of electrochemical research and development in about ten years.

The joint project "Carbon2Chem[®]" funded by the German Federal Ministry of Education and Research (BMBF) aims to close cross-industrial carbon cycles and develop flexible, accelerated processes for load changes. Carbon dioxide, which is generated during steel manufacture, can replace crude oil as a raw material in the chemical industry using renewable energy. By using such new production processes in the steel and

chemical industry, CO₂ emissions can be significantly reduced. As part of Carbon2Chem[®], Fraunhofer develops technologies and system solutions for gas purification, to adapt the catalytic production of methanol and higher alcohols, and for fuel production.

North Rhine-Westphalia gets three new Fraunhofer High Performance Centers. One of these is "DYNAFLEX". Dynamic, adaptive and flexible processes and technologies for the energy transition and raw materials shift are to be researched and developed here. The scientific basis for the adaptation of the energy and chemical industry to changing framework conditions is developed by Fraunhofer UMSICHT in Oberhausen together with the three universities of the Ruhr area in Bochum, Duisburg-Essen and Dortmund.

Fraunhofer High Performance Centers organize the close alliance between university and non-university research and business. They are characterized by authoritative, complete roadmaps for the partners involved in the performance dimensions research and teaching, promotion of junior staff, infrastructure, innovation and transfer. Fraunhofer High Performance Centers form part of the policy of developing academic excellence with social benefits as a priority. The DYNAFLEX High Performance Centers is intended to make a major contribution to the success of the energy transition.



Slag heap "Halde Haniel" in Bottrop/View of the amphitheater through steles, photo: Ursula Ujma

Ethics, integrity, and management

With the freedom of research protected in article 5 of the German Basic Law, science is granted a right to self-regulation. This freedom also results in social and ethical responsibility – beyond legal requirements. This means that academics must take into consideration the risks arising from their research in the event of misuse and prevent direct and indirect damage to people and the environment as far as possible.

VALUES AND PRINCIPLES, STANDARDS OF BEHAVIOR

The topic of sustainability was included in the principles of the Fraunhofer-Gesellschaft: "Through our research we contribute to the sustainable development of an ecologically sound environment, and an economically successful and socially balanced world. We are strongly committed to this responsibility." The Fraunhofer-Gesellschaft has thus now also joined the United Nations Global Compact (UNGC) (p. 41).

The Fraunhofer-Gesellschaft has published an internal Code of Conduct. This is thematically wide-ranging and describes the key fields of responsibility, such as corruption prevention, dealing with customers, ethical academic responsibility, and resource conservation in the workplace. For our cooperation partners, we have published the "Principles of Collaboration" as explanations for third parties, with which we proactively and transparently adopt a position on key topics.

The Fraunhofer-Gesellschaft relies on information, sensitization and advice when accepting its ethical responsibility. Relating to this, specific measures such as a central, internal advice hotline for ethical questions were initiated. Employees are sensitized to the topic via various means of communication and there is an active exchange with external experts and national and international networks. What's more, Fraunhofer has appointed contact persons for ethics and academic responsibility, to whom the employees can turn, thus anchoring the topic within the institution.

The Fraunhofer-Gesellschaft is managed by an Executive Board. The Gesellschaft is advised here by the Senate, which corresponds to the highest supervisory board in accordance with GRI. For 2015, we show this board according to age classes and gender for the first time.

Age and gender distribution of the highest control body at the Fraunhofer-Gesellschaft in 2015.

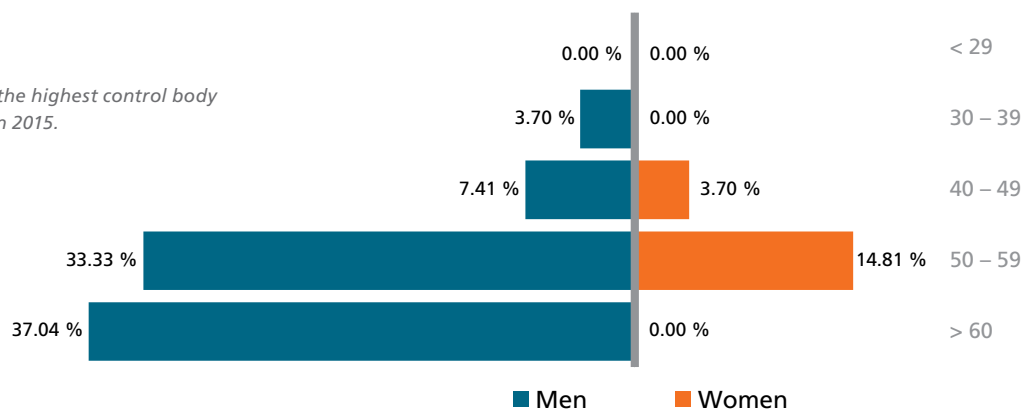


Fig. 1: Age pyramid of the Fraunhofer Senate 2015

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MATERIAL REPORT CONTENT AND STAKEHOLDER DIALOG

In order to identify the key topics for Fraunhofer UMSICHT, internal stakeholders and external stakeholders were interviewed in workshops in April and early May 2016. It was found that both groups were not so different in terms of what they considered essential. The summarized recommendations from the second stakeholder dialog are: assume a position, develop a pioneering role in sustainable development, exhibit research responsibility and academic excellence, and highlight extras in academic education and further education and the importance of the institute for the region.

Twelve employees from various divisions, thematic areas and boards at the institute came together for the internal stakeholder dialog. Following constructive feedback on the last sustainability report, the topics that the participants would like to read about in the new report were discussed, and then the topics were divided into groups and prioritized. The following topics were considered particularly essential: Representation of the specific contributions by UMSICHT to sustainability (e.g. contribution to transformation processes, to the energy transition and raw materials shift, and, where possible, also quantification of these contributions), long-term responsibility for employees (e.g. human resources development, handling personnel fluctuations, training planning for employees), knowledge transfer and visibility (research ethics, positioning, setting of topics, knowledge transfer, international effect), and credibility.

Around 20 people from business, science, politics and society met for the external stakeholder dialog in 2016. The Oberhausen citizens' center Alte Heid, a world war high-rise shelter that was transformed into a citizens' center with urban development funds represents a prime example of a sustainable building conversion, was chosen as the meeting place.

The focus of the initial dialog lay on the projects with which the institute is driving forward the energy transition and raw materials shift. The participants then looked back on the developments that had arisen since the first stakeholder dialog in 2014. The request that Fraunhofer UMSICHT should increasingly contribute to transformation processes as a credible, independent expert was e.g. implemented with the online map service "maps4use" focusing on renewable energy sources. With this, Fraunhofer UMSICHT has been providing the community with freely available maps on topics relating to the energy transition and raw materials shift for non-commercial use since the end of 2015 (maps4use.de). The desire for Fraunhofer UMSICHT to assume a stronger position led to the development of a series of position papers that started with a position paper on "microplastics".



Duisburg rail freight depot, photo: Daniel Maga

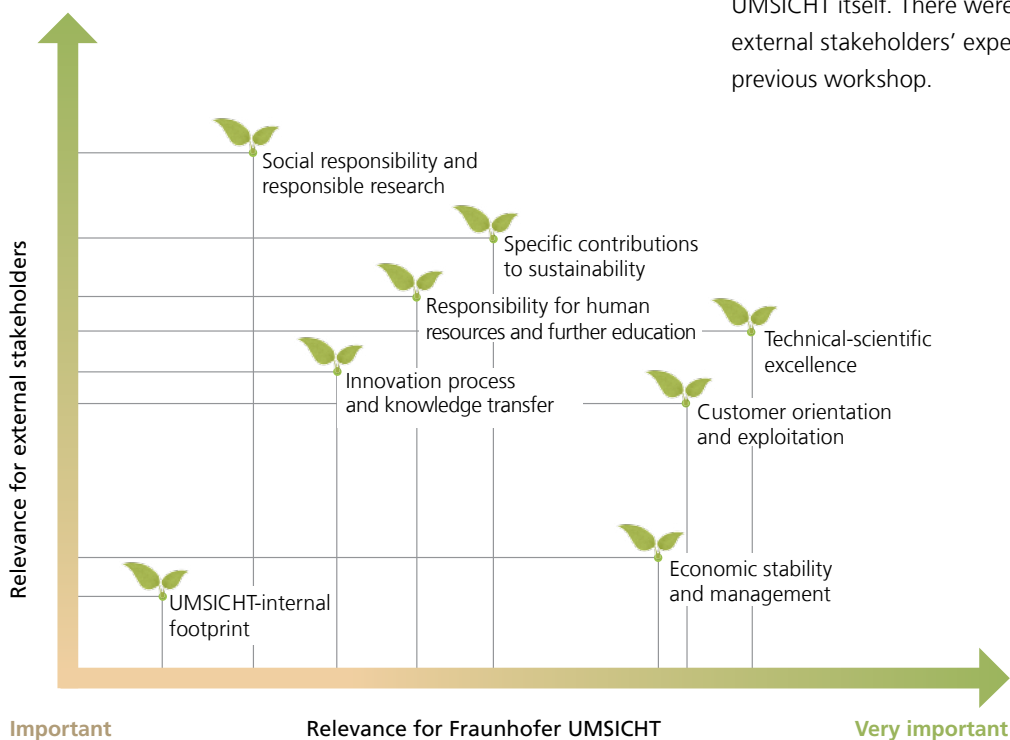
KEY TOPICS FOR THE SUSTAINABILITY REPORT 2016

Fraunhofer UMSICHT is to continue to assume a position and drive forward self-marketing and its increase in external perception. The external stakeholders recommended that Fraunhofer UMSICHT further emphasize its role as a pioneer and identify which topics are important for sustainable development. At the same time, the research responsibility perceived internally and externally should be communicated more strongly while demonstrating academic excellence and expertise as a research and development partner.

The participants considered a further area of focus for the upcoming reporting to be the topic of human resources, particularly in terms of employees' academic education and further education. They wanted to find out more about where Fraunhofer UMSICHT goes beyond the standards, what extras there are and specific examples of how responsibility for employees is taken. It was also recommended that the topic of sustainability should be used to bring more women into technical professions. Furthermore, the importance of the institute for the region and regional development should be shown.

The materiality matrix developed was presented to and adopted by the steering committee of the institute. In comparison with the previous report, the topic of "specific contributions to sustainability" was a new addition. Some other topics were specified more precisely. These topics (technical and scientific excellence, economic stability, and customer orientation and exploitation) have increased in importance for Fraunhofer UMSICHT itself. There were few changes in terms of the external stakeholders' expectations in comparison with the previous workshop.

Fig. 2: Materiality matrix of Fraunhofer UMSICHT 2016



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RESPONSIBILITY FOR EMPLOYEES AND HUMAN RESOURCES DEVELOPMENT

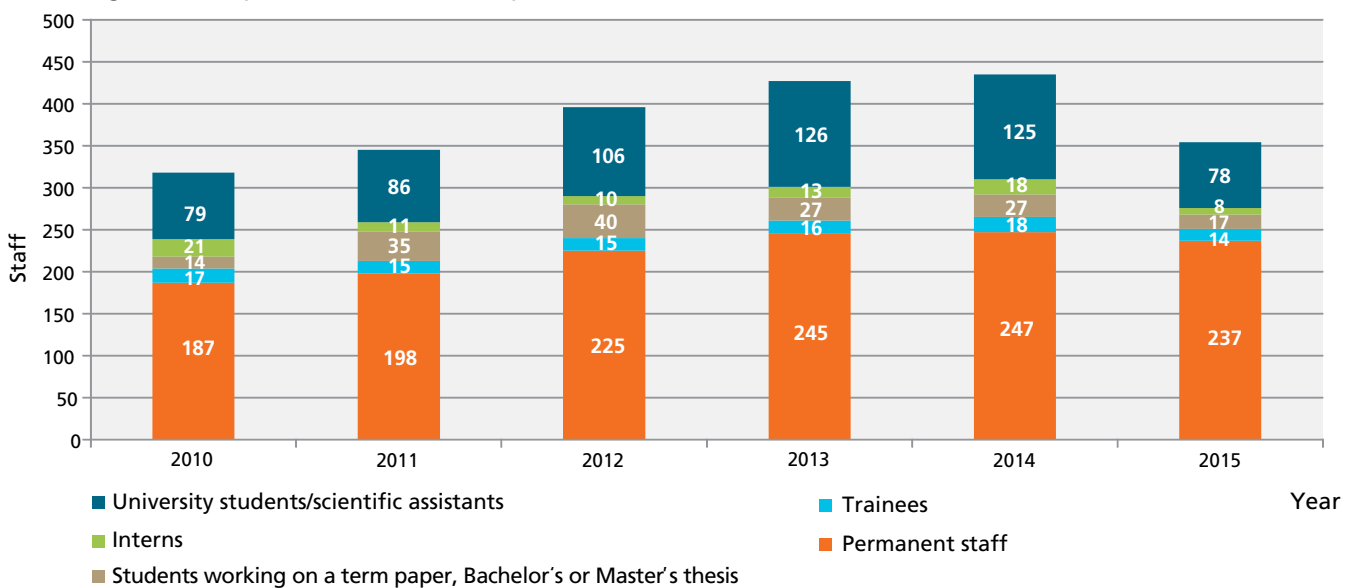
Development of the workforce

After the workforce had continuously increased from 2010 to 2014, a consolidation took place in 2015 as a response to the institute's tense financial situation (p. 20 and 21). Positions for student assistants and internships were particularly heavily affected. The permanent workforce fell to 237 people in 2015. This only affected temporary posts. At the same time, the handling of temporary employees was governed for the first time in guidelines at the Fraunhofer-Gesellschaft and at Fraunhofer UMSICHT. The temporary employment guidelines

require an earlier decision on long-term career development for researchers and thus increases transparency and planning security for the employees.

In the first half of 2016, there was only a selective reduction in workforce and, in the second half of the year, the first rehiring took place, particularly PhD students. The hiring of further PhD students is to be expected for 2017 due to the workload of a large number of publicly financed projects.

Fig. 3: Development of the staff composition





Toy telephone in the parent-and-child office at Fraunhofer UMSICHT

Diversity and equal opportunities

The Fraunhofer-Gesellschaft supports equal opportunities measures and realizes active diversity management: all employees are treated without prejudice and are appreciated – regardless of gender, nationality, ethnic background, religion or ideology, disability, age, sexual orientation and identity. Fraunhofer recognizes that work and family must be compatible and makes employees flexible offers with this in mind. Throughout Fraunhofer, these include flexible place of work and working hours models, workshops on the compatibility of work and family, emergency childcare, advice and support services in the field of homecare and eldercare, and professional life coaching by the pme family service. What's more, Fraunhofer UMSICHT also specifically offers localized services such as childcare for schoolchildren between 6 and 12 years during vacations and a parent-and-child office.

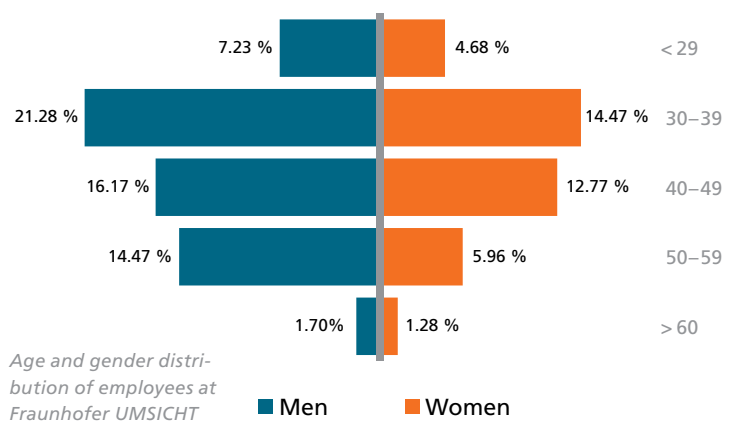
The importance of the topic is, last but not least, emphasized by the fact that diversity and the compatibility of work and family have been declared Executive Board topics since 2011 and have since been managed by Prof. Alexander Kurz, Executive Vice President for Human Resources, Legal Affairs and IP Management at Fraunhofer-Gesellschaft.

To enable the workforce to be suitably supported and supervised, an Equal Opportunities Officer (BfC) is elected as a mandatory body at every institute every four years, in addition to the services provided centrally. The BfCs are closely linked to each other and also act beyond the institute boundaries with local Equal Opportunities Officers for the respective cities and communities as well as those of local universities and universities of applied sciences. All Fraunhofer Institutes together are provided with a total of €250,000 each year in order to establish measures to improve the compatibility of work and family (examples here include the provision of kindergarten places, the equipping of a parent-and-child office, and services to organize vacation childcare).

AGE PYRAMID AND NATIONALITIES

To show diversity, an age pyramid was created for the first time for this report in order to gain an overview of the workforce of permanent employees.

Fig. 4: Age pyramid Fraunhofer UMSICHT 2015



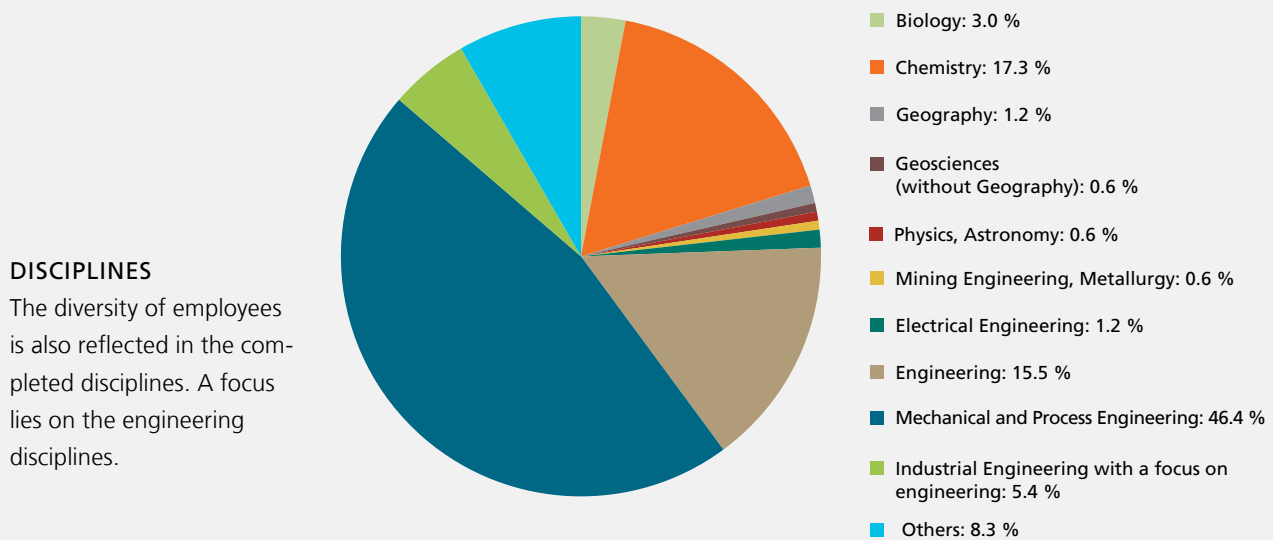
The average age of the scientific staff was 41 years in 2015.

In 2015, 20 employees had foreign nationality. This corresponds to a share of around 6 percent based on the total number of employees. Of these 20 employees, 60 percent come from Europe. All executives at Fraunhofer UMSICHT have German nationality.

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RESPONSIBILITY FOR EMPLOYEES AND HUMAN RESOURCES DEVELOPMENT

Fig. 5: Distribution of disciplines at Fraunhofer UMSICHT in the year 2015



The Fraunhofer-Gesellschaft has taken on the task of increasing the proportion of female employees, starting with female researchers (from salary group 13), to the 1st and 2nd management level through to directors, by a total of 3.1 percent to 22.2 percent for Fraunhofer as a whole between 2013 and 2017. Various measures are being put in place in order to achieve the target figures with regard to the proportion of

female researchers. One of the central measures is the TALENTA program launched by the Fraunhofer headquarters in 2013. "Fraunhofer TALENTA" is a two-year funding and development program to acquire and develop female researchers, which targets various stages of career development in three versions. Eight female candidates from Fraunhofer UMSICHT have been funded since 2015 as part of the program.

Human resources development

The success and the performance of Fraunhofer UMSICHT are crucially influenced by the skills of the employees. Human resource management and human resources development are thus considered central tasks at the institute. Besides the promotion of junior staff, personnel marketing and personnel recruitment, needs-appropriate training and individual development planning for employees lies at the heart of human resources development.

STEM* PROMOTION OF JUNIOR STAFF

For many years, Fraunhofer UMSICHT has been systematically committed to fostering the next generation of researchers and each year offers established formats that are targeted towards school pupils and students of STEM subjects. These include the Fraunhofer Talent School, the Girls' Day and various initiatives specifically for female students as a partner as part of the joint project ChanceMINT.NRW.

*STEM = "Science, technology, engineering und mathematics", in German MINT



Presentation kit, photo: Fraunhofer UMSICHT/ Ilka Drnovsek

What's more, there is always the opportunity for pupil internships and tours of the institute for school classes and students. However, due to high demand, a targeted selection and restriction of the offer must be made.

TRAINING AND DEVELOPMENT

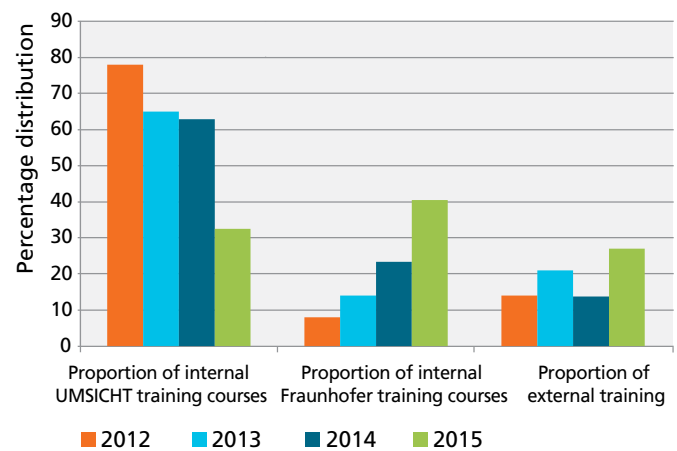
As part of systematic human resources development, an extensive education program is offered, which comprises professional and generic training measures. These are used to strengthen and further develop professional, scientific, entrepreneurial and social skills of academic and non-academic employees at the institute. The further education measures include seminars, training courses and workshops that are provided for specific target groups in-house (e.g. acquisition seminars, PhD coaching, communication training, language courses) or externally. What's more, our employees attend events such as conferences, meetings, and trade fairs, as far as these contribute to the aim of developing the aforementioned skills.

In 2015, our employees underwent an average of 0.7 days of further training. The high figures for the previous years arose, among other things, through mandatory training courses for executives.

Training measures	Unit	2012	2013	2014	2015
Total training days per year	[d/a]	607	622.5	623.8	207.5
Training rate per employee	[d/employee]	2.7	2.5	2.5	0.7

The education program is adapted each year to the current requirements and needs in the institute. The needs assessment takes place primarily using the annual staff appraisals. Over the years, an increase in internal Fraunhofer training courses and external training courses has been shown compared to internal UMSICHT training courses.

Fig. 6: Distribution of further education opportunities at Fraunhofer UMSICHT according to provider



In order for research institutions to be successful, continuous personnel renewal is also always required alongside ensuring practical knowledge in order to generate innovative ideas and approaches. The human resources policy at the Fraunhofer-Gesellschaft thus entails an above-average fluctuation, particularly among research staff. For this reason, careful and systematic successor planning for important departmental and management positions is of great importance for the long-term success of Fraunhofer UMSICHT. With this in mind, the key functions and knowledge-carriers, and the potential offered by employees are recorded in a structured manner in annual human resources development meetings with executives and, based on this, individual measures (e.g. study funding, mentoring, TALENTA funding program, coaching) are determined or individual human resources development plans drafted for people with potential.

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RESPONSIBILITY FOR EMPLOYEES AND HUMAN RESOURCES DEVELOPMENT

Employee survey

The fourth Fraunhofer-wide employee survey in 2015 found the institute to be in a tense economic situation (p. 20). This was reflected in poorer survey results in the areas of strategy and management. The result report particularly highlights slight uncertainty among employees. It was all the more important that the institute handled the results in an open, constructive manner during the follow-up process and derived suitable measures from them. This was possible as part of executive dialogs and workshops across all levels. Measures that

should particularly be highlighted include the new expansion of the steering committee of the institute by four permanent members from the heads of department and the improvement in processes and communication channels in HR work.

External further academic education

Besides human resources development services oriented towards employees, Fraunhofer UMSICHT is also a provider of sustainability-oriented further academic education. These external further academic education activities by Fraunhofer UMSICHT focus on the Interdisciplinary Distance Learning Program in Environmental Sciences (*infernum*), which, alongside work and family, offers forward-looking further academic education in the fields of environment and sustainability. The established range of studies has been offered since 2000 in cooperation between the FernUniversität (distance learning university) in Hagen and Fraunhofer UMSICHT. *infernum* is part of the Fraunhofer Academy and cooperates as part of its teaching services with the Centre for Sustainability Management (CSM) at Leuphana University of Lüneburg and the Wuppertal Institut für Klima Umwelt Energie gGmbH.

With currently over 550 enrolled students, the master course, which has already been reaccredited for the second time, is characterized by its interdisciplinary orientation, the subject-related breadth of the range of courses and the flexibility of the organization. With these unique selling points, *infernum* fills a gap in the field of environmental science further academic education and enjoys steadily growing demand

on the further education market in view of the high current relevance of environmental protection and sustainability and their increasing importance in the future, as well as the need for life-long learning.

In 2014, *infernum* was named as a "Place of Progress" by the Ministry for Innovation, Science and Research in the state of North Rhine-Westphalia. Following numerous awards as a UN Decade Project in recent years, the offered courses also received the award for "UNESCO Global Action Programme Network Education for Sustainable Development" in 2016 from the German UNESCO Commission and the German Federal Ministry of Education and Research (BMBF).

infernum also offers additional qualification options to the employees at Fraunhofer UMSICHT as the provider of the study program. By assuming teaching activities, experience in academic teaching can be collected and consolidated.

4

UMSICHT-INTERNAL FOOTPRINT



Dancing electricity pylon "Sorcerer's Apprentice" (inges idee, 2013), photo: Daniel Maga

UMSICHT-internal Footprint

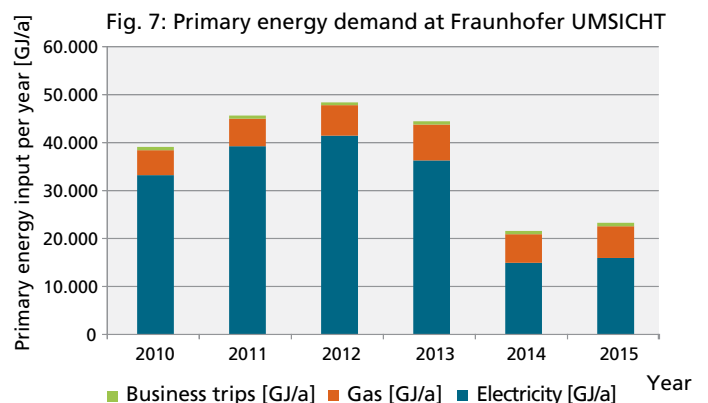
The global use of resources has increased over recent years, and forecasts for the future also indicate an increasing use of resources. One example of this is increasing energy consumption, which is currently driven, among other things, by low oil prices at less than \$50/barrel (as of Dec. 2016).

At the same time, the federal government has set itself the goal of increasing the use of renewable energy sources. Overall, according to the coalition contract of December 2013, renewable energy sources are supposed to account for 40 to 45 percent of electricity generation in 2025 and 55 to 60 percent in 2035.

As a pioneer for technical innovations in the fields of energy, processes and products, Fraunhofer UMSICHT wants to drive forward sustainable management, environmentally-friendly technologies, and innovative behavior in order to improve the quality of life of people and promote the capacity for innovation within the economy. At the same time, Fraunhofer UMSICHT wants to contribute to the raw materials shift and energy transition with its developments.

Even if its own footprint appears relatively low compared with the potential savings generated by developing innovations, Fraunhofer UMSICHT wants to improve the efficiency of its own use of resources in the research process.

As figure 7 shows, electricity consumption at Fraunhofer UMSICHT is responsible for the largest proportion of primary energy demand. When the institute switched to 100 percent electricity from hydro-electric power at the beginning of 2014, it was possible to reduce the overall primary energy demand of Fraunhofer UMSICHT from approx. 50,000 GJ (gigajoules) in 2012 to approx. 23,000 GJ in 2015. By switching over to green electricity, Fraunhofer UMSICHT also contributes to the energy transition and protects fossil resources.



Besides the switchover to renewable power, Fraunhofer UMSICHT is working on precisely recording energy use. To this end, the institute underwent an energy audit in 2015, which highlighted potential savings. In addition, monthly energy consumption measurements have been taken at 44 points from 2016 in order to identify consumption hotspots as well as targeted cost-efficient savings measures. Independently of this, an electricity saving measure has already been undertaken: The whole workshop area was equipped with energy-saving, long-lasting LEDs as part of a major renovation project. The offices are also gradually to be fitted with this type of lighting. A safety switch integrated into the LEDs used was developed and patented by employees of the institute. The green IT measures (use of thin clients) are being continuously pursued.

4

UMSICHT-INTERNAL FOOTPRINT

Despite implementing measures to reduce final energy consumption, absolute final energy consumption through gas and electricity increased in 2015 compared with the two previous years from approx. 18,500 gigajoules (GJ) to approx. 20,000 GJ. Consumption at Fraunhofer UMSICHT significantly depends on the R&D projects undertaken in the respective years.

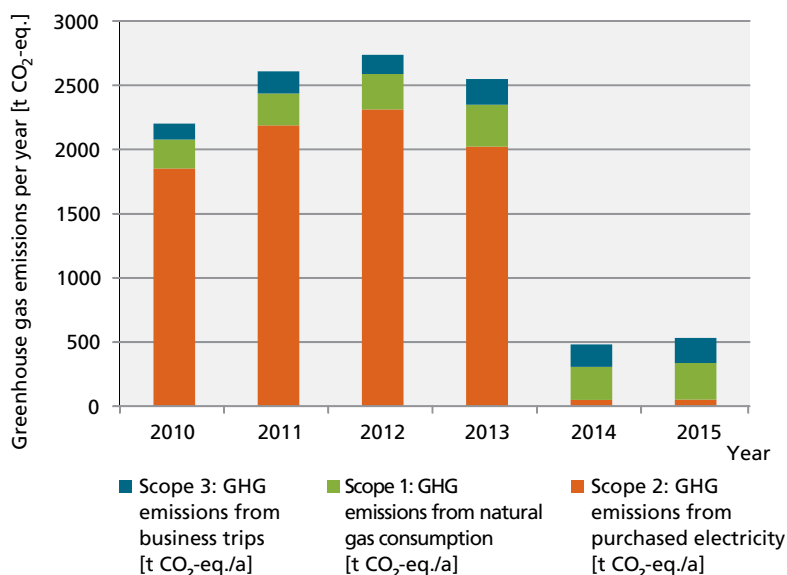
Besides absolute energy consumption, air pollutants through the provision of electricity and heat particularly play a key role in how environmentally friendly they are. These are discussed below.

Greenhouse gases and other air pollutants

The Greenhouse Gas Protocol, which divides greenhouse gas emissions in and due to a company into three different "scopes", has become established as a standard for reporting greenhouse gas emissions in companies. A distinction is made between direct greenhouse gas emissions, which are produced or can be controlled by the company (scope 1), greenhouse gas emissions through the purchasing of electricity (scope 2), and other indirect greenhouse gas emissions e.g. through the purchasing of materials or through transport (scope 3). At present, Fraunhofer UMSICHT records green-

house gas emissions from the combustion of natural gas for heating, greenhouse gas emissions from purchased electricity and greenhouse gas emissions through travel activities (exclusively means of transport). Figure 8 shows the development of greenhouse gas emissions between 2008 and 2015. It can be seen that the majority of greenhouse gas emissions, which were determined by the purchasing of electricity in previous years, has significantly been reduced since 2014 by switching to electricity from hydro-electric power.

Fig. 8: Greenhouse gas emissions at Fraunhofer UMSICHT



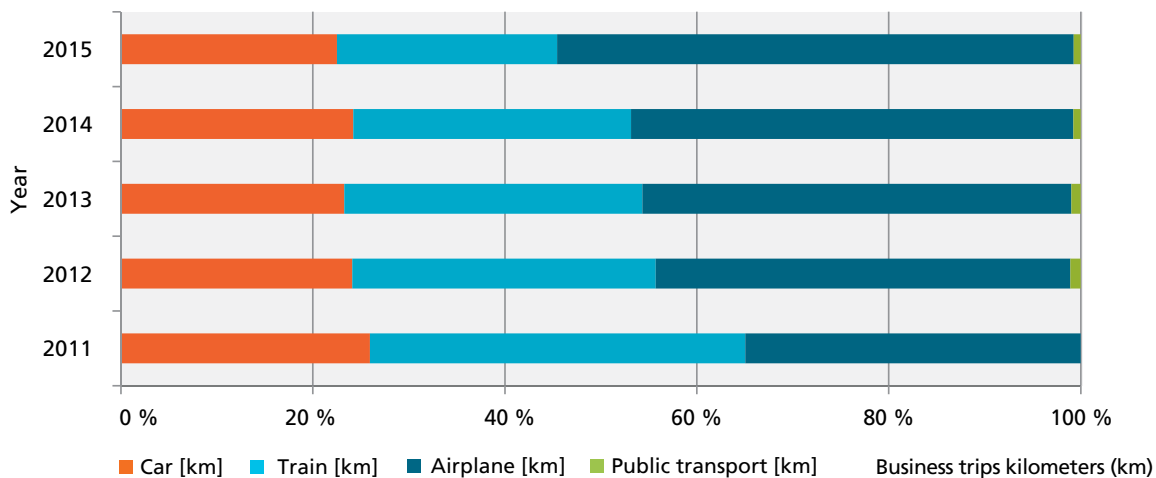


Slag Heap "Halde Haniel" in Bottrop, photo: Dennis Schlehuber

The reduction in greenhouse gas emissions from purchased electricity causes the proportion of greenhouse gas emissions from the combustion of natural gas and through business trip activities to increase in importance. In 2015, approx. 37 percent of greenhouse gas emissions were thus caused by business trips. The business trip distance per employee and year has slightly increased from approx. 6,800 km in 2013 to approx. 6,950 km

in 2015. What's more, the proportion of kilometers travelled by train, as shown in figure 9, is declining, whereas the proportion of air kilometers has increased. Although Fraunhofer UMSICHT books rail travel with green electricity, the redistribution of transport use meant that the associated greenhouse gas emissions per employee only dropped minimally from 824 kg CO₂eq. in 2013 to 820 kg CO₂eq. in 2015.

Fig. 9: Distribution business trips kilometers



At the same time, employees of Fraunhofer UMSICHT once again got involved in the campaign "By Bike to Work" (www.mdrza.de) in 2014 and 2015, as well as in "City Cycling" (www.city-cycling.org) in 2015. In 2014, a total of 31 employees in Oberhausen took part in the first of these campaigns and covered 14,475 km by bike (there were also 9 people from Sulzbach-Rosenberg with 3,180 km). From 2015, participation took place on an individual basis with corresponding advertising at the institute, so no figures can be given here. As part of "City Cycling 2015" in Oberhausen, the team Fraunhofer UMSICHT with 19 employees covered a total of 4,271 km, and the CO₂ saving came to 615 kg.

Besides greenhouse gas emissions, other harmful substances such as nitrogen oxide emissions (NO_x) are of relevance. Across all modes of transport, 589 kg of NO_x in 2014 and 665 kg of NO_x in 2015 were demitted. NO_x emissions thus increased slightly compared to 2013 (590 kg of NO_x).

4

UMSICHT-INTERNAL FOOTPRINT

Water

Despite a slightly increased number of employees, freshwater consumption (figure 10) has remained constant in the last two years at approx. 15,000 m³/a. A further approx. 15,000 m³ of wastewater resulted from precipitation, meaning that a total of approx. 30,000 m³ of wastewater was discharged.

Waste

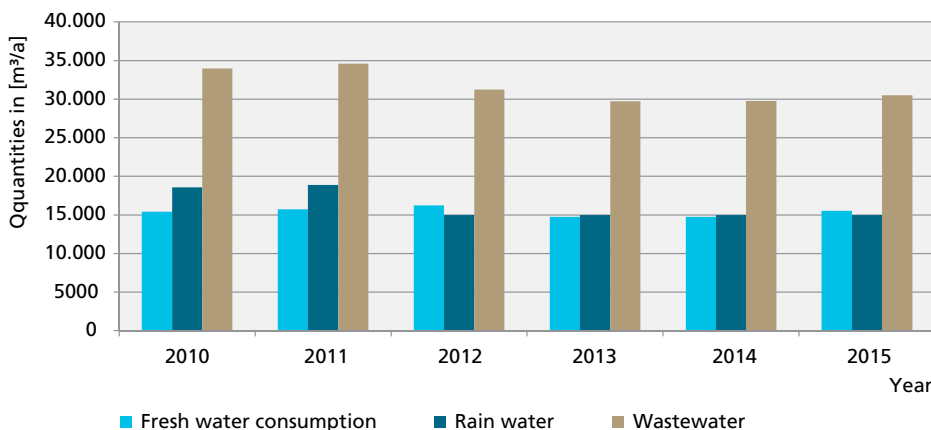
Fraunhofer UMSICHT records its quantities of waste each year in a waste balance in line with a waste code. The total quantities of waste remained constant at approx. 80 t per year in the last three years (79 t in 2013, 76 t in 2014 and 78 t in 2015).

The institute's own list of "hazardous waste" over recent years shows that some chemicals are need edregularly and these then appear in the waste balance, although it was possible to reduce the consumption of organic halogenated solvents in the years 2010 – 2014 by around 80 per cent (from 910 kg to 170 kg). These figures must certainly always be viewed based on the current ongoing projects; however, a minimization can be seen over the years.

Resource consumption

It was possible to reduce paper consumption in recent years up to 2013 from originally approx. 6,000 sheets per employee per year in 2008 to approx. 3,000 sheets per employee and year. Measures included e.g. optimized standard print settings such as double-sided printing, an increasing digitalization of administrative processes such as digital travel applications, digital time-recording forms, use of the scan function or the now often standard digital submission of offers and applications, and the creation of digital reports. It was not possible to reduce paper consumption further in the years 2014 (3,940 sheets/employee) and 2015 (3,440 sheets/employee).

Fig. 10: Water/Wastewater volume





*Nitrogen generator at Fraunhofer UMSICHT,
photo: Silvia Lorenz*

Insight into our laboratory

In the last sustainability report, three starting points for improving the sustainability of our labs were presented: 1. Work in the lab, 2. project planning and 3. construction measures.

Point 1 contained the recording of energy consumption alongside a detailed inventory of the consumption of lab materials. A further clarification of disposal routes (from the disposal company) and the identification of replacement materials for hazardous substances are still ongoing. Replacement substances or replacement substance combinations can be determined for hazardous solvents using solvent parameters from a database. In the near future, it will be investigated whether Fraunhofer UMSICHT needs to procure corresponding software.

With regard to project planning, a measure will be presented in the following which could be of interest when setting up new plants. Plants for nitrogen enrichment from compressed air reduce the use of bottled gas. At Fraunhofer UMSICHT, corresponding equipment can be found in two places. Due to its inertness, nitrogen is used in a variety of plants and equipment as a flushing or transport gas. Its consumption (in bottles) at Fraunhofer UMSICHT is higher than that of all other lab or pilot plant station gases (e.g. argon, helium) put together. In the analytical lab, the HPLC-coupled mass spectrometer alone uses almost 6 m³ of nitrogen per day in standby

operation. A nitrogen enrichment plant was thus purchased for this reason, which works according to the pressure swing absorption principle and achieves nitrogen purity of 99.5 percent. While the impurities here predominantly consist of oxygen, which has hardly any influence on mass spectrometry in this concentration, nitrogen from gas cylinders primarily contains impurities due to hydrocarbons and would have to be used for this application with a purity of 99.999 percent (quality 5.0).

With regard to point 3, we continue to consider the assessment of our labs in accordance with the certification system, for instance by the German Sustainable Building Council (DGNB), as a goal. This is to ensure that our laboratories are socially ("humane environment"), ecologically ("protection of the environment, protection of natural resources") and economically ("reduction in life-cycle costs") sustainable and thus contribute to sustainable development. However, this can only take place when suitable and publicly accessible assessment criteria for laboratories as existing buildings are available, and these do not currently exist.

5

ECONOMIC STABILITY AND MANAGEMENT

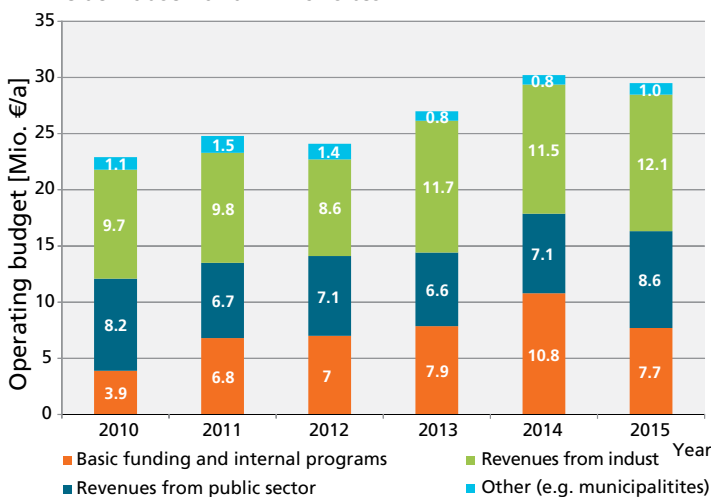
Economic development 2015 and outlook 2016

Fraunhofer UMSICHT gained an operational budget of 29 million euros at the Oberhausen and Willich sites in 2015. The financing included over 12 million euros from research and development contracts with partners from industry, e.g. with SMEs. A further 9.5 million euros of public project financing was acquired, among other things, from German federal ministries, states, municipalities and the EU. In addition to this income, Fraunhofer UMSICHT had around 8 million euros of basic funding at its disposal for preliminary research and internal Fraunhofer research projects. With these funds, Fraunhofer UMSICHT is able to proactively react to entrepreneurial and societal needs and lay the foundations for the necessary product and service innovations. The Sulzbach-Rosenberg institute branch gained external project income amounting to around 7 million euros in the same period.

What's more, Fraunhofer UMSICHT invested around 3.4 million euros in setting up new and expanding existing pilot plant stations in the years 2014 and 2015. Besides expanding the pilot plant station for biomass utilization and the addition of the photonics lab, the topic of energy storage including equipment investments for battery manufacture was, in particular, a key focus of investment. Besides the largely project-funded research facilities, the institute made infrastructural investments above all in terms of the performance and security of the IT landscape.

In 2016, Fraunhofer UMSICHT overcame the economic slump that the institute experienced in 2014 and 2015 with declining profits and increasing costs. In terms of costs, the effect of the previous operational cost savings and a consistent consolidation of the workforce can be seen. When it came to revenue, the strong acquisition campaign of recent years paid off in 2016 with significant incoming long-term contracts, characterized by the launch of strategic large-scale projects. This results in a positive development trend for the institute for 2016 and 2017. However, solid, long-term growth will only be possible if the future inhibiting conditions of the public funding landscape and internal Fraunhofer consolidation effects (reduction in basic funding) are anticipated and counteracted with corresponding measures.

Fig. 11: Development of the institute's budgets at the Oberhausen and Willich sites





Art installation at slag heap "Halde Haniel" in Bottrop, photo: Ursula Ujma

Medium-term development prospects

The consolidation phase of recent years has opened up the opportunity for the institute's cost structure to undergo a thorough assessment and optimization. This led to moderate and economical budget management relating to equipment, which can also be implemented in subsequent years without restricting the institute's ability to act. At the same time, a process was initiated to develop and train staff resources over the longer term in order to maintain a highly skilled and motivated workforce, even in times of stagnating staffing levels.

The successful results of the continuing acquisition offensive are also proving to have an effect on the current positive institute development. Above all in terms of public donations, intensive efforts to initiate strategic large-scale projects together with the German industry are beginning to bear fruit, so that for the following years, complemented by increasing applications for national and European third-party funds, a solid foundation for economic development of the institute has been laid. Contract research with companies in the private sector is at a stable level, but should be the focus of acquisitions over the medium-term, particularly considering the long-term exploitation of results from strategic research topics.

The recently experienced dependence of the institute's budget above all on the budgetary policies of public grant providers also represents the greatest challenge for medium-term planning in the future. It is to be expected that the trend for declining project funding by the federal government and states for the Fraunhofer-Gesellschaft will continue in view of the balanced budget amendment that has been implemented – and currently due to the election year 2017. What's more, besides generally growing regulatory pressure at a European level, a reduction in funding for overheads at the Fraunhofer Institutes should also be expected. These financing shortfalls

must increasingly be covered by the preliminary research budget, financed with basic funding. However, even this basic funding for the Fraunhofer-Gesellschaft is ultimately experiencing a decline. This is due to reduced growth of institutional funding by the federal government and states from 5 percent to 3 percent as part of the new pact for research, which came into force in 2016. UMSICHT is prepared for the looming risks in the public financing landscape with a strong volume of orders, a consolidated portfolio of innovative technologies and a wide network of public and private sector cooperation partners. Strategic large-scale projects and partnerships promise long-term development and exploitation pathways. It will be the task of the institute to use these actively and keep a focus on the mix of funding, above all with regard to contract research with business. The Controlling department of the institute has reacted to the economic volatility of recent years and, besides professionalizing cost controlling, has above all invested in establishing customer relationship management and strategic acquisition controlling.

6

NO MAN IS AN ISLAND – SOCIAL RESPONSIBILITY

"O brave new world, that has such people in't!"¹

For most readers, "Brave New World" is first and foremost the title of Aldous Huxley's most famous novel, which was published in 1932 and is frequently read even outside of schools to this day. It is one of the most influential works of the 20th century.

However, "Brave new world" is also a quote by Shakespeare. In "The Tempest" (1611), he has Miranda, Prospero's daughter, shout this out in pleasant surprise. This brave new world is borne by citizens and is thus the alternative to Huxley's conditioned, indoctrinated society characterized by self-optimization. Miranda's brave new world has citizens who assume responsibility, who not only participate in social change but shape it themselves.

Fraunhofer UMSICHT understands this social responsibility as an investment in the future, which is suitable for improving the relationship between business and society.

We want to link economic actions and social commitment strategically and develop suitable tools and methods of assuming social responsibility, for instance in the form of employee commitment (corporate volunteering).

As a member of the Fraunhofer-Gesellschaft as a registered association, we are not allowed to make financial donations or donations in kind. It is all the more important to give our employees the opportunity to get involved in non-profit projects and promote the existing voluntary commitment of the employees. For instance, one employee has been volunteering for years as a mentor for young people with a poor standard of education, another is involved in the steering group of the "Lokale Agenda Oberhausen" and in the Fairtrade working group. Many of our employees do many small things to change the face of the world – just like in the quote attributed to Stefan Zweig.

Our contribution is to give committed employees room for their voluntary work inside and outside of working hours. We support those who donate their time and knowledge pro bono publico, as we are convinced that this not only increases intrinsic motivation, but also expands horizons. The proverbial academic ivory tower is an obsolete model.

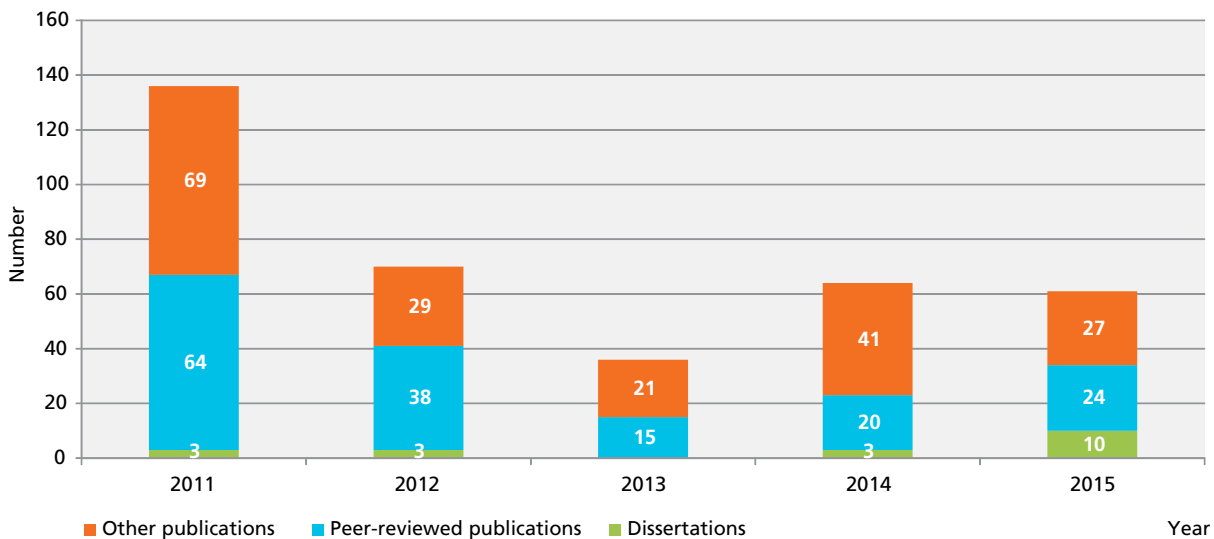
For us, communication with society always moves in both directions. Our research results can not only be found in dissertations and peer-reviewed journals, but also in many detailed press releases and in radio and TV contributions.

¹ William Shakespeare, "The Tempest"



Debate at Fraunhofer UMSICHT

Fig. 12: Publications per year (absolute)



The number of completed PhDs is pleasantly high at UMSICHT – 10 employees received their doctorates in 2015. In the future, too, we want to continue our work so that young people gain further qualifications and thus contribute to the excellence of the institute, the Fraunhofer-Gesellschaft and the entire academic community.

The UMSICHT science award, which is awarded annually by the institute's Friends and Patrons Group, aims in the opposite direction. It honors people who undertake outstanding industry- and market-oriented research and those who report on research in an understandable way in the media and thus con-

tribute to the dialog between science and society in the areas of environment, safety in process engineering, and energy. As at all Fraunhofer UMSICHT events, interested citizens are also always invited to the UMSICHT science award ceremony.

Conversations on current topics relating to research and technology, culture and society take place regularly under the title "Debate". In 2015, "Open Innovation" and the free trade agreements TTIP and CETA were the subject of the debates, while the focus in 2014 lay on "Fairtrade Town".

6

NO MAN IS AN ISLAND – SOCIAL RESPONSIBILITY

Engagement in the region

One result from the first stakeholder dialog in 2014 was the request to pass on knowledge in the education field and collaborate with educational institutions. Besides the commitment to Girls' Day and the Fraunhofer Talent School, the institute has deepened its cooperation with the Sophie-Scholl-Gymnasium high school in Oberhausen. The project course for the qualification level was also supervised in both years of the report period. Each year, the pupils concerned themselves with the topic of sustainability in two groups. While one group in the last course designed lesson units on sustainability for the lower grade and tried them out in practice, the second group looked at the sustainable design of school buildings. The results achieved by the pupils were impressive. It was also possible to continue supervising the project course in the following school year. One of the two groups concerned itself with the detailed designing

of a sustainable school building, while the second group, in parallel to the current exhibition "Wonder of Nature" at Gasometer Oberhausen, used the examples of plastic waste and deforestation of the rainforest to draw up its own multimedia documentation about how this wonder is put at risk by humans' unsustainable handling of nature.

We also describe the local and regional commitment of Fraunhofer UMSICHT using the example of a cooperation project with the city of Oberhausen in the chapter "Our research projects – our contribution to sustainability" (p. 29).



Photo: Machoczek/Gasometer Oberhausen GmbH

From left:

Dr. Markus Hiebel, head of department for Sustainability and Resources Management Fraunhofer UMSICHT, Prof. Görgo Deerberg, Deputy Director of Fraunhofer UMSICHT, the school pupils Elena Konietzko, Celina Altena, Jannika Cornelius, Annika Drießen, Harald Willert, school principal of the Sophie-Scholl-Gymnasium, Cornelia Schiemanowski, head of the biology project course, and Jeanette Schmitz, managing director of Gasometer Oberhausen GmbH.

7

OUR RESEARCH PROJECTS – OUR CONTRIBUTION TO SUSTAINABILITY

SmartRegion Pellworm: Intelligent electricity grid for the energy system of the future

A small island in the North Sea is showing how the energy transition can work successfully: Pellworm's share of renewable energy sources in the total energy mix already corresponds to the energy concept 2050 today. As part of the joint project "SmartRegion Pellworm", in which Fraunhofer UMSICHT was also involved, an intelligent electricity network was developed for the island, which enables the redistribution and storage of excess energy. The project won the German Renewables Award in 2015.

In the North Frisian Wadden Sea and immediately next to the islands Amrum and Föhr lies the small North Sea island of Pellworm. With a good 21 gigawatt hours, the island uses wind power, photovoltaics and other systems to produce, when viewed over the year, three times as much electricity as it consumes annually. So that these energy surpluses can be used by the island itself at times of low energy feed-in (such as when there is a lack of wind or the sun does not shine), a consortium from science and industry tested the optimum collaboration of electrical and thermal storage with renewable energies as part of the three-year joint project SmartRegion Pellworm. In this way, an intelligent electricity network was created on Pellworm, which makes it possible to use the renewable energy sources directly on site.

FORECAST OF HEAT REQUIREMENTS

The aim of the overall project was to set up an intelligent electricity network with a hybrid storage system. The team at Fraunhofer UMSICHT particularly considered the use of thermal storage within the hybrid storage system and provided scientific assistance. As part of this, one of the researchers' central tasks was to create a heat requirement forecast. When, like on Pellworm, electrical storage heating systems are used to balance out imbalances between consumption and generation in the electricity grid, the heat requirements

of the island's inhabitants must naturally still be covered at all times. So that plant deployment can be planned with foresightedness and at an early stage taking into account the most important boundary conditions, it is thus necessary to forecast the heat requirements to be covered in the coming hours. In this way, more renewably generated electricity can be used through the intelligent use of storage.

TRANSFERABILITY

The analyses show various possible uses for hybrid energy storage systems. Besides increased use of electricity generated on site through the intermediate storage of excess electricity, it was possible, for instance, to demonstrate the use of the storage on the electricity market and to relieve pressure on the electricity grid. The demonstration project on the island is thus considered a model example of the path towards a successful energy transition. For this reason, the transferability of the hybrid storage concept designed for Pellworm to other regions of Germany had to be assessed. The team at Fraunhofer UMSICHT together with RWTH Aachen University thus selected comparable regions and investigated these in simulations. With the result: The concept can fundamentally be transferred, although it should be adapted to the respective individual supply situation. It is now a case of taking the development steps from a demonstration project to a project with standardized processes and interfaces – so that other regions can benefit from an intelligent electricity grid like on Pellworm in the future.



7

OUR RESEARCH PROJECTS – OUR CONTRIBUTION TO SUSTAINABILITY

Microplastics working group: From workshop to a joint study

As part of the workshop series, an internal discussion round was held in March 2014 to discover relevant research ideas on the topic of "microplastics" in order to tie in with the increased discussion of microplastics as a potential danger to the environment. The aim of the "microplastics workshop" was to gain an overview of the state of knowledge and technology to derive research tasks and strategies for action. To look at this topic in more depth, Fraunhofer UMSICHT, together with the Green Technologies Cluster North-Rhine Westfalia, organized the "Round table Microplastics and sewage treatment plants" with 25 experts primarily from urban water management on November 18, 2014. Shared view to date was, that there have been too few studies to make well-founded statements, such as about quantities or ecological consequences of microplastics in sewage treatment plants. Consequently, at the proposal of Fraunhofer UMSICHT the "Microplastics Initiative" was founded, which provides information about microplastics via an Internet platform.

Under the leadership of Jürgen Bertling, a consortium on microplastics and plastic litter was created, which has met regularly since April 2016 to become engaged in the problem. Participants in the joint study are 11 partners from the cosmetics, plastics processing and recycling industries, urban water management and research. The aim of the study is to evaluate current data and trends, assess them objectively and to develop entrepreneurial strategies, business models and projects from this. The focal points of research are:

- Sources, quantities, qualities and entry paths for microplastics and plastic litter
- Degradation and behavior of plastics in waters
- Reduction potential for sewage treatment plants and other technologies to remove microplastics and plastic litter
- Harmful effects of microplastics
- Role and potential of business, society and politics

Fraunhofer UMSICHT is working on a study based on results and findings from research and consortium meetings. A wide array of data has already been collected and evaluated, which raises expectations of exciting findings. The innovation phase began in November 2016. The joint study will be completed in May 2017.

Numerous student and thesis papers on the topic of microplastics, about distribution and degradability or possible solutions, for instance the development of a biomimetic filter, are currently ongoing at Fraunhofer UMSICHT. Due to the topicality of the subject in society, the work at Fraunhofer UMSICHT relating to microplastics is supported by the Public Relations department. Even at the "Fraunhofer Talent School" in 2015 and 2016, a microplastics workshop was offered that enjoyed active participation. A third workshop for 2017 is currently under preparation. The microplastics working group also aims to establish a network across various locations covering a range of topics. UMSICHT is part of the political debate at the "Marine Litter Round Table", initiated by the Federal Environment Agency. UMSICHT took a leading and participatory role in numerous project proposals in various R&D networks in the BMBF (German Federal Ministry of Education and Research) call for proposals "Plastics in the Environment" published on June 10, 2016.

In the future, microplastics will continue to be an important topic at Fraunhofer UMSICHT. The focus lies on identifying entry paths, quantifying the amount of plastics, urban water management, development of technical applications for reduction of plastic emissions and the sustainable handling of plastics in everyday life by citizens. In this way, awareness of handling recyclable material based on crude oil is to be created in order to protect resources and reduce the pollution of the environment.



Bio-based products developed by Fraunhofer UMSICHT in cooperation with FKUR Kunststoff GmbH, photo: Pia Borelbach

Bio-based plastics as a contribution to the raw materials shift

Plastics made from renewable raw materials make important contributions to reducing CO₂ emissions, creating independence from fossil raw materials and the alternative use of agricultural areas. As a national information point, Fraunhofer UMSICHT provides easily comprehensible information about this.

For years, researchers at Fraunhofer UMSICHT have been working on the systematic development of plastic compounds made from renewable raw materials. The aim here is to develop customized biomaterials that offer a specific, application-oriented, where possible innovative property profile that corresponds or, ideally, exceeds that of fossil-based polymer materials.

Already established, short-lived products based on biodegradable plastic compounds developed by Fraunhofer UMSICHT include catering items such as cutlery, cups and plates, films such as agricultural films, carrier bags and trash bags, as well as packaging.

PROTECTING WOOD RESOURCES

The project "Bio-Based Sandwich" Panel conducted from 2014 to 2016 focused on the use of bio-based plastics in a long-lasting product. Here, board material with a lightweight foamed core structure from bioplastic was developed. To produce this kind of sandwich panel, the project partner Thünen Institute in Hamburg adapted the process it had developed in which, by adding heat and applying pressure, a reduced-density foam core is created between the compressed wooden surface layers. Biomaterial development by Fraunhofer UMSICHT opens up the possibility of completely substituting previously used, crude oil-based polystyrene. The result: An innovative lightweight construction material based on biological raw materials.

The project was funded by the Forest Climate Fund based on a decision by the German Bundestag under the joint leadership of the Federal Ministry of Food and Agriculture (BMEL) and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

GEOTEXTILE FILTERS WITH DEFINED BIODEGRADABILITY

A further new area of application for bio-based plastics is to be opened up with the joint project "Bioshoreline". Fraunhofer UMSICHT, together with the project partners BNP Brinkmann GmbH & Co. KG, Trevira GmbH, FKUR Kunststoff GmbH and BAW Bundesanstalt für Wasserbau, would like to develop new geotextile filters for shoreline reinforcement on waterways. The background is that the EU Water Framework Directive demands an ecological improvement in this field. One possibility of natural shoreline protection is using planting on the embankments. Geotextiles have to be used as erosion protection during the critical initial period, in which the plants and, in particular, their roots, need to develop. The aim of the researchers is designing various components of the textile that disintegrate at various speeds: Quickly degradable natural fibers create growth channels for rooting. Slow-degrading bio-based polymer fibers ensure soil protection over a period of at least three years, until the vegetation takes on the task of reinforcement.

The financing of the "Bioshoreline" project (funding code: 22000815) takes place with funds from the Federal Ministry of Food and Agriculture (BMEL) based on a decision by the German Bundestag.

7

OUR RESEARCH PROJECTS – OUR CONTRIBUTION TO SUSTAINABILITY

BMBF project "Guidelines for Sustainability Management for Research Organizations – LeNa"

Research institutions not only contribute to sustainable development with their scientific results. As a key element of the innovation system, as an employer and as a (partially) publicly financed organization, they also have the social mandate to concern themselves with their own responsibility with regard to the environment, society and employees in their own research and operational processes. In the BMBF research project "LeNa", the Fraunhofer-Gesellschaft, the Helmholtz-Gemeinschaft and the Leibniz-Gemeinschaft collaborate with the involvement of 25 of their institutions and around 90 project participants from business, administration and management.

In LeNa, a joint understanding of strategic fields of action in non-university research institutions is being developed for the first time, with which contributions to sustainable development can be made and the Federal Government's sustainability goals can be supported effectively. The result is the handout "Sustainability Management for Non-University Research Institutions", which contains an extensive action framework with clear and methodically proven courses of action as well as scientifically derived fact sheets. The motivation here is to develop a joint research-specific approach that is used by all establishments, centers and institutes as the basis and framework for establishing sustainability management in research and in supportive processes and to facilitate access to the topic. The undertaking is divided into three sub-projects, which concern themselves with the topics "research with societal responsibility", "human resources", and "property management".

RESULTS

There is a range of standards and procedures that commercial enterprises can use to establish sustainability management. Their value creation and business models work according to principles that differ from those at non-university research organizations. The special characteristics of research processes and the associated support processes have so far barely been analyzed in sustainability management and transferred into suitable processes. In order to fill this gap, the central result of the project is the handout "Sustainability Management for Non-University Research Institutions". It uses areas of operation to highlight central approaches, strategic fields of action and implementation opportunities which explicitly take into account the features of research organizations – regardless of whether they undertake application-oriented or fundamental research. This strategic approach is supported by over 30 factsheets and brief reports. These factsheets are academic analyses that were created within the three sub-projects. They support work in relevant fields of activity with specific analyses and guidance. An ideal type of roadmap is being developed for the implementation of this strategic approach in the organizations and institutions. The results were presented to the general public and discussed in October 2016 at the third symposium "Sustainability in Science (SIS)" by the BMBF (German Federal Ministry of Education and Research).



Nachhaltigkeitsmanagement in außeruniversitären
Forschungsorganisationen



Ideas box: Future City 2030+ workshop, photo: Silvia Lorenz

What do we do locally? – Future City Oberhausen

Under the slogan "Vision Oberhausen 2030+, Present – Vision – Future", a future vision for the entire city of Oberhausen was jointly developed by the municipality of Oberhausen and Fraunhofer UMSICHT from July 2015 to the end of May 2016. During the project phase, all citizens of Oberhausen were called upon to actively participate in the process and formulate or visualize their ideas and visions for Oberhausen – after all, everyone should be able to identify with the result of Vision 2030+ for Oberhausen. Over 2000 contributions were collected from schools, kindergartens and city festivals via surveys, workshops, online votes, ideas boxes and round tables: From a catchphrase and an audio drama to a stage play! All of them together have contributed to the overall vision that has now been developed.

As a special distinguishing feature, five mobile advertising columns that symbolized five formulated guiding topics of identified visions were used throughout the entire project period. These guiding topics were characterized for the advertising columns by the keywords life, social matters, work, dialog, and culture. The columns were used to collect and arrange the ideas and visions of the citizens and to better structure the discussions and surveys.



The vision is based on feedback from all sections of the population and age classes in Oberhausen. A very broad participation process was initiated for this. This was organized by the Future City team, which was comprised of administration officers, representatives of academic and media

partners, employees from various administrative departments and representatives from the Youth Parliament. To collect information, ideas and requests, a dedicated website www.oberhausen2030.de was set up and the annual Jugendförderpreis (young people's award) placed under the competition's slogan. The 2000 ideas were brought together on main topics and bundled with regard to the central statements. All of the indicators from the urban society showed the great creativity and self-motivation of the citizens; consequently, creativity was placed at the center of the Future City in a workshop. The topic was summed up by the slogan "Oberhausen Think Tank – Where Things are Really Going On!".

To visualize the process and the results, a film was made and the vision was summarized in a brochure. These ideas will form the basis for the implementation phase. Building on the formulated vision, the development of a holistic and sustainable planning and implementation concept is to follow. The overall vision is being checked academically and transferred into a feasible implementation concept together with citizens, academia, business, civil society and the municipality. Specific measures for implementation are being developed. The aim is to implement the entire vision and realize particularly innovative partial concepts. Fraunhofer UMSICHT will continue to assist the city of Oberhausen as a local actor and academic catalyst. This can also be seen in the collaboration on the "Altmarktgarten", a project in which an innovative roof greenhouse is to be created on a building.



OUR SITE IN SULZBACH-ROSENBERG

"Creating a STEM future": Award for Fraunhofer UMSICHT

The branch of Fraunhofer UMSICHT in Sulzbach-Rosenberg was honored for its outstanding measures in terms of external personnel marketing and STEM promotion of junior staff by the nationwide initiative "Creating a STEM future". The branch of the institute offers several activities to promote the next generation, which is why the initiative has included it in its network. The initiative, whose patron is German Chancellor Dr. Angela Merkel, appeals to young people to inspire them with regard to technical and scientific professions at an early stage.

Pupils' Week is thus held at the institute branch once a year. Pupils from the 11th grade at Herzog-Christian-August-Gymnasium in Sulzbach-Rosenberg and Georg-August-Zinn-Schule Reichelsheim take part. The young people can take a look into the everyday working lives of scientists. Besides presenting the departments, practical experiments also take place. What's more, regional partners were brought on board, who are visited by the groups of pupils (Stadtwerke Amberg, Schmack Biogas GmbH, Zweckverband Müllverwertung Schwandorf, Medienhaus Der Neue Tag and Ostbayerische Technische Hochschule Amberg-Weiden [OTH – Technical University of Applied Sciences]). During Pupils' Week, a joint get-to-know-each-other evening and a city tour of Sulzbach-Rosenberg are organized for the teenagers.

Girls' Day gives young girls the chance to find out about the institute. Researches are on hand to answer any questions and report on their everyday working lives and their academic careers. What's more, on Career Day at the Ostbayerische Technische Hochschule Amberg-Weiden (OTH – Technical University of Applied Sciences), the students are presented with attractive career options and informed about the current advertisements for internships and final theses.

As a further measure to inspire young people when it comes to technical and scientific careers, the institute branch cooperated with Herzog-Christian-August-Gymnasium in Sulzbach-Rosenberg via various seminar formats. These make it possible for the teenagers to gain practical experience in the scientific professional world. One seminar format extends over three half school years and is intended to prepare school pupils in the Bavarian upper school for working and student life. This seminar is supported by interview training and the creation of an application folder for every pupil.

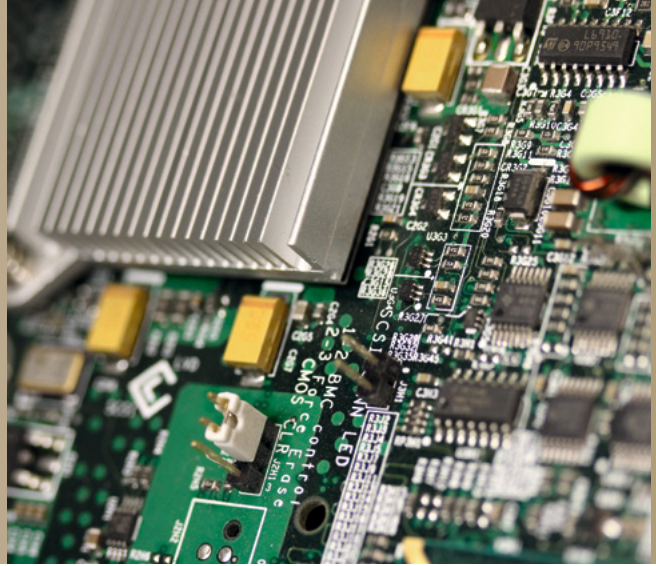
STEM is made by people – conveying this is the task of STEM ambassadors. Prominent, important personalities are just as much a part of the ambassador network as executives from companies, foundations, universities and secondary schools. Susanne Lettner, head of Marketing at Fraunhofer UMSICHT in Sulzbach-Rosenberg, is a STEM ambassador.

STEM qualifications:

Science, technology, engineering and mathematics (in German: MINT = mathematics, informatics, natural sciences and technology)



Group photo of participants in Pupils' Week 2016 at Fraunhofer UMSICHT



Identifying waste as a potential recyclable material

Recycling of precious metals from electrical and electronic waste

Electrical and electronic waste from old equipment contains a variety of rare metals. Solutions for resource efficiency and improving recirculation are particularly important for Germany as a country that is low in raw materials and reliant on imports. After all, metals such as gallium, germanium, neodymium, indium and rare earths, which can be found, for instance, in laptops and cell phones, are required for the production of high-tech products. However, the majority of these metals are lost with current processing methods. In order to efficiently recover the rare metals, the team led by Dr. Matthias Franke, head of the Recycling Management department, is developing innovative processes. The research work takes place as part of the project *gagendta+*, which is funded by the German Federal Ministry of Education and Research (BMBF) as part of the framework program "Research for sustainable development (FONA³)".

The UMSICHT technology is integrated into existing processing chains; this allows the recycling of gallium, indium or rare earths, for instance, to be undertaken efficiently and on a small scale. This strengthens the concept of regional value creation and secures jobs. The raw materials that are to be recovered have huge economic importance. However, being supplied with them comes with risks, as German companies are heavily dependent on actors from overseas. For some elements, there are only very few suppliers, who control the global market. What's more, these raw materials are generally difficult to substitute. Recovery reduces dependence on countries that supply raw materials, and a lower demand for primary raw materials also protects natural deposits and reduces the environmental impact. Researchers in the Recycling Management department are working on developing a complete process chain that can be expanded in a modular way to recover gallium, germanium, neodymium and tantalum as well as the by-metals dysprosium, indium, praseodymium and yttrium. To do this, they are

investigating the existing recovery processes used by recyclers and ascertaining which components and which material flows contain the precious metals.












During the mechanical processing of electrical and electronic waste, capacitors containing tantalum end up, for instance, in aluminum or printed circuit board fractions. However, this trace metal cannot be recovered in the later recycling processes for aluminum or copper and remain unused in the slag. The approach taken by Fraunhofer UMSICHT is to get involved at the start of the recycling chain, when tantalum is still in the original component. These components are separated with mechanical processors and decomposed in a pyrolytic process. The coveted metals are recovered from the pyrolysis coke. The oil and gas produced as a by-product is used to supply the process with energy. The metal-enriched residue can then, for instance, be fractionated using electrolysis. Metals are acquired as a product and then go back into the manufacturing of new products. The result is a modular system that can be retrofitted into existing decentralized recycling operations.

This chapter is devoted to selected projects at our site in Sulzbach-Rosenberg. In the subsequent reports, further integration into sustainability reporting at the institute is planned.

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MEASURES AND OBJECTIVES

In this sustainability report, we have rearranged our measures according to the key topics and significantly supplemented them. In many cases, we have refined the objectives and shown the measures in more detail. Where it was possible for us, we have stated milestones for target achievement.

OBJECTIVE	MEASURE	TARGET ACHIEVEMENT, WHERE APPLICABLE WITH PERIOD	STATUS
SPECIFIC CONTRIBUTIONS BY FRAUNHOFER UMSICHT TO SUSTAINABILITY			
Make contribution of our projects to sustainability visible (a.o. with reference to the raw materials shift and energy transition)	Presentation in the annual report	Presentation of the contribution of the following R&D activities: Smart Region Pellworm , microplastics working group , bio-based plastics , guidelines on sustainability management LeNa , Oberhausen Vision 2030+ (p. 25 – 29)	
	and in the next sustainability report	Exemplary projects from Sulzbach-Rosenberg: Creating a STEM future (p. 30) and electronic waste recycling (p. 31) Local activity: Pupil projects Sophie-Scholl-Gymnasium (p. 24) Presentation of the reference of selected projects to the Sustainable Development Goals (SDGs)	
LONG-TERM RESPONSIBILITY FOR EMPLOYEES, PEOPLE, EDUCATION			
Enhance good management	Perform corresponding further training	Since 2013, all persons with management responsibility have undergone mandatory further education programs (p. 13)	
Enable careers with Fraunhofer; train employees for various career paths	Create human resources development plans systematically for all employees	Introduction from mid-2016, training courses ongoing	
	Strengthen human resources development with staff	Create new position in HR from 2017	
Maintain contact with former employees, increase in alumni work	Founding of the alumni association at Fraunhofer-Gesellschaft	Founded in 2015	
	Information for alumni in UMSICHT employee magazine for:um	Continuously	
	Invitation of alumni to Christmas party and UMSICHT events	Continuously	
	Exit survey	From 2017	
Support for employees with children	Parent-and-child office; children's vacation childcare between 6 and 12 years	Parent-and-child office since 2009; childcare since 2011 (p. 11)	
Support for employees with relatives needing care	Services of pme Familienservice	Continuously	

HD = heads of department, EX = executives, DI = directorate, AR = annual report, EM = employees, SU = sustainability, PR = public relations

 Measure fully implemented

 Measure partially implemented

 Measure not implemented

 Measure started (no assessment possible yet)



Slag heap "Halde Haniel" in Bottrop/view of the amphitheater through steles, photo: Ursula Ujma

OBJECTIVE	MEASURE	TARGET ACHIEVEMENT, WHERE APPLICABLE WITH PERIOD	STATUS
Improve working conditions/ employee satisfaction in the institute	Implement measures from employee survey across all levels (p. 14)	Regular monitoring by the HR department regarding progress in the departments and report in the steering committee of the institute	
Increase in internationality	Increasingly undertake international projects	Continuously	
	UMSICHT scholarship	Ended, elements of which are implemented from 2016 in the internal UMSICHT Research School (p. 41)	
Improvement in employee health	Health days, vaccinations	Continuously	
Increase diversity (including increase in proportion of women)	Presentation of diversity using age, gender, nationality and educational qualifications in the sustainability report	Contained in this report (p. 11/12)	
	Increase in proportion of women on the Board of Trustees	2016: Appointment of 3 new female members of the Advisory Board, increase to a total of 5 (p. 41)	
INNOVATION PROCESS AND TRANSFER OF KNOWLEDGE TRANSFER			
Increase visibility	Also increase publications in general interest magazines that our customers read	Continuously	
Positioning on current topics	Microplastics position paper published (p. 26)	Other papers will follow	
Increase comprehensibility of research	Sensitization of employees; training on academic writing	Continuously	
Increase transfer of knowledge in society	UMSICHT science award	Annually	
Adapt research process with sustainability target	Sensitize employees to sustainability	Develop tool (reflection framework) for employees to record sustainability contribution (LeNa assistance , P. 29)	
EXPLOITATION AND CUSTOMER ORIENTATION			
Increase exploitation proceeds, increase impact	Optimize exploitation management	Continuously	
Get to know customer needs even better	Organization of stakeholder dialogs with customers and partners; UMSICHT: Zur Sache! series of events	Continuous (e.g. microplastics consortium study)	
Increase customer loyalty, optimize customer contact	Establishment of a customer relationship management system (CRM)	Introduced in 2016; success of the system is continuously monitored	
Use local factor to a greater extent	Ascertain economic effects on the city/region; intensify collaboration in the Wissenschaftsforum Ruhr (Science Forum)	2016	
	Increase collaboration with Ruhr University Bochum		

9

MEASURES AND OBJECTIVES

OBJECTIVE	MEASURE	TARGET ACHIEVEMENT, WHERE APPLICABLE WITH PERIOD	STATUS
TECHNICAL AND SCIENTIFIC EXCELLENCE			
Increase benefits for customers	Make offers more tailored (customized; think in value creation chains, take into account all skills of Fraunhofer UMSICHT)	Continuously	
Increase success rate for public proposals	Increase quality of proposals through clear responsibilities in the management team and organization of proposal writing workshops	Performed in 2015/16	
Ensure highest quality for offer or proposal preparation and reporting	Establish editing for quality assurance	From 2017	
Help shape new research approaches	Contribution in structure-forming large-scale projects Acquire one structure-forming large-scale project per year	Continuously Example 2015: Fraunhofer lighthouse project Electricity as a Raw Material	
Increase in the number of publications	Introduction of bonus system Monitoring using Fraunhofer research indicators	Per research assistant every 7 years from one peer-reviewed publication to one peer-reviewed publication every 3 years (p. 23)	
Increase in the number of doctorates	Increased work with PhD students Monitoring using Fraunhofer research indicators	Complete approx. 10 dissertations per year throughout the institute (p. 23)	
Increase in the number of supervised student or thesis papers	Advertise for more master theses Monitoring using Fraunhofer research indicators	Approx. 90 supervised master theses per year	
Increase perception of academic excellence	Increased applications for research awards	Submit at least one application per year	
ECONOMIC STABILITY AND MANAGEMENT			
More precise medium-term forecast of departmental results and the annual result for the institute	Further improve controlling Additional, more detailed evaluation of financial data Development of medium-term human resources and cost controlling	By end of 2016	
Focusing of the institute's profile	Introduction of business developers	Introduced in 2014 Success is verified by Controlling department	
Concentrate on sufficient funding programs	Decision-making tools are provided	Continuously	

Measure fully implemented

Measure partially implemented

Measure not implemented

Measure started
(no assessment possible yet)



Art installation at Slag Heap " Halde Haniel" in Bottrop, photo: Ursula Ujma

OBJECTIVE	MEASURE	TARGET ACHIEVEMENT, WHERE APPLICABLE WITH PERIOD	STATUS
Reduction in the use of own funds for the co-financing of research projects	Proposals in suitable funding programs	From 2016	
SOCIAL RESPONSIBILITY AND RESEARCH RESPONSIBILITY			
Strengthen pioneering role; show customers which topics are relevant for sustainable development	Sensitization of the employees with information events; holding of debates on current topics	Continuously	
Optimize research processes	Question how we research, e.g. in the sustainability working group	Continuously	
Sensitize the public	Sustainability quiz	Created and published online in 2015	
Create guidance for academics on communication	Development of an internal policy to communicate R&D results	Being developed by the end of 2018	
Strengthening of interdisciplinary and transdisciplinary research	Offer platform for opinion formation; try out new opinion formation formats "Dezentrale" as an offer Contribution to "Innovative Citizen"-Project	Continuously	
UMSICHT-INTERNAL FOOTPRINT			
Efficient use of the deployed resources	Switchover to LEDs	Gradual switchover to LEDs (p. 15)	
	Leasing times, monitors, PCs and thin clients extended from 3 to 5 years	Leasing times extended	
	Employee sensitization	Poster with tips on sustainable behavior created in 2015, also published on the Internet	
Reduction of the carbon footprint	Switchover to green electricity	Switchover to green electricity in 2014 (p. 15)	
	Green travel by train	Rail travel CO ₂ -neutral (p. 17)	
	More rail travel instead of use of aircraft, even where costs are higher	Permitted despite additional costs (p. 17)	
Improve knowledge about energy flows	Evaluation of energy audit (p. 15) from 2015 and derivation of measures Monthly measurement of electricity consumption in the technical shops	Continuously	
Reduce paper consumption	Offer more and more forms digitally (travel, vacation, time recording, "asset sign" for the handover of equipment)	Continuously	

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GRI CONTENT INDEX

GRI	GENERAL STANDARD DISCLOSURES	ADDITIONAL INFORMATION AND REASONS FOR OMISSION	REFERENCE, CHAPTER
ASPECT: STRATEGY AND ANALYSIS			
G4-1	Statement from the Executive Board	Preface of the directorate	P. 2
G4-2	Effects of business activities and threats and opportunities		P. 3, p. 6
ASPECT: ORGANIZATIONAL PROFILE			
G4-3	Name of organization	Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT as an institute of Fraunhofer-Gesellschaft	
G4-4	Most important brands, products and services	At the end of December 2016, the Oberhausen institute had over 71 active patent families, 38 of which had subsequent applications abroad, 6 utility models, 40 German trademarks and 9 EU trademarks. The most important word marks are CryoSol®, Q-TE-C®, inFARMING® and cleantan®	Examples of our research from p. 25
G4-5	Headquarters of the organization	Oberhausen for Fraunhofer UMSICHT, Munich for Fraunhofer-Gesellschaft	
G4-6	Countries with business activities	Primarily Germany, Europe, but also Africa, Asia and South America	
G4-7	Ownership structure and legal form	e.V.	
G4-8	Served markets	Germany, Europe, but also Africa, Asia and South America	
G4-9	Size of the organization		P. 10, p. 20
G4-10	Employment figures/relationships		P. 10
G4-11	Employees recorded by collective bargaining agreements	100 % of employees according to TVöD (Collective Agreement for Public Service Employees)	
G4-12	Supply chain of the organization	Variable supply chains as no direct production	
G4-13	Changes during the reporting period	Integration of Sulzbach-Rosenberg site (see G4-17)	P. 31
G4-14	Precautionary principle of the organization	Established risk management	P. 20
G4-15	Charters, principles or initiatives	Utopia Changemaker, Diversity Charter, German Sustainability Code, UN Global Compact	P. 4, p. 11, p. 41
G4-16	Association memberships	Fraunhofer UMSICHT and individual employees are members of various associations/committees (VDI, DECHEMA, ...)	
ASPECT: IDENTIFIED MATERIAL ASPECTS AND BOUNDARIES			
G4-17	List of all companies which are listed in the consolidated annual financial statement	Sites: Oberhausen and Willich; Sulzbach-Rosenberg became part of the institute in 07/2012, although this is still not taken into account	P. 31
G4-18	Processes for determining report content	Internal and external stakeholder dialog	P. 8 – 9
G4-19	Material aspects for reporting		P. 8 – 9
G4-20	Boundary of material aspects (inside the organization)		P. 8 – 9
G4-21	Boundary of material aspects (outside the organization)		P. 8 – 9
G4-22	Effects of restatements from earlier reports	No change	
G4-23	Important changes to the scope and boundaries of aspects	See internal and external stakeholder dialog	P. 8 – 9
ASPECT: STAKEHOLDER ENGAGEMENT			
G4-24	Stakeholder groups engaged	Internal: employees, directorate; external: business, academia, politics, society	P. 8 – 9
G4-25	Basis for the selection and identification of stakeholder groups	Selection in sustainability working group	P. 8 – 9



"Slinky Springs to Fame" in Oberhausen/work by Frankfurt-based artist Tobias Rehberger, photo: Sabine Bülten

GRI	GENERAL STANDARD DISCLOSURES	ADDITIONAL INFORMATION AND REASONS FOR OMISSION	REFERENCE, CHAPTER
G4-26	Approach to stakeholder engagement	Dialog form, workshop	P. 8 – 9
G4-27	Most important topics and concerns of stakeholders	See materiality matrix	P. 8 – 9
ASPECT: REPORT PROFILE			
G4-28	Reporting period	2014 to 2015; partially also information about 2016	
G4-29	Date of the most recent previous report	October 2014 for 2012/2013	s.fhg.de/QEc
G4-30	Reporting cycle	Biennially	
G4-31	Contact person for questions	Markus Hiebel (sustainability officer)	
G4-32	"In accordance" option	Core	
G4-33	External verification	No	
ASPECT: GOVERNANCE			
G4-34	Management structure of the organization	See strategic structure of the institute in the annual report 2014/2015 and organizational chart	
ASPECT: ETHICS AND INTEGRITY			
G4-56	Values, principles and codes and standards of conduct for the organization	Mission of Fraunhofer-Gesellschaft, UMSICHT's own guidelines	P. 6 – 7
GRI	SPECIFIC STANDARD DISCLOSURES	ADDITIONAL INFORMATION AND REASONS FOR OMISSION	REFERENCE, CHAPTER
CATEGORY: ECONOMIC			
ASPECT: ECONOMIC PERFORMANCE			
G4-DMA	Management approach		P. 20
G4-EC1	Direct economic value generated and distributed		P. 20
CATEGORY: ENVIRONMENTAL			
ASPECT: ENERGY			
G4-DMA	Management approach		P. 15 – 17
G4-EN3	Energy consumption within the organization		P. 15 – 17
G4-EN4	Energy consumption outside of the organization		P. 15 – 17
G4-EN5	Energy intensity		P. 15 – 17
G4-EN6	Reduction of energy consumption		P. 15 – 17
ASPECT: EMISSIONS			
G4-DMA	Management approach		P. 16 – 17
G4-EN15	Direct greenhouse gas (GHG) emissions		P. 16 – 17
G4-EN16	Energy indirect greenhouse gas (GHG) emissions		P. 16 – 17
G4-EN17	Other indirect greenhouse gas (GHG) emissions		P. 16 – 17
G4-EN19	Reduction of greenhouse gas (GHG) emissions		P. 15 – 17

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GRI CONTENT INDEX

GRI	SPECIFIC STANDARD DISCLOSURES	ADDITIONAL INFORMATION AND REASONS FOR OMISSION	REFERENCE, CHAPTER
ASPECT: EFFLUENTS AND WASTE			
G4-DMA	Management approach		P. 18
G4-EN23	Total weight of waste by type and disposal method		P. 18
CATEGORY: SOCIAL (LABOR PRACTICES AND DECENT WORK)			
ASPECT: EMPLOYMENT			
G4-DMA	Management approach		P. 10
G4-LA1	New employee hires and employee turnover		P. 10
G4-LA2	Benefits only provided to full-time employees	None	
ASPECT: OCCUPATIONAL HEALTH AND SAFETY			
G4-DMA	Management approach	No changes since the last sustainability report	
G4-LA6	Occupational diseases, lost days, and work-related fatalities	Occupational health and safety: no changes compared with the previous report. There were no accidents at work in 2014 and one accident at work in 2015. In addition, there were 2 commuting accidents in 2014 and one in 2015. Absence due to illness: The illness rate constantly hovers around 3 %. It was 3.1 % in 2014 and 3.5 % in 2015	
ASPECT: TRAINING AND EDUCATION			
G4-DMA	Management approach		P. 12 – 14
G4-LA9	Average hours of training per year per employee		P. 13
G4-LA10	Programs for skills management and lifelong learning		P. 13 – 14
G4-LA11	Performance and career development reviews		P. 13 – 14
ASPECT: DIVERSITY AND EQUAL OPPORTUNITY			
G4-DMA	Management approach		P. 11 – 12
G4-LA12	Diversity of employees and governance bodies	Proportion of women recorded	P. 11
ASPECT: EQUAL REMUNERATION FOR WOMEN AND MEN			
G4-DMA	Management approach		P. 11
G4-LA13	Ratio of basic salary and remuneration of women to men	TV6D (Collective Agreement for Public Service Employee), no differences	
CATEGORY: SOCIAL (HUMAN RIGHTS)			
ASPECT: NON-DISCRIMINATION			
G4-DMA	Management approach		P. 11
G4-HR3	Incidents of discrimination and corrective actions taken	No discrimination incidents are known in the report period	



Peacock in Oberhausen's Kaisergarten park, photo: Ursula Ujma

GRI	SPECIFIC STANDARD DISCLOSURES	ADDITIONAL INFORMATION AND REASONS FOR OMISSION	REFERENCE, CHAPTER
CATEGORY: SOCIAL (SOCIETY)			
ASPECT: ANTI-CORRUPTION			
G4-DMA	Management approach		
G4-SO3	Sites assessed for the risks related to corruption	Fraunhofer UMSICHT is regularly assessed (including internal audits)	
G4-SO5	Confirmed incidents of corruption and actions taken	No cases of corruption were reported in the report years. The regular training of employees is being continued	
ASPECT: POLITICS			
G4-DMA	Management approach		
G4-SO6	Total value of political contributions	As a non-profit association, we do not make political donations	
CATEGORY: RESEARCH AND DEVELOPMENT (SPECIFIC ASPECTS FOR FRAUNHOFER UMSICHT)*			
ASPECT: RESEARCH RESPONSIBILITY			
G4-DMA	Management approach		P. 26 – 29
R&D1	Increase in sensitization of employees to sustainability	See measures on the Internet and project LENA	P. 28
R&D2	Contribution of the institute to transformation processes (e.g. energy transition)	See annual report 2014/2015	P. 25
ASPECT: RESPONSIBILITY FOR EMPLOYEES AND (FURTHER) EDUCATION			
G4-DMA	Management approach		
R&D4	Employee involvement and participation strategy	Employee survey	P. 14
ASPECT: SOCIAL RESPONSIBILITY FOR EDUCATION			
G4-DMA	Management approach		
R&D5	External involvement	Distance learning program infernum, project with local Sophie-Scholl-Gymnasium, debates, Girls'Day, Fraunhofer Environment Talent School	P. 14, p. 23 – 24, p. 29
R&D6	Educational performance	Lectures given by UMSICHT employees	
ASPECT: INNOVATION PROCESS AND KNOWLEDGE TRANSFER			
G4-DMA	Management approach		
R&D7	Knowledge transfer	E.g. via supervision of qualification work	P. 22 – 23
R&D8	Contribution as an independent expert in participatory processes	Climate protection concepts and partial concepts	P. 29
R&D9	Publications	Publications, dissertations	P. 23

*In this report, we point out R&D-specific aspects for Fraunhofer UMSICHT in the index. These will continuously be developed further.

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Fraunhofer UMSICHT: Tomatoes, zucchini, chilies and more have been flourishing magnificently in the aquaponics facility since spring 2016

Highlights from 2016

2016 was a successful and very labor-intensive year for UMSICHT, meaning that the completion of the current sustainability report was unfortunately postponed until 2017. In order to find a balance and bring our readers up to date, we present measures here from 2016 that relate to our key topics but lie outside the actual report framework as highlights.

DIVERSITY:

Increase in the proportion of women on the Fraunhofer UMSICHT Board of Trustees

Since December 2002, the institute has been supported by a Board of Trustees, which is comprised of external members from academia, business, politics and administration and advises the directorate on important topics. In 2016, three new female members of the Advisory Board were appointed. In doing so, the proportion of women was significantly increased. At present, the Board of Trustees consists of 11 people, 5 of whom are women. This puts the proportion of women above the politically required target of 30 percent.



HUMAN RESOURCES DEVELOPMENT: Founding of the UMSICHT Research School

The UMSICHT Research School was created in fall 2016. It is a support service for doctoral candidates at UMSICHT. The aim is to enable the completion of PhDs within three to four years and create standardized framework conditions. Through training plans with individually coordinated further academic education offers, necessary and helpful skills for doctorates and for an academic career are to be acquired. Over the long term, the UMSICHT Research School is supposed to become a label that represents the excellence of the academic training at UMSICHT. At the same time, it is hoped to increase the number of doctorates at UMSICHT and thus further increase the technical and scientific excellence of the institute.

CONTRIBUTION TO SUSTAINABILITY:

Installation of an aquaponics facility

Since spring 2016, a small aquaponics facility has been present on the UMSICHT site. In the greenhouse system measuring 21 m², fish farming is combined with the growing of crop plants. The principle behind the system is both simple and useful: The plants – e.g. tomatoes, zucchini, pumpkins, chilies – grow in containers, which, in turn, are supplied with nutrient-rich water from fish tanks in which five mirror carps live. The excess water is fed back to the fish and largely cleans itself using biological processes. The system is intended to help address research problems on forms of urban gardening.



AND, LAST BUT NOT LEAST: WE SUPPORT Fraunhofer joins the UN Global Compact

Shortly before our report went to press, we received further delightful news: On January 31st, 2017, the Fraunhofer-Gesellschaft joined the United Nations Global Compact. It is thus committed to supporting the ten principles of the UN Global Compact with regard to human rights, labor, environment and anti-corruption and promoting this within its area of influence, as well as drawing up a Global Compact report for its stakeholders every two years about the commitment.

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