Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Fraunhofer

The Fraunhofer-Gesellschaft's 2025 annual report

Innovations for People and Markets

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Foreword

Dear Reader,

The 2025 financial year was one of opportunities, progress and successful collaboration for the Fraunhofer-Gesellschaft. In a dynamic environment and despite a difficult economic climate, we were once again able to demonstrate our strength as one of the leading applied research organizations and to drive significant advances in the areas of innovation and sustainable development. Together with our partners in industry, government and society, we helped bring pioneering technologies closer to real-world deployment and develop tangible solutions to the major challenges of our time.

Let me provide some examples: In December 2025, the Fraunhofer Research Institution for Battery Cell Production FFB in Münster became the first organization to demonstrate that electrically functional lithium-ion battery cells can be produced using entirely European manufacturing technology. This is a milestone on the road to competitive battery production. At the Fraunhofer Heilbronn Research and Innovation Centers HNFIZ, eight Fraunhofer institutes are pooling their expertise in the fields of AI and digital transformation. Supported by the Dieter Schwarz Foundation and working closely with companies, organizations and public institutions across the region, they are creating a unique scientific ecosystem focused on intensive technology transfer and commercialization. The research portfolio covers various levels of maturity and is deliberately geared toward urgent present-day challenges and the demands of industry and society. Fraunhofer's research is driven by industry needs. That is a testament to our mission.

Germany has an outstanding, highly specialized research landscape, engineering expertise, high-performing industrial companies and an innovation-driven small and medium-sized enterprise (SME) sector. These are exactly the strengths that the German federal government's High-Tech Agenda Germany (HTAD) is building on with the aim of advancing Germany's innovative capacity and sovereignty in global technological competition. As a key innovation partner to industry, the Fraunhofer-Gesellschaft will do everything in its power to promote the implementation of the HTAD by pursuing cutting-edge applied research, establishing regional innovation partnerships and transferring research results into practical applications.

The success of the HTAD will largely depend on all stakeholders across the innovation ecosystem making contributions in line with their respective strengths. For this, Germany needs a regulatory environment that clears the path to innovation for all stakeholders in the system. The implementation of the highly anticipated Freedom of Innovation Act will be crucial in this regard. Through measures such as reforms to nonprofit law, it has the potential to create greater flexibility that will strengthen the transfer of knowledge and technology across Germany's innovation system.

What Germany and Europe need is the courage to set priorities, confidence in their strengths and willingness to pursue structural reform. A modern culture of risk-taking and entrepreneurship must become a hallmark of Germany's innovation system, alongside an environment that enables innovation rather than holding it back. Let us work together to make this vision a reality.

Sincerely,

Holger Hanselka
President and Chair of the Executive Board of the Fraunhofer-Gesellschaft

Photo: Fraunhofer / Stefan Obermeier

Holger Hanselka,
President and Chair of the Executive Board of the Fraunhofer-Gesellschaft

Contents

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

4 Executive board's report
5 The executive board
7 2025 management report

32 Senate's report
33 The senate's report on the 2025 financial year
35 New senate members

39 Review of Fraunhofer research
40 Pioneering achievements
43 Initiatives, structures, funding programs
58 Projects and results
69 Awards
82 People behind the research
89 Technology transfer activities

94 Finances
95 Balance sheet at December 31, 2025
96 Income statement for the 2025 financial year
97 Excerpts from the notes to the 2025 financial statements
99 Convenience translation of the German independent auditor's report

102 About Fraunhofer
103 Structure of the Fraunhofer-Gesellschaft
105 Members, governing and advisory bodies
107 Locations in Germany

108 Publisher's information

Foreword

Contents

Executive board's report
The executive board
2025 management report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Executive board's report

Foreword

Contents

Executive board's report
The executive board
2025 management report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Photo: Fraunhofer / Stefan Obermeier

The executive board

Constantin Häfner
Executive Board Member for Research and Transfer

Sandra Krey
Executive Board Member for Finances and Controlling

Holger Hanselka
President, CCO and Chair of the Executive Board

Elisabeth Ewen
Executive Board Member for Human Resources, Corporate Culture and Legal Affairs

Axel Müller-Groeling
Executive Board Member for Research Infrastructures and Digital Transformation

Foreword

Contents

Executive board's report
The executive board
2025 management report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Learn more about Fraunhofer's executive board members

Holger Hanselka
President and Chair of the Executive Board, Corporate Strategy and Communications

Holger Hanselka has served as the 11th president of the Fraunhofer-Gesellschaft since 2023 and as chair of the executive board since April 2025. Before that, he was president of the Karlsruhe Institute of Technology (KIT) for ten years and vice president of the Helmholtz Association, responsible for the field of energy research. A mechanical engineer by training, Hanselka headed the Fraunhofer Institute for Structural Durability and System Reliability LBF in Darmstadt from 2001 until 2013 and was, for a time, a member of the Fraunhofer presidential council. He is active on various advisory committees that support the German chancellor on matters of science and research policy.

Constantin Häfner
Executive Board Member for Research and Transfer

Constantin Häfner joined the executive board in February 2025 and is responsible for research and transfer strategy at Fraunhofer. He is a professor at RWTH Aachen University and was previously the director of the Fraunhofer Institute for Laser Technology ILT in Aachen. In 2019, the laser physicist returned from the U.S., where he had been conducting research into laser-based inertial confinement fusion at the Lawrence Livermore National Laboratory in California. He led an expert group on fusion research (German Federal Ministry of Education and Research [BMBF]) until 2023 and is currently a member of the fusion research advisory board of the German Federal Ministry of Research, Technology and Space (BMFTR).

Axel Müller-Groeling
Executive Board Member for Research Infrastructures and Digital Transformation

Axel Müller-Groeling is a professor at Kiel University. The physicist and executive has conducted research at several renowned institutes and research organizations in Germany, France and Canada. He worked as a management consultant and co-founded an international, publicly traded solar energy company, where he also served as an executive vice president. In 2016, he became the director of the Fraunhofer Institute for Silicon Technology ISIT in Itzehoe. He then also became director of the Fraunhofer Institute for Microelectronic Circuits and Systems IMS in Duisburg. He has been on the executive board of the Fraunhofer-Gesellschaft since August 2022.

Elisabeth Ewen
Executive Board Member for Human Resources, Corporate Culture and Legal Affairs

Elisabeth Ewen is a fully qualified lawyer with an additional specialization in administrative and labor law. After graduating, she worked as a lawyer in the HR department of the German Aerospace Center (DLR) before she became director of human resources at GMD – Forschungszentrum Informationstechnik GmbH. She joined the Fraunhofer-Gesellschaft in 2001 when GMD was integrated into the Fraunhofer-Gesellschaft. Since then, she has held several senior roles in human resources at the Fraunhofer-Gesellschaft, most recently as director of human resources. Ewen has served on the executive board of the Fraunhofer-Gesellschaft since August 2022.

Sandra Krey
Executive Board Member for Finances and Controlling

Sandra Krey studied business administration and holds a doctorate from the University of Erlangen-Nuremberg. She worked for several years as an auditor at KPMG before joining the MAN Group, where she held various leadership roles in finance and accounting over a 20-year period. Starting in 2013, she served as senior vice president for accounting and finance processes at MAN Truck & Bus SE and, at the same time, managing director of the MAN Shared Services Center in Poland. Krey has been on the executive board at the Fraunhofer-Gesellschaft since August 2022.

Photos: Fraunhofer / Stefan Obermeier

Foreword

Contents

Executive board's report
The executive board
2025 management report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

2025 management report

Contents

8 Key data

9 Profile, strategy and operating environment
9 Profile of the Fraunhofer-Gesellschaft
10 Framework strategy process
11 Science policy framework and positioning
12 National and European large-scale projects
13 International partnerships

15 Business report
15 Total business volume
16 Contract research
19 Additional research funding
20 Major infrastructure
21 Financial and net asset position
22 Shareholdings and spin-offs
22 Exploitation of intellectual property rights

23 Sustainability aspects
23 Responsible corporate governance
24 Environmental responsibility
25 Employees

27 Opportunities, risks and outlook
27 Opportunity management
28 Risk management and risks
30 Outlook

Foreword

Contents

Executive board's report
The executive board
2025 management report

Senate's report

Review of Fraunhofer research

Finances

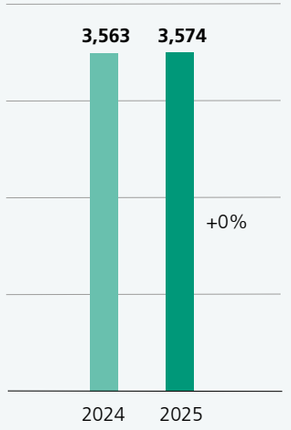
About Fraunhofer

Publisher's information

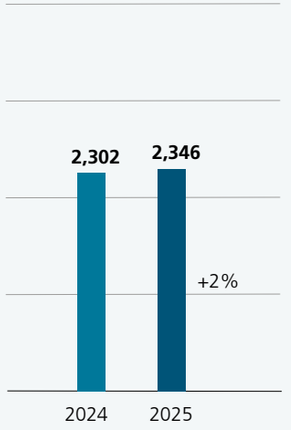
Fraunhofer-Gesellschaft—key data for 2025 (in € million)

	2024	2025		Change
Total business volume	**3,563**	**3,574**	**+11**	**+0%**
Contract research	3,136	3,152	+16	+1%
Additional research funding	260	219	-41	-16%
Major infrastructure[1]	167	203	+36	+22%
Business volume by budget	**3,563**	**3,574**	**+11**	**+0%**
Operating budget	2,978	3,048	+70	+2%
Capital expenditures[2]	585	526	-59	-10%
Project revenue	**2,302**	**2,346**	**+44**	**+2%**
Contract research	2,162	2,220	+58	+3%
of which industrial revenue	867	966	+99	+11%
of which public-sector revenue[3]	1,295	1,254	-41	-3%
Additional research funding	133	100	-33	-25%
Major infrastructure	7	26	+19	+271%

Total business volume
in € million



Project revenue
in € million



1 Major infrastructure including investments in the APECS pilot line under the EU Chips Act

2 Current capital expenditure for contract research, additional research funding and major infrastructure capital expenditure

3 Comprises German federal and state government, EU and other revenue

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Profile, strategy and operating environment

Profile of the Fraunhofer-Gesellschaft

Since it was founded in 1949, the Fraunhofer-Gesellschaft has been strengthening the **competitiveness of industry** and **driving innovation in Germany and Europe**. The Fraunhofer institutes help companies turn scientific findings into new technologies, supporting them every step of the way from idea to market launch and giving them a technological and competitive edge in international markets. As an essential innovation partner for industry, the Fraunhofer-Gesellschaft **helps strengthen German and European competitiveness**.

The Fraunhofer-Gesellschaft is a **nonprofit** organization **with public funding that specializes in applied research**. In keeping with the Fraunhofer funding model, at least two-thirds of the contract research that forms the core of Fraunhofer's activities is funded by industry contracts, license-fee revenue and competitive public project funding. The aim is to strike a balance **between industrial revenue and public project funding**. A maximum of one-third of Fraunhofer's research financing consists of institutional funding from the German federal and state governments at a ratio of 90:10. This federal and state funding facilitates strategic pre-competitive research and the long-term development of technologies with high innovation potential that will become relevant to industry and society in the near future. This funding model directly reflects the entrepreneurial aspect of the Fraunhofer-Gesellschaft's mission and ensures that Fraunhofer innovations are consistently aligned with specific (future) market needs.

In 2025, more than 30,000 employees, predominantly scientists and engineers, generated the annual research volume of around €3.6 billion across 75 institutes. Of this total, €3.2 billion was attributable to the core business of contract research. Fraunhofer generated €966 million from industry contracts and license-fee revenue. This sets a new record—all the more remarkable considering the challenging economic environment. Compared to other non-university research institutions that are financed almost exclusively from institutional funding, the **high proportion of industrial revenue** in the Fraunhofer funding model is one of the factors that **make Fraunhofer unique**.

One of the core values of the Fraunhofer-Gesellschaft and its institutes is that they always join forces with universities, universities of applied sciences and businesses in the region. This facilitates the growth of **dynamic regional innovation ecosystems** that can help strengthen regional economies. Moreover, Fraunhofer employees ensure that the next generation of scientific and technical personnel have access to sound vocational training and continuing education and help improve **public acceptance of modern technology**. This is also made possible by the joint positions held by Fraunhofer research scientists at universities and universities of applied sciences.

Each individual Fraunhofer institute and research institution develops its own business units and core areas of expertise on the basis of its immediate market environment and its links with the wider scientific community. Although the institutes operate as separate profit centers, they are not autonomous legal entities. Fraunhofer institutes also cooperate in cross-institute structures such as expertise-based groups, market-driven alliances and research fabs in order to facilitate the joint marketing of specific business units or sectors.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Framework strategy process

The framework strategy goals adopted in 2024 were the first important step in refocusing the Fraunhofer-Gesellschaft on its mission and core responsibility of working with companies to drive the transfer of scientific knowledge into practical application:

- Remain key partner for industry
  - Generate revenue based on the Fraunhofer model
  - Leverage pathways to industrial application
  - Strengthen SMEs and large companies
- Drive groundbreaking technological innovation
  - Expand technological leadership
  - Attract and develop highly qualified and motivated employees
  - Provide outstanding technology infrastructure
- Be an outstanding institution
  - Demonstrate reliability as a partner and employer
  - Increase efficiency
  - Think and act entrepreneurially

These defined goals provide guidance for specific strategies at the organizational level, the institute level, as well as for strategies for Fraunhofer partnerships (such as groups, alliances, etc.). They are known across all institutes and widely accepted throughout the Fraunhofer-Gesellschaft. Their impact is felt for instance at meetings of the institutes' boards of trustees, where they provide a structural framework.

The specific institute strategies are still the cornerstone of the Fraunhofer-Gesellschaft's future-oriented activities, while the framework strategy defines the parameters for each institute's strategic processes. The framework strategy goals thus ensure that strategic activities are consistently aligned across the organization while promoting the creation of synergies.

In 2025, the framework strategy process focused on the development of a performance measurement system to facilitate the operationalization of framework strategy goals using targeted measures:

1. KPIs for organizational-level specialist strategies
In 2025, Fraunhofer defined a number of paramount framework strategy goals designed to get the operationalization phase off to a focused start. Priority will be given to aligning the relevant specialist strategies with these goals, and their contributions will be measured using a set of key performance indicators (KPIs).

KPIs have been defined to increase the productivity of Fraunhofer's real estate and infrastructure as part of an infrastructure strategy contributing to the framework strategy goal "Provide outstanding technology infrastructures." One aim is to increase the energy productivity of Fraunhofer's properties; this will be measured by the ratio of energy consumption to revenue. Another is to increase the effective, value-adding use of infrastructure by implementing collaborative usage models.

Fraunhofer's communications strategy is making an important contribution to the framework strategy goal "Demonstrate reliability as a partner and employer." Its aim is to strengthen employees' engagement with Fraunhofer's strategic direction by optimizing internal communication. This contribution will be measured by including appropriate questions in the Fraunhofer employee survey. Fraunhofer is also planning a strategic relaunch of its website with the aim of creating a more engaging, professional and clearly structured corporate image.

The KPIs and their target values for 2027 form the link between the framework strategy goals and the operationalization of these goals through specialist strategies, each of which is the responsibility of the respective executive unit. The executive units have maximum freedom to formulate and implement measures; however, these measures must be consistently aligned with the framework strategy goals. If necessary, conflicts between KPIs in different specialist strategies are discussed by the executive board in order to leverage synergies and prevent tension.

2. Measuring the viability of the institutes in the Fraunhofer model
In 2025, Fraunhofer introduced a new indicator to measure whether its institutes are currently viable within the Fraunhofer model and whether they will remain so in the medium and long term. Viability in this context is understood not only in economic terms but also from a holistic perspective. When assessing current viability, close attention is paid to the immediate financial situation. Medium-term risks are evaluated by reviewing factors such as the balance of revenue sources. When evaluating long-term prospects, Fraunhofer also considers aspects such as the institute's innovative capacity with regard to its scientific profile. However, the indicator is not merely a way of measuring institute performance after the fact. It also serves as input for crisis prevention and crisis response processes (see "Outlook"). This enables Fraunhofer to respond to crisis situations without losing sight of its longer-term alignment with the framework strategy goals.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Science policy framework and positioning

Research policy in 2025 was shaped by the **formation of the new German federal government** and the resulting shifts in science, innovation and research policy. By restructuring the **German Federal Ministry of Research, Technology and Space (BMFTR)** under federal minister Dorothee Bär, the German federal government has set its sights on a mission-driven innovation policy with clearly defined value-creation targets. Efforts to **reduce bureaucracy** and advance **digital transformation**—both of which are **key levers** driving **Germany's innovative capacity**—have now been brought together in the newly established **German Federal Ministry for Digital Transformation and Government Modernisation (BMDS)** under federal minister Karsten Wildberger.

Fraunhofer became involved in the realignment of political priorities early on. During the run-up to the German federal elections of 2025, Fraunhofer published a number of **position papers** and other documents on topics relevant to Germany as a high-tech location. Some of these were Fraunhofer's own papers, while others were authored in cooperation with strategic partner organizations.

The new federal government's key science policy initiatives, including the **High-Tech Agenda Germany (HTAD)** and the **Freedom of Innovation Act**, were integrated into the coalition agreement. At their core, both initiatives aim to strengthen Germany's innovative capacity in the face of international competition and to promote outstanding scientific research with a clear focus on practical application. The HTAD takes a mission-driven approach to these goals, focusing on 6 key technologies and 5 research fields. Fraunhofer is closely involved with the HTAD, reinforcing it with Fraunhofer moonshot topics and establishing freedom of innovation as a requirement for research and faster transfer of knowledge and technology to practical application. The Freedom of Innovation Act is intended to free research from the minutiae of funding bureaucracy. From Fraunhofer's perspective, the main areas in which bureaucracy could be reduced are **contract research for industry** (modifications to the legal framework governing nonprofit organizations), **licensing** (modernization of individual secondary regulations in nonprofit law) and **spin-offs**.

Fraunhofer also contributed to political discourse on key interdisciplinary topics relating to digital and innovation policy, for instance by contributing its expertise during consultations on the National Data Center Strategy, the law implementing the EU AI Act and the German federal government's startup strategy. Fraunhofer drew up specific **recommendations** regarding the further development of the **research data ecosystem**, the implementation of the **Freedom of Innovation Act** and the government draft of the **Living Laboratories Act**. Fraunhofer also developed contributions on lightweight design and transportation and research infrastructure, focusing in particular on the organization of funding from the Off-Budget Fund for Infrastructure and Climate Neutrality.

The **Pact for Research and Innovation (PFI)** is a cornerstone of Germany's scientific landscape and provides reliable, internationally unparalleled financial backing for the Fraunhofer-Gesellschaft, the Helmholtz Association, the Leibniz Association, the Max Planck Society and the German Research Foundation (DFG). The fourth phase, which began in 2021, will be the first to cover a ten-year period and is set to continue until 2030. For Fraunhofer, it is vitally important that the Pact continues beyond 2030, since reliable base funding is imperative for conducting pre-competitive research and developing the expertise necessary to secure and implement industry projects. In 2025, the PFI celebrated its 20th anniversary. The **anniversary event**, which took place on May 13, 2025, at Futurium in Berlin and focused on the theme "20 Years of IMPACT for Research and Innovation," opened with a welcome speech by Dorothee Bär, Federal Minister of Research, Technology and Space (BMFTR).

In 2025, the Fraunhofer-Gesellschaft took over the rotating role of **spokesperson for the Alliance of Science Organisations in Germany**. This means Fraunhofer is now playing an active role in the German research landscape with regard to research security, international cooperation and commitment to shared values. The premature collapse of the governing coalition, the ensuing coalition negotiations and the restructuring of the BMFTR all impacted the Alliance's work, as did **international developments such as the wars in Ukraine and the Middle East and the repositioning of the United States**. Moreover, it became necessary to address issues relating to dependence on U.S. data, databases and software systems. The Alliance responded by joining the International Coalition for Science, Research and Innovation in Ukraine, developing a strategy for scientific publishing, and presenting a paper on cutting through red tape to the Bundestag's research committee.

Ongoing geopolitical challenges have made **research security** an increasingly important issue. There has been intensive debate both within Germany and across Europe on protecting critical technology, managing international partnerships and regulating dual-use research. Fraunhofer actively contributed to these debates with position papers on science policy and statements on topics such as the planned EU research and innovation strategy **Horizon Europe Secure**. Fraunhofer also took part in the BMFTR's stakeholder consultation process on research security, which started in 2024, was paused in the summer of 2025 and later resumed in a new dialogue format involving the German federal and state governments and the Alliance. As spokesperson for the Alliance, Fraunhofer represented the Alliance's interests jointly with the German Science and Humanities Council and helped shape the initial concept for a **national research security platform**. In this new format, the German federal and state governments and the Alliance agreed on a policy paper for a national platform.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Furthermore, Fraunhofer President Holger Hanselka was appointed to the **German Federal Chancellor's Strategy Group for Technology and Innovation.** The Strategy Group is the German federal government's highest-level advisory committee for technology and innovation policy. It was appointed by the German Federal Chancellor for the 21st legislative period and consists of members of the German federal government and senior representatives of science and industry. The Strategy Group examines new developments, findings and trends in the innovation cycle and discusses specific proposals for strengthening the research and innovation system, resilience and technological sovereignty.

National and European large-scale projects

Large-scale project management plays a vital role in the success of Fraunhofer's research and development projects by promoting structured planning and effective collaboration between institutes. The central management of complex projects ensures that quality standards are maintained while improving communication and coordination with diverse (internal and external) stakeholders and facilitating the goal-oriented development of strategic projects.

This is particularly important for developing innovative solutions and accelerating the transfer of research findings into practice. Efficient large-scale project management therefore contributes significantly to Fraunhofer's competitive standing and strategic positioning in the German and international research environment.

Examples of large-scale projects coordinated within the Fraunhofer-Gesellschaft include:

- Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems (APECS)
- Fraunhofer Heilbronn Research and Innovation Centers HNFIZ
- Fraunhofer Research Institution for Battery Cell Production FFB
- Fraunhofer Clean Aviation
- Strategic partnership between Fraunhofer and DESY

APECS pilot line under the EU Chips Act
The strategically significant infrastructure project Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems (APECS), implemented under the EU Chips Act, continued as planned during the fiscal year 2025. As part of this initiative, the Fraunhofer-Gesellschaft is responsible for coordinating and implementing one of the key European semiconductor research pilot lines for Research Fab Microelectronics Germany (FMD), a unique group of Fraunhofer and Leibniz institutes. Building on the preceding project, Quantum and Neuromorphic Computing Modules (QNC), which served as a national precursor to the pilot line, the year under review saw the development of key components, processes and initial infrastructure modules for advanced packaging and heterogeneous integration. These projects are an integral part of the APECS pilot line and are designed to accelerate the transfer of research results to industrial application. The total project costs add up to around €730 million, approximately €509 million of which is attributable to investments and €231 million to operating expenses. More than 95 percent of the funding came from grants provided by the EU, the German federal government and the federal states in which the participating institutes are located.

APECS is an outstanding example of European collaboration: Seven leading research organizations are working in partnership with the Fraunhofer-Gesellschaft as part of this EU initiative. Together they are establishing a **technology-neutral European value chain in the area of semiconductor packaging and integration**. Despite isolated procurement delays, caused for instance by geopolitically induced supply bottlenecks and limited availability, the implementation process is generally still on schedule. Continuous project oversight and close coordination with Corporate Procurement and the funding bodies have ensured that the planning and award processes are managed efficiently. The project is intended to make a significant **contribution to Europe's technological sovereignty and supply security**. It is strengthening the bridge between excellent research and industrial implementation while emphasizing the key role played by the Fraunhofer-Gesellschaft in the European innovation landscape in accordance with the digital strategy and the European Green Deal.

Fraunhofer Heilbronn Research and Innovation Centers HNFIZ
The Fraunhofer Heilbronn Research and Innovation Centers HNFIZ bring together diverse areas of expertise in Heilbronn. In 2025, 8 Fraunhofer institutes began establishing 9 such research and innovation centers in Heilbronn with funding from the nonprofit Dieter Schwarz Foundation. The HNFIZ initiative addresses key future topics in the areas of AI and digital transformation and works to advance them. In doing so, it focuses on close collaboration with small, medium-sized and large companies, organizations and public institutions in the Heilbronn region and beyond. Working closely with educational institutions and innovation stakeholders in the Heilbronn region will create a unique scientific ecosystem that promotes intensive knowledge transfer and the commercialization of research results. In 2025, the centers garnered considerable attention by publishing a Fraunhofer transformation index and holding an international symposium on quantum AI.

Fraunhofer Research Institution for Battery Cell Production FFB
The development and production of batteries as a key technology is a vital factor in the technological sovereignty of Germany and Europe and in climate-neutral transportation and energy supply. One of the goals of the HTAD **is to build a competitive battery production and value chain** by 2035 and to integrate it into a European production network. The establishment of the Fraunhofer Research Institution for Battery Cell Production FFB as a bridge between science and industry is a major step in this

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

direction, since it enables new battery technologies to be scaled up and transferred from the laboratory to industrial application. Companies and research institutions can test and optimize production processes in a globally unique digital research infrastructure with a modular design. Fraunhofer FFB brings together expertise in fields such as the automotive industry, mechanical engineering and chemistry while contributing to the training of skilled personnel. The facility is being built in two construction phases. The German federal government is contributing up to €500 million in project-based funding, while the state of North Rhine-Westphalia is providing approximately €320 million. The FFB PreFab pilot plant was opened in 2024, while the FFB Fab for gigafactory-level production and scaling research is currently under construction.

Another major milestone was reached in December 2025 with the **production of the first electrically functional lithium-ion battery cell at the FFB PreFab pilot facility**. This was the first ever realization of a complete process chain using exclusively European manufacturing technology at all stages from electrode manufacture through to the charged cell.

Fraunhofer Clean Aviation
The institutional European Partnership for Clean Aviation (EPCA) was launched with the goal of achieving climate neutrality by 2050. Its mission is to pave the way for safe, reliable, affordable and sustainable air transport. As with the predecessor programs Clean Sky 1 and 2, Fraunhofer is one of the founding members.

In 2025, Fraunhofer was involved in 12 of the 28 clean aviation projects. The participating institutes received funding in the amount of just under €20 million, of which €5.97 million was allocated in 2025. In 2026, the number of projects will increase to 14, bringing in an additional €2.68 million in funding for 2026 and 2027. Each project can involve 50 or more partners in the European aviation sector, including Airbus, Rolls-Royce, ATR G.I.E. and Lufthansa. Further projects are expected in calls 4 and 5.

Strategic partnership between Fraunhofer and DESY
On February 25, 2025, the Fraunhofer-Gesellschaft and Deutsches Elektronen-Synchrotron (DESY), a leading research institution in the field of particle accelerators, signed a framework agreement governing their strategic collaboration. The two organizations aim to pool their expertise, infrastructure and knowledge with the goal of accelerating the transfer of research findings into industrial application. One key element of the collaboration is Fraunhofer's prioritized access to the Positron-Electron Tandem Ring Accelerator III (PETRA III), one of the world's most powerful synchrotron radiation sources. Synchrotron radiation is a special form of light that makes it possible to analyze materials at atomic level.

Fraunhofer has secured an annual allocation of beamtime for 2026 and aims to provide faster, simpler access to the PETRA III experimental stations and infrastructure for Fraunhofer projects involving industry partners. This prioritized access has the potential to boost the competitiveness of the Fraunhofer institutes and to give them a strategic advantage in applied synchrotron research.

The strategic partnership between Fraunhofer and DESY brings together cutting-edge infrastructure and applied research, thus laying the foundations for innovative solutions that will benefit industry and society alike.

International collaboration

The Fraunhofer-Gesellschaft's activities in international research markets aim to create scientific value within the organization and to generate added value for Germany and Europe as well as partner countries. In the majority of their international collaborations, the Fraunhofer institutes work directly with industry and research partners in European and global research markets. The total project value of these partnerships on the part of the institutes amounted to €393 million (excluding license-fee revenue) in 2025.

Fraunhofer has developed various models to generate excellent scientific content and create value for industry in collaboration with attractive partners worldwide. The 9 legally independent Fraunhofer foreign affiliates represent the most institutionalized form of such partnerships:

- Fraunhofer USA, Inc.
- Fraunhofer Austria Research GmbH
- Fraunhofer Italia Research Konsortial-GmbH
- Fraunhofer UK Research Ltd
- Fundación Fraunhofer Chile Research
- Associação Fraunhofer Portugal Research
- Fraunhofer-Chalmers Research Centre for Industrial Mathematics FCC (in Sweden)
- Fraunhofer Singapore Research Ltd.
- Fraunhofer Spain Research Foundation

The foreign affiliates act as legal entities for 13 research centers outside of Germany. These institutionalized Fraunhofer partnerships with local universities facilitate long-term research activities abroad. As their work is not profit-oriented, the foreign affiliates generally qualify for base funding from their country of domicile. Their funding follows the Fraunhofer model.

On October 10, 2025, a celebration was held to mark the official **launch** of a new foreign affiliate, the **Fraunhofer Spain Research Foundation**. Funded by the Spanish government, the government of Catalonia and the city of Barcelona, the new affiliate will conduct research based on the Fraunhofer model at a leading international location for biotechnology innovation. The first center

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

to be brought under the umbrella of Fraunhofer's newest foreign affiliate is the Fraunhofer Center for Applied Theragnostics CAT, which primarily focuses on research in the fields of bioengineering, biosensors and biomimetic systems for biomedical applications. The center's partner institute is the Fraunhofer Institute for Biomedical Engineering IBMT, which specializes in stem cell processing technology and cell-based microsystems.

International Fraunhofer representative offices in China, Brazil, India, Japan, and Korea function as liaison offices for networking and marketing. They provide local support for all Fraunhofer institutes in initiating and setting up partnerships with research partners from their respective countries. The representative offices provide the Fraunhofer research portfolio with crucial impetus thanks to their knowledge of the respective regional and local research landscape.

The objective of the PACT (Program for Affiliate Cooperation and Knowledge Transfer) program and the associated R&D projects, commercialization activities, and initiatives is to create added value for the entire Fraunhofer network by increasing collaboration between the Fraunhofer foreign affiliates and Fraunhofer institutes. A total of 15 projects from the PACT program were approved in 2025, involving 3 foreign Fraunhofer affiliates, 6 centers and 20 Fraunhofer institutes. Other international collaboration models include:

- **Fraunhofer innovation platforms (FIPs)**
  Long-term partnerships with international universities and research institutions; in 2025, there were 14 FIP partnerships in 11 countries

- **ICON program**
  Funding for three-year research projects with excellent international partners; in 2025, there were Fraunhofer researchers working on 18 ICON projects with research institutions in 13 countries

- **Fraunhofer International Mobility Program (FIM)**
  Support for international networking through research visits lasting several months; in 2025, research visits for 11 Fraunhofer employees were funded, including placements in Yale University (U.S.), Stanford University (U.S.), RIKEN (Japan) and at the University Hospitals of Strasbourg (France)

- **Fraunhofer-Bessel Research Award**
  As part of the award ceremony, top-level researchers are invited to undertake a research visit at Fraunhofer. In 2025, a research scientist from the University of Connecticut (U.S.) completed a research stay at the Fraunhofer Institute for Solar Energy Systems ISE, while a research scientist from the University of Guelph (Canada) spent time at the Fraunhofer Institute for Applied Optics and Precision Engineering IOF.

Commitment in Ukraine

The Alliance of Science Organisations in Germany has joined the International Coalition for Science, Research and Innovation in Ukraine under the guidance of the Fraunhofer-Gesellschaft. Leading international stakeholders have thus affirmed their commitment to strengthening science, research and innovation in Ukraine. The new coalition is based on the Rome Declaration of Intent for Science, Research and Innovation in Ukraine, which was signed on July 11, 2025, during the Ukraine Recovery Conference (URC) in Rome. The signatories included the Ukrainian Ministry of Education and Science, the European Commission and the German Federal Ministry of Research, Technology and Space (BMFTR). In essence, the Rome Declaration is closely linked with the Ukraine Action Plan developed by the Alliance of Science Organisations in Germany and takes its funding policy objectives into account. Since 2023, the Fraunhofer Future Foundation has been funding nine technology transfer projects as part of the special program "Rebuilding Ukraine—resilient and sustainable." These projects are being realized jointly with science and industry partners in Ukraine for the purpose of implementing new technologies in the Ukrainian market. In 2025, the Fraunhofer Future Foundation allocated funding totaling €1.6 million to the special program.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

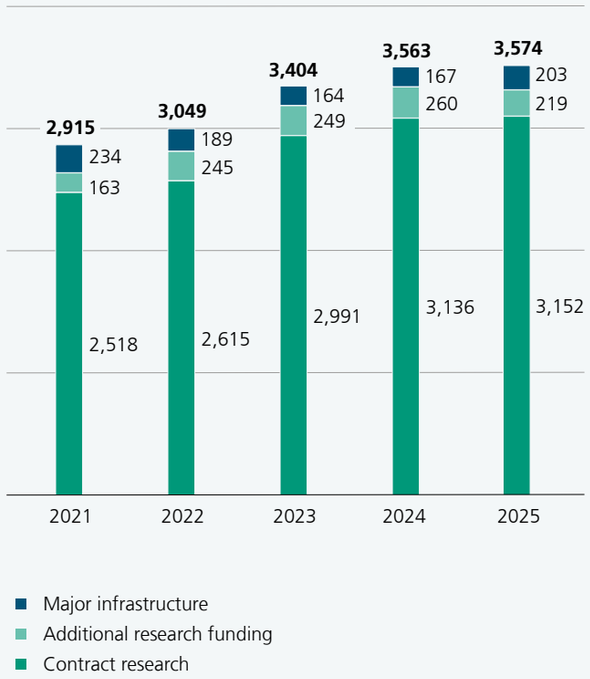
Business report

Total business volume

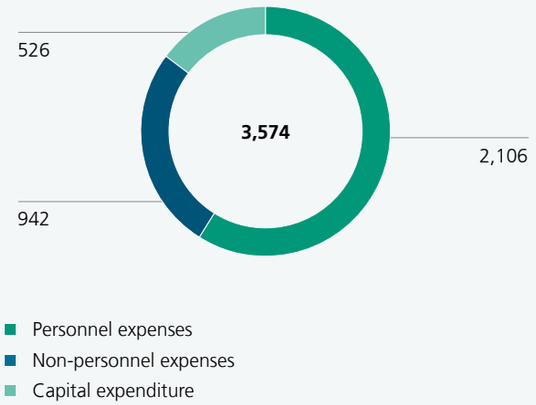
At €3.6 billion, the total business volume remained at the previous year's level. Contract research is the Fraunhofer-Gesellschaft's core activity, accounting for 88 percent of its total business volume, equivalent to €3.2 billion. Fraunhofer wins more than two-thirds of its contract research projects in open competition in the market while striving to maintain a balance between industrial revenue and public-sector revenue. The funding base is provided through institutional funding from the German federal and state governments. Research with long-term funding that falls outside regular institutional funding is reported under a new item, additional research funding, which amounted to €219 million in the reporting period. Spending on major infrastructure amounted to €203 million, which includes €23 million in investments in the APECS pilot line under the EU Chips Act. These three segments will be discussed in greater detail in the following sections.

The total business volume encompasses personnel and non-personnel expenses in accordance with generally accepted accounting principles. It also includes capital expenditure at the full amount without depreciation and amortization. Starting in 2025, amounts drawn from reserves will no longer be offset against expenses. As a result, the total business volume now corresponds to the expenses reported in the income statement and excludes changes in the financing of current assets. Personnel expenses amounted to €2,106 million in 2025. The 2 percent year-on-year increase was primarily due to the pay rise under the German Collective Bargaining Agreement for the Public Service (Tarifvertrag für den öffentlichen Dienst, TVöD), which came into effect on April 1, 2025. Non-personnel expenses were recognized at €942 million. In contrast, capital expenditure declined significantly, falling by 10 percent to €526 million. Overall, the total business volume was in line with the previous year's forecast.

Fraunhofer total business volume in € million



2025: total business volume by budget in € million



Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Contract research

Contract research encompasses Fraunhofer's core activities and is financed from three revenue streams:

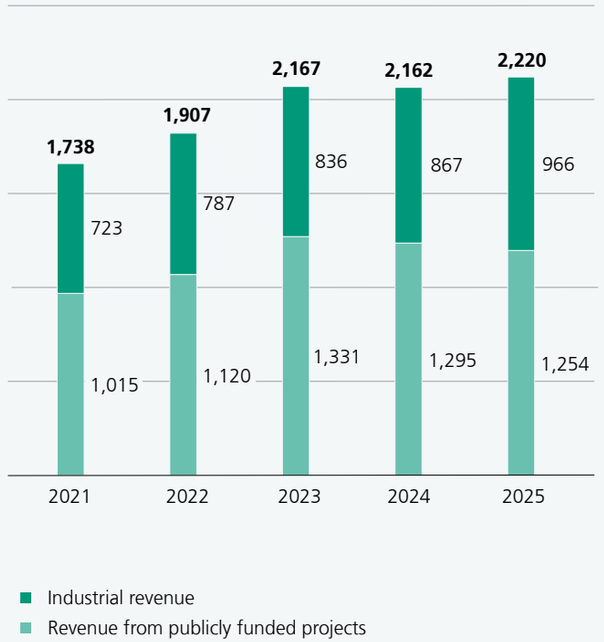
- Industry contracts and license-fee revenue
- Publicly funded research projects
- Institutional funding

Institutional funding is provided by the German Federal Ministry of Research, Technology and Space (BMFTR) and the state governments in the ratio of 90:10. This forms the basis for groundbreaking pre-competitive research that will become important for the private sector and society in the years ahead.

Despite the strained economic climate, Fraunhofer's **industrial revenue** exceeded expectations, rising by 11 percent to €966 million. Revenue from contracts with industry increased by 9 percent to €768 million. License-fee revenue from industry amounted to €198 million. After being adjusted to account for a special effect on the balance sheet, this is equivalent to a 12 percent increase.

At 48.0 percent, more than half of industrial revenue is attributable to customers from the manufacturing sector in line with the European Community's system for classifying business sectors (NACE classification). Within this sector, the greatest total share of industrial revenue comes from projects with customers operating in the manufacture of computer, electronic and optical products, basic pharmaceutical products, electrical equipment and motor vehicles, or of machinery and equipment. The second largest share of industrial revenue, 27.8 percent, comes from customers engaged in professional, scientific and technical activities. These include, for example, companies in research and development, engineering firms and patent pool management companies.

Project revenue from contract research in € million



Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

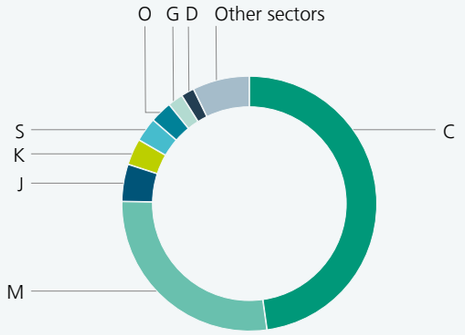
About Fraunhofer

Publisher's information

Industrial revenue in 2025 by industry

NACE code* based on the statistical classification of economic activities in the European Community since 2008				% of total	Cumulative
C	of which:	Manufacturing		48.0%	48.0%
	26	Manufacture of computer, electronic and optical products	15.1%		
	28	Manufacture of machinery and equipment	7.1%		
	29	Manufacture of motor vehicles, trailers and semi-trailers	4.6%		
	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	3.7%		
	27	Manufacture of electrical equipment	3.1%		
		Other manufacturing	14.4%		
M		Professional, scientific and technical activities		27.8%	75.8%
J		Information and communication		4.6%	80.4%
K		Financial and insurance activities		3.6%	84.0%
S		Other service activities		3.0%	87.0%
O		Public administration and defense; compulsory social security		2.6%	89.6%
G		Wholesale and retail trade; repair of motor vehicles and motorcycles		2.1%	91.7%
D		Electricity, gas, steam and air conditioning supply		1.6%	93.3%
		Other sectors or no sector		6.7%	100.0%

Industrial revenue by industry
(in % of total)



* European Commission, Eurostat, (2008). NACE Rev. 2: Statistical classification of economic activities in the European Community. Publications Office. https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-ra-07-015

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

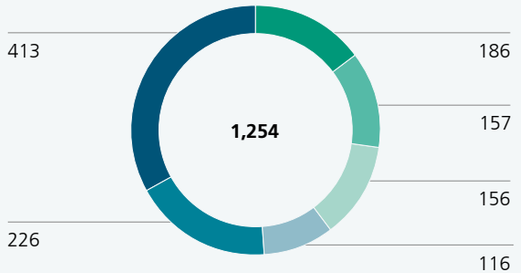
About Fraunhofer

Publisher's information

At €1,254 million, the **revenue from publicly funded projects** generated in 2025 was lower than in the previous year. Project funding from the German federal government decreased by 11 percent to €755 million. Along with a decline in revenue from the German Federal Ministry of Research, Technology and Space (BMFTR), which fell by 8 percent to €413 million, the funding received from the German Federal Ministry for Economic Affairs and Energy (BMWE) decreased by 15 percent to €226 million, while funding received from other federal ministries fell by 14 percent to €116 million. In contrast, the project funding received from the German state governments rose by 23 percent to €186 million following a significant decline the previous year. EU revenue also increased, rising by 9 percent to €157 million. This figure includes additional revenue from funding for the APECS pilot line. Other revenue increased by 3 percent to €156 million, including revenue from foundations, universities and other research funding institutions, and license-fee revenue of €2 million from customers outside of industry.

In addition to being one of the Fraunhofer institutes' criteria for success, the **high share of funding coming from external project revenue** is a **unique selling point** for the Fraunhofer-Gesellschaft. The share of project funding therefore serves both as a key performance indicator and as a guide for establishing an optimal funding mix in contract research. It is calculated as the share of project revenue in the operating budget, including imputed depreciation of capital assets (excluding project groups and special effects on the balance sheet). At 71.1 percent, the share of externally generated revenue in 2025 was in line with the previous year. Within this figure, the share of project funding from the German federal and state governments fell to 30.1 percent, while the share of industrial revenue increased to 31.0 percent.

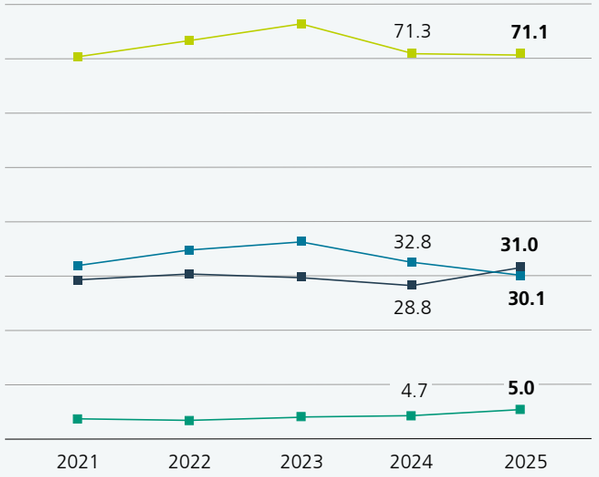
2025: Revenue from publicly funded projects in € millions



- BMFTR
- BMWE
- Other federal ministries
- State governments
- EU
- Other revenue

International revenue from industry contracts rose by 6 percent to €217 million, while other revenue increased by 10 percent to €19 million. €88 million of the total came from customers and partners within the EU and €148 million was generated by customers and partners outside the EU. The largest international markets were the U.S. with revenue of €40 million, Switzerland with €32 million and Japan with €21 million.

Funding share in %



- Total project revenue (including other revenue, 2025: 5.0%)
- Industry
- Federal and state governments
- EU

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Additional research funding

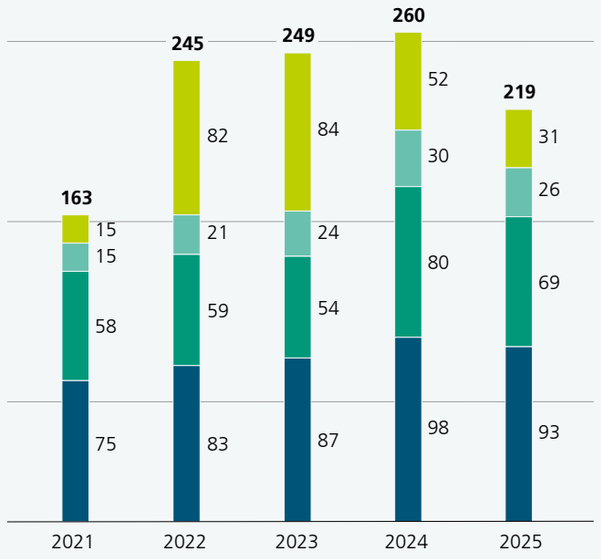
Additional research funding covers research activities with long-term funding outside the scope of regular institutional funding. In addition to defense-related research, this includes the National Research Center for Applied Cybersecurity ATHENE and the Fraunhofer Research Institution for Battery Cell Production FFB.

ATHENE is operated jointly by the Fraunhofer Institute for Secure Information Technology SIT and the Fraunhofer Institute for Computer Graphics Research IGD in collaboration with the Technical University of Darmstadt, the Darmstadt University of Applied Sciences and Goethe University Frankfurt. Its research focuses on the protection of critical infrastructure such as electricity and transportation systems and the security of IT systems. The center takes an interdisciplinary approach, combining IT and engineering with legal and economic issues, psychology and ethics. ATHENE is funded by the BMFTR and the federal state of Hesse at a ratio of 70:30 and had a budget of €26 million in 2025.

The development and operation of the **Fraunhofer FFB** incurred expenses of €31 million in 2025. The BMFTR is providing a total of up to €500 million in funding for this large-scale initiative through project finance. Another €320 million is being provided by the federal state of North Rhine-Westphalia for land acquisition and new construction. Fraunhofer FFB is to become the center for developing modern, sustainable and scalable battery cell production for Germany and Europe.

In the field of **defense research**, Fraunhofer has consolidated the research and development activities of seven Fraunhofer institutes that received institutional funding and ongoing project funding from the German Federal Ministry of Defence (BMVg) in 2025. The objective of these R&D activities is to provide people, infrastructure and the environment with the best possible protection against potential security threats resulting from natural disasters or military, technological, terrorist or criminal activity. Following a significant increase in the previous year, expenditure on defense research fell to €162 million. Institutional funding from the BMVg decreased by €5 million to €93 million, while project funding from the BMVg fell by €11 million to €69 million.

Additional research funding in € million



Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Major infrastructure

Major infrastructure covers building projects and the purchase of scientific instruments and furnishings for new facilities. Expenditure on the construction and equipping of new facilities rose to €180 million. Expenditure on building projects rose by €11 million to €159 million, most of which (€113 million) was attributable to large-scale building projects. Capital expenditure on equipping new facilities increased by €2 million to €21 million. Special funding for major building projects and the equipping of new facilities is provided by the federal and state governments in a 50:50 ratio. The state governments often provide additional funding from the European Regional Development Fund (ERDF), which reduces the funding required from federal and state governments by an equivalent amount. The funding required from the German federal and state governments totaled €177 million. ERDF funds from the German state governments and other revenue accounted for €3 million of project revenue.

Beginning in 2025, investments in the Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems (APECS) infrastructure project, which is being implemented under the EU Chips Act, will be reported separately under "Major infrastructure." With total funding amounting to €730 million, APECS is being co-financed by the European partnership Chips Joint Undertaking and by national funding from eight European countries. Two-thirds of the German funding is being contributed by the German Federal Ministry of Research, Technology and Space (BMFTR), while one-third is being provided by the participating federal states (see "National and European large-scale projects"). In 2025, the APECS pilot line received €23 million in capital expenditure through project funding under "Major infrastructure." Expenditure of €54 million on the preliminary project Quantum and Neuromorphic Computing Modules (QNC), which was completed at the end of 2025 and forms part of the APECS pilot line, was again reported under contract research.

Major infrastructure in € million

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Financial and net asset position

At December 31, 2025, the Fraunhofer-Gesellschaft had total assets of €4,809 million, down €28 million or 0.6 percent year on year. Assets presented in the ordinary accounts comprised 99.7 percent of total assets, with the remaining 0.3 percent accounted for by the capital of the nonprofit organization.

Noncurrent assets accounted for 67 percent of assets and were €85 million higher at €3,243 million. This increase was chiefly attributable to the fact that capital expenditure on property, plant and equipment exceeded depreciation. Property, plant and equipment grew by €88 million to €3,169 million.

Current assets accounted for 31 percent of assets and were €124 million lower at €1,498 million. Work in progress increased by €198 million, driven by new funding programs from the German federal states and new projects for the APECS pilot line. Receivables from the German federal and state governments relating to base funding decreased by €10 million to €387 million, including receivables for funding approved during this financial year. Their availability beyond the end of the fiscal year is ensured by the budget instrument known as "independent resource management." As a result, these include "Selbstbewirtschaftungsmittel" (SBM, resources managed independently) amounting to €357 million from the German Federal Ministry of Research, Technology and Space (BMFTR) and SBM amounting to €20 million from the German Federal Ministry of Defence (BMVg). Receivables from the German federal and state governments from project billing (including contracts) decreased by €151 million to €147 million. Receivables from affiliated companies increased by €0.7 million to €1.1 million. Bank account balances (including cash and cash equivalents) rose by €6.5 million to €24.7 million. The value of the securities portfolio was €92 million lower, at €231 million. €231 million of this amount corresponds to the license-fee revenue reserve.

At €15.7 million, there was a slight increase in **equity**, which consists of nonprofit organization capital not funded from grants. A sum of €11,525 was withdrawn from the reserves for statutory purposes.

The extraordinary item "License-fee revenue reserve for statutory purposes" decreased by €97 million to €231 million in the reporting year. Of this, €24 million was allocated to the extraordinary item "Financing of current assets" to pre-finance projects funded by third parties. An additional €14 million was used to meet obligations, relating in particular to the partial funding of high-performance centers and the expansion of photovoltaic systems. A further €60 million was drawn from the reserve in order to balance the budget and cover additional requirements at the Fraunhofer institutes. The extraordinary item "Grants relating to noncurrent assets" was €84 million higher at €3,231 million. The extraordinary item "Financing of current assets" amounts to €222 million at the reporting date and is used to account for revenue not yet received, less expenses not yet paid, by the reporting date. A sum of €5.3 million was used from the extraordinary item "Financing restructuring measures," which was set up to finance the restructuring of the cleanroom infrastructure. The remaining funds, which amounted to €4.7 million, were released in full. As of the reporting date, the extraordinary item "Payments from patent sales" amounted to €18 million, €8 million down on the previous year.

Provisions fell by €40 million to €354 million, with the decline attributable in equal measure to provisions for personnel and non-personnel expenses. Unused provisions amounting to €38 million were released. Provisions with maturities of more than one year amounted to €50 million. In the case of pension and compensated leave provisions, a corresponding amount of receivables from the German federal and state governments totaling €123 million was recognized on the asset side of the balance sheet.

Liabilities decreased by €3 million to €729 million. In addition to a decrease of €26 million in unappropriated grants from the federal and state governments relating to institutional funding and project billing, the trade payables and accounts payable to affiliated companies rose by a total of €23 million. Other current liabilities remained unchanged year on year at €27 million.

As a beneficiary of public funds, the Fraunhofer-Gesellschaft is subject to budgetary constraints that prohibit it from making use of the capital markets or lines of credit with banks. Nevertheless, the organization's liquidity is guaranteed at all times as it can regularly call on cash payments from its grant authorities under base funding arrangements and can use its reserves as needed. The Fraunhofer funding model has proved its worth in times of crisis and is built on a solid foundation.

The **Fraunhofer Future Foundation**, established in 2008, is a legally independent institution that supports technology-oriented research projects at the Fraunhofer institutes in line with the statutes. The foundation added a total of €7 million to the expendable capital in 2025. These additions result from pro-rata returns from successful foundation projects, repayable grants, revenue from asset management and donation income. The Fraunhofer Future Foundation provided €11 million in funding for projects at Fraunhofer institutes in 2025. Expendable capital decreased from €83 million to €78 million.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Shareholdings and spin-offs

At the reporting date, the Fraunhofer-Gesellschaft held equity investments in 83 companies across a broad range of sectors. The transfer of technology to industry formed the focus of activities at 53 of the companies in the investment portfolio, while a further 21 equity investments were of a strategic nature. Equity investments also include 9 affiliated companies. In 2025, the Fraunhofer-Gesellschaft invested a total of €3.5 million in the acquisition of equity interests in shareholdings. The portfolio was expanded by another four companies, with the Fraunhofer-Gesellschaft investing €0.4 million in their share capital. Furthermore, 3 foreign Fraunhofer affiliates were reclassified as affiliated companies following a reassessment. These had previously been listed under other legal forms for information purposes. Fraunhofer also sold its shares in 4 companies during the same period. The total carrying amount of shareholdings (including shares in affiliated companies) increased to €36.8 million (previous year: €36.0 million). Proceeds from the divestiture of shareholdings came to €1.9 million.

Spin-offs are an integral part of Fraunhofer's strategy for leveraging its industrial property rights. In individual cases, Fraunhofer takes a minority equity stake in the spin-off as part of its technology transfer activities. In 2025, Fraunhofer Venture provided support to 89 new spin-off projects. Across Fraunhofer as a whole, 29 new spin-offs were established.

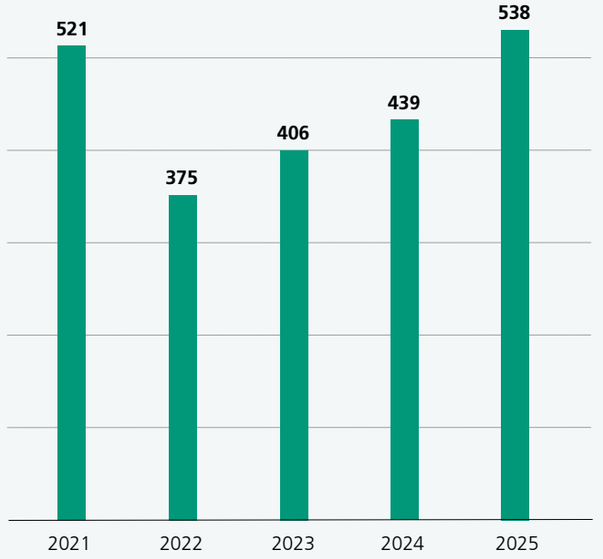
Fraunhofer has set itself the goal of increasing not only the number of spin-offs but also their proportional contribution to overall industrial revenue. Fraunhofer's innovation hub AHEAD offers a package of targeted entrepreneurship measures and programs to help achieve this. Overall, 60 teams took an active part in the Fraunhofer AHEAD program in 2025. In-depth workshops and coaching sessions are provided to teach entrepreneurship. Fraunhofer AHEAD offers a networking platform for early-phase spin-off and licensing projects with the national entrepreneurship ecosystem. As well as the general AHEAD program, there are also specialized tracks in the fields of Sustainable Development Goals and life sciences.

Exploitation of intellectual property rights

In 2025, Fraunhofer continued to pursue its intellectual property (IP) strategy with a clear focus on securing long-term patent protection for inventions with strong potential for exploitation. The institutes are aligning decisions on patent applications and maintenance even more closely with strategic and economic criteria to ensure that resources are used efficiently and IP portfolios streamlined further. The Fraunhofer institutes are also making extensive use of the far-reaching international coverage offered by the EU unitary patent. In 2025, **589 inventions** were reported and **538 patent applications claiming rights of priority** were submitted. The European Patent Office's Technology Dashboard 2025, formerly the Patent Index, identifies the Fraunhofer-Gesellschaft as the leading European research institution for patent applications. The portfolio of active patent families remained stable year on year at around 7,000. This shows that the targeted focus and consolidation of the IP strategy is proving successful, allowing Fraunhofer to maintain a high level of intellectual property protection even in increasingly challenging economic conditions.

In general, Fraunhofer generates revenue from the **commercial exploitation of IP** rights by concluding licensing agreements. In addition, IP can also be contributed to patent pools or exploited through the sale of IP. The most successful of these pools consist of patents for audio and video encoding. Together with other patent holders from different countries whose patents are relevant to standards, Fraunhofer uses various patent pools to issue licenses on a worldwide basis. The revenue from these pools is reinvested in pre-competitive research, thereby helping strengthen Germany's position as a research hub for the long term. Revenue from the licensing and sale of IP amounted to approximately €200 million.

Patent applications claiming rights of priority



Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Sustainability aspects

Responsible corporate governance

Fraunhofer works with partners from science, industry and society to develop solutions for the future. The Fraunhofer-Gesellschaft's research and technology transfer activities make a vital contribution to the development of innovative approaches addressing **environmental, economic and societal challenges**. Transferring research findings to practice provides support to companies in achieving their sustainability targets and developing resource-efficient products and services.

Sustainability is also an integral element of responsible corporate governance at the Fraunhofer-Gesellschaft. Fraunhofer has been a member of the UN Global Compact since 2017 and is committed to the ongoing implementation of its ten principles and to **supporting the Sustainable Development Goals (SDGs)**. This commitment is upheld by an established compliance management system.

Overall responsibility for sustainability rests with the president of the Fraunhofer-Gesellschaft. Sustainability is seen as a cross-cutting responsibility shared by all executive units. The Sustainability Management department, which reports to the Presidential Office, coordinates sustainability activities across Fraunhofer in close cooperation with the relevant specialist departments. Furthermore, an interdisciplinary sustainability working group brings together the strategic and operational measures needed to achieve the organization's sustainability goals. Sustainability considerations are integrated into corporate governance in order to strengthen the effectiveness and resilience of the organization and ensure it responds appropriately to regulatory, technological and societal change.

Principles of corporate governance
Fraunhofer is a nonprofit association registered under German law with a governance structure oriented toward transparency, accountability and efficiency.

The organization is primarily **governed** by the **executive board and the senate**. The executive board of the Fraunhofer-Gesellschaft currently operates as a collective body consisting of the president and chair of the executive board together with 4 additional members. It is responsible for the general management of the organization and for its strategic direction. The conduct of the executive board shapes the corporate culture and, for the Fraunhofer-Gesellschaft as a whole, ensures a coherent research portfolio that meets both legal and scientific standards. The executive board establishes and implements the framework necessary for the lawful, proper and cost-effective management of the organization's activities and those of its institutes and research units. This is achieved through guidelines and control systems. The senate, which comprises up to 26 representatives from research, industry and government, is responsible for advising the executive board, monitoring its activities pursuant to section 13(1) of the Fraunhofer statutes, appointing its members, approving the business plan and making recommendations regarding the establishment of the central elements of the science and research strategy pursuant to sections 13(6c) and (7b) of the Fraunhofer statutes. The senate is supported by three standing **committees** drawn from among its members: **the audit committee, the committee for executive board affairs and the nomination committee**. The Fraunhofer-Gesellschaft has had an established **compliance management system (CMS)** in place since 2010. This is regularly adapted to reflect increasing regulatory requirements and the growing complexity of the research ecosystem. The CMS is based on a compliance framework consisting of clearly defined regulations, roles and responsibilities, including for sustainability. This framework was developed in cooperation with the research units.

The **Fraunhofer-Gesellschaft's** code of conduct, which was revised and updated during the reporting year, defines the core values and principles that guide the actions of all employees as well as those of the executive board and senate. It provides the framework for conduct grounded in integrity and responsibility, while emphasizing the importance of trust, respect and fairness in Fraunhofer's everyday scientific and administrative work.

The **Fraunhofer whistleblower system** was established in compliance with the German Whistleblower Protection Act (Hinweisgeberschutzgesetz, HinSchG) and facilitates internal and external reporting of potential legal violations. It also encompasses measures to protect whistleblowers and prevent retaliation.

The CMS also includes mechanisms for **preventing and combating corruption and bribery**. These are reviewed and expanded on a regular basis. The findings of these analyses are used to develop various training concepts, with particular attention paid to work areas identified as vulnerable to corruption.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Environmental responsibility

The Fraunhofer-Gesellschaft's environmental responsibility centers first and foremost on climate-friendly research processes and sustainable infrastructure design. In its climate strategy, adopted in 2020, the Fraunhofer-Gesellschaft pledged to significantly reduce its absolute greenhouse gas (GHG) emissions.

Using 2019 as the baseline year, the emissions[1] reported in accordance with the Greenhouse Gas (GHG) Protocol are to be reduced by at least 55 percent by 2030. Furthermore, Fraunhofer aims to achieve net zero greenhouse gas emissions in its scientific operations by no later than 2045. Since the end of 2020, measures have been systematically implemented across all three scopes in order to achieve these goals. These measures are designed for example to increase energy efficiency, to support the transition to renewable energies, to promote climate-friendly transportation and to reduce climate-relevant gases during the research process. The Climate Management department at headquarters is responsible for overall management and progress monitoring.

Energy efficiency

Improving energy efficiency is a key lever for achieving the Fraunhofer-Gesellschaft's climate targets. In 2023, four regional energy efficiency and climate action networks were launched as a step in this direction. The first review in May 2025 showed clear signs of progress: The implementation of around 100 measures is expected to reduce annual energy consumption by approximately 6.4 gigawatt-hours (GWh). This is equivalent to roughly 27 percent of the overall target of 23.5 GWh per annum and is expected to cut preventable CO_2 emissions, expressed in CO_2 equivalents (CO_2e), by approximately 2,250 tons per year. A total of just under €7 million was invested in these measures, with an average payback period of around 6.3 years. The measures implemented focus primarily on optimizing ventilation and cooling systems, expanding photovoltaic (PV) systems and modernizing lighting, compressed air and heat supply systems.

The Fraunhofer energy efficiency and climate action networks and, with them, the 43 participating institutes, have been part of Germany's nationwide Initiative for Energy Efficiency and Climate Action Networks since 2025.

Overall energy consumption

In 2025, the Fraunhofer-Gesellschaft's total energy consumption amounted to 433 GWh[2], with electricity accounting for the largest share. In 2025, Fraunhofer used 250 GWh of grid-supplied (not self-generated) electricity, mainly to operate data centers and research facilities such as clean rooms, electrolyzers and melting furnaces. A further 93 GWh was attributable to natural gas consumption, 88 GWh to the use of district heating (steam) and cooling, 2.2 GWh to heating oil and 0.8 GWh to the use of wood chips for heating. The slight increase in energy consumption compared to 2024 (+3 GWh) is explained by increased heating demand caused by the weather conditions in 2025.

Since the **green energy resolution** came into effect in 2023, all electricity procured under the Fraunhofer framework agreement has come from renewable sources (based on canceled guarantees of origin in accordance with section 42 of the German Energy Industry Act (EnWG)). Renewable energy can therefore be assumed to account for at least 52 percent of Fraunhofer's total energy consumption.

The number of Fraunhofer-owned photovoltaic (PV) systems increased to 60 in 2025, with 10 additional systems connected to the grid during the year. As of December 31, 2025, Fraunhofer had installed 3.7 megawatts peak (MWp) of solar power generation capacity for its own use, generating around 3.3 GWh of renewable electricity per year.

Fraunhofer **also successfully concluded its first power purchase agreement** (PPA). The Fraunhofer Research Institution for Battery Cell Production FFB concluded a solar PPA with the utility company Stadtwerke Münster with effect from November 1, 2025. According to this agreement, 6.36 GWh of regional green electricity will be delivered to Fraunhofer FFB every year via a direct connection for use in operating the research fab FFB PreFab.

Climate-relevant gases from research processes

In addition to energy-related emissions, particular importance is attached to greenhouse gas emissions from the use of climate-relevant process gases in certain research fields, especially in microelectronics and clean room technology. These gases, most of which are fluorine and nitrogen compounds, can in some cases have high global warming potential and therefore require close attention. An organization-wide procedure for recording and evaluating these emissions is currently being developed as part of the Fraunhofer climate strategy. This will progressively quantify them and identify ways to reduce them. Initial pilot measurements have already been taken.

1 Fraunhofer's GHG inventory and climate targets as of December 31, 2025, do not contain a full record of the relevant GHG emissions defined under scope 3.1 and 3.2. This is due primarily to the complexity of the data collection process.

2 This is a forecast value. Since not all the consumption data for 2025 was available at the time the report was prepared (coverage = 89.4%), a trend analysis based on available meter readings and comparisons with the previous year's consumption was issued for each energy source. These analyses were then used to forecast the total energy consumption.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Employees

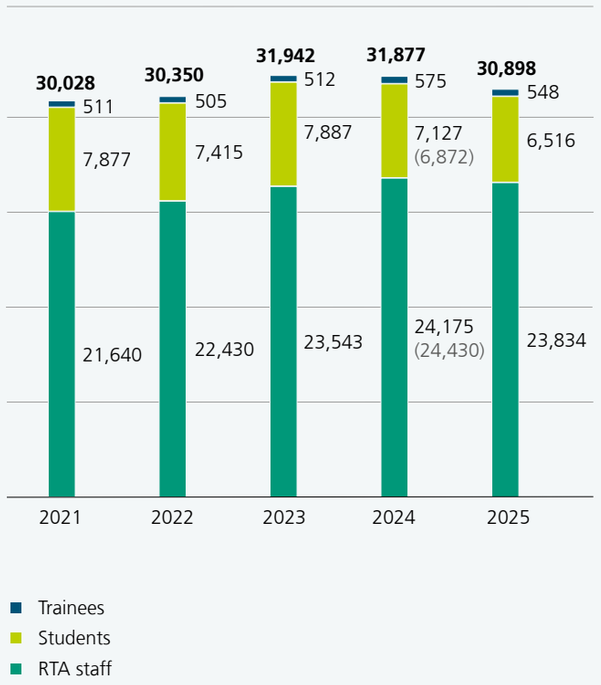
As at December 31, 2025, Fraunhofer had **30,898 employees**. This represents a 3.1 percent decrease in headcount (979 individuals) since the previous year. The number of research, technical and administrative (RTA) staff dropped by 1.4 percent (341 individuals). 2025 also saw the number of research staff decrease by 304 or 2.3 percent year on year. Based on the new classification of student employees (see note to the chart), the number of students was down 8.6 percent (611 students) on the previous year.

As of December 31, 2025, 548 individuals were undergoing vocational training at Fraunhofer. This represents a decrease of 27 trainees (4.7 percent) compared with the previous year. The biggest absolute decline was noted in vocational training programs leading to a recognized chamber qualification (19 individuals or 3.8 percent). However, the biggest decline by percentage was recorded in the cooperative study programs that did not lead to a recognized chamber qualification. As of December 31, 2025, 57 people were employed in these programs, down 9 (13.6 percent) from the previous year.

Note on the chart

Since mid-2024, Fraunhofer has been gradually converting employment contracts for students not involved in scientific work into student employee contracts under the German Collective Bargaining Agreement for the Public Service (Tarifvertrag für den öffentlichen Dienst, TVöD). They were originally classified as RTA staff. However, they have now been recategorized as students with retroactive effect from the end of 2024 in order to provide consistent time series for RTA staff and students. The figures originally reported for 2024 are presented in gray and in parentheses (255 student employees counted as RTA staff, now classified as students).

Fraunhofer employees (number at year-end)



Diversity in the workforce

The Fraunhofer-Gesellschaft is actively committed to **gender equality**. Women make up 36.3 percent of the workforce across all employee groups.

Employee groups	Women	Total	Percentage of women
RTA staff	8,845	23,834	37.1%
University students	2,183	6,516	33.5%
Trainees	186	548	33.9%
Total	11,214	30,898	**36.3%**

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

For the following analysis, the RTA employee group is divided into research staff and non-research staff. As of December 31, 2025, women accounted for 52 percent of non-research staff, while 24.4 percent of research staff were women. The breakdown by level is as follows:

	Non-scientific employees (research support, administration, infrastructure) as of December 31, 2025			Research staff (pay group 13 upwards with scientific responsibilities) as of December 31, 2025		
	Women	Total	Proportion of women	Women	Total	Proportion of women
Level 1	5	11	45.5%	18	107	16.8%
Level 2	399	865	46.1%	468	2,528	18.5%
Level 3	5,308	10,100	52.6%	2,647	10,223	25.9%
Total	5,712	10,976	**52.0%**	3,133	12,858	**24.4%**

Note on the tables

Level 1: employees at management level 1
(institute directors and directors at headquarters)
Level 2: employees at management levels 2–5
(managers below institute management level)
Level 3: employees without management responsibilities
(individuals without management responsibilities)

As part of the Pact Agreement for 2026 to 2030, specific targets have been set to **increase the proportion of female research scientists**, especially in management positions, using the **Fraunhofer-specific cascade model**.[1] The targets for 2025, 2028 and 2030 are as follows:

Fraunhofer-specific cascade model Proportion of female research staff (pay group 13 upwards with scientific responsibilities)			
	Goal Dec. 2025	Goal Dec. 2028	Goal Dec. 2030
Institute directors	19%	25%	28%
Level 1	20%	25%	28%
Level 2	21%	23%	25%
Level 3	27%	29%	30%
Total	**26%**	**28%**	**29%**

In 2025, women accounted for 16.8 percent of research scientists at level 1 (previous year: 16.8 percent). This means the 2025 target of 20 percent was missed by 3.2 percent. At level 2, 18.5 percent of the research scientists were women (previous year: 18.2 percent), again falling short of the target of 21 percent (deviation 2.5 percent). The smallest deviation from the cascade target was recorded at level 3, where 25.9 percent of the research scientists were women (previous year: 26.1 percent), just 1.1 percent short of the target.

The measures currently being undertaken to consolidate the Fraunhofer-Gesellschaft are making it significantly more difficult to achieve the cascade goals. Nevertheless, Fraunhofer is still implementing targeted programs and structurally embedded measures in an endeavor to increase the percentage of women in the workforce and in management positions and thus to reach the targets agreed. Initiatives such as the equal opportunities **support program** and the **diversity funding program** are strengthening the professional development of women. The **TALENTA career program** focuses on all three levels of the Fraunhofer cascade model, thus promoting the development of female scientists in management positions.

As of December 31, 2025, the proportion of employees with severe disabilities or equivalent status stood at 2.94 percent. As of the same date, there were 701 employees with severe disabilities or equivalent status in the RTA category (+22) along with 16 trainees (+4).

1 German Joint Science Conference, Pact for Research and Innovation (page only available in German)

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Opportunities, risks and outlook

Opportunity management

One of Fraunhofer's **unique selling points** in the German research landscape is its **large proportion of contract research for industry**, i.e. the transfer of research findings to businesses of all sizes. This also offers a major opportunity for Fraunhofer to contribute to the forward-looking transformation of the German economy with greater competitiveness, productivity and sustainability. For example, Fraunhofer is heavily engaged in industrial artificial intelligence (AI) and robotics, materials and recycling science, as well as energy technologies. It sees strong potential for innovation and improvement in these areas through partnerships with industry.

Fraunhofer helps companies **turn scientific findings into new technologies,** supporting them every step of the way from idea to market launch and potentially giving them a **technological and competitive edge in international markets**. The impact of applied research can extend well beyond the direct benefits for customers: Fraunhofer institutes help improve the performance and productivity of companies while strengthening public acceptance of modern technologies. They also ensure that the next generation of scientific and technical personnel have access to sound vocational training and continuing education.

The Fraunhofer institutes, with the support of Fraunhofer headquarters, conduct active opportunity management by independently focusing their portfolios on promising unique selling points in pioneering technologies. This focus takes into account external dynamics that are highly relevant to the applied research framework and have the **potential to cause technological and global disruption**. In 2025, these criteria were met by three exceptionally dynamic developments:

- the adoption of the High-Tech Agenda Germany (HTAD)
- the growing importance of **defense research**
- research in a world shaped by **artificial intelligence (AI)**

These developments could have a critical impact on Germany's future. The Fraunhofer-Gesellschaft is well positioned to respond to these dynamics and is aware of the responsibility that comes with them.

Adoption of the High-Tech Agenda Germany

By adopting the HTAD, the German federal government has realigned its research and innovation policy with the aim of increasing value creation, competitiveness and technological sovereignty. The HTAD focuses on 6 key technologies and 5 strategic research fields. Implementation work began in the fall of 2025. Thanks to the institutes' market knowledge and technological expertise, Fraunhofer was able to position itself early on as an implementation partner for industry. In the summer of 2025, Fraunhofer presented 9 moonshot innovation briefs (MIBs) in key technologies such as AI, robotics, climate-neutral power generation, nuclear fusion, biotechnology and health. These directly support the HTAD's goals of technological sovereignty and value creation. As part of the current HTAD implementation phase, Fraunhofer is participating in all roadmap processes for the key technologies and contributing to additional measures. In this way, it is actively fulfilling its role as an enabler in the innovation system.

Growing importance of defense research

Given the altered geopolitical security situation, Fraunhofer has the opportunity to make a significant contribution to strengthening national and European security and defense capabilities as a key player in security-related civilian and military research and development in Germany. In this context, the Fraunhofer institutes can offer extensive expertise and a wide range of enabling technologies, including sensor technology, artificial intelligence, autonomous systems, cybersecurity, secure communication and cryptography, new materials, specialized manufacturing technologies, and testing and inspection laboratories.

To reflect the magnitude of this issue, expertise from all relevant specialist departments has been pooled in an internal project titled "**Fraunhofer's Contributions Toward Strengthening Germany's Overall Defense**." The aim is to leverage cross-institute expertise and services as a means of closing defense-related capability gaps in Germany (and Europe).

The sub-initiatives encompass the following:

- Capability development/technological sovereignty: strategic analysis to identify ways in which Fraunhofer can help reduce Germany's (and Europe's) external dependencies in security-related contexts

- Development of a practice-oriented guide to support civilian institutes wishing to conduct security-related research, e.g., for the German Federal Ministry of Defence (BMVg) or the security and defense industry

Research in a world shaped by AI

The Fraunhofer-Gesellschaft is both a user and a developer of artificial intelligence (AI). As such, it implements numerous research and development projects with the aim of promoting the use of AI as a means of safeguarding the competitiveness of German and European industry. Fraunhofer also develops and implements

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

AI tools designed to significantly increase its internal efficiency. These systems can increase the speed, quality and transparency of processes and enable the provision of new services. In 2025, the Fraunhofer-Gesellschaft therefore decided to establish a dedicated directorate for AI systems to support research and administration within the organization. The directorate aims to increase the number of staff who use these AI applications by 20 percent each year.

Decentralized organization and strategic research management

The Fraunhofer-Gesellschaft's decentralized structure, entrepreneurial mindset and culture of learning from mistakes are keys to its opportunity management. Strategic research management in the form of centrally coordinated initiatives such as those described above can also strengthen the institutes' prospects of success.

Risk management and risks

The Fraunhofer-Gesellschaft still has to contend with a complex risk landscape. The changed geopolitical security environment, macroeconomic uncertainty, volatile energy markets, stricter regulations and the impact of climate change are all part of the ongoing polycrisis observed since 2022. Fraunhofer is countering these challenges by

- consistently implementing its framework strategy and specialist strategies,
- enhancing cybersecurity measures,
- optimizing processes and accelerating digital transformation,
- steadily expanding sustainability initiatives.

These measures are continuously strengthening Fraunhofer's **organizational and financial resilience**. Despite the challenging environment, the likelihood of risks materializing that could pose a lasting threat to the continued existence of the Fraunhofer-Gesellschaft is generally considered to be low. At present, there are no tangible developments that would materially impair the Fraunhofer-Gesellschaft's future viability.

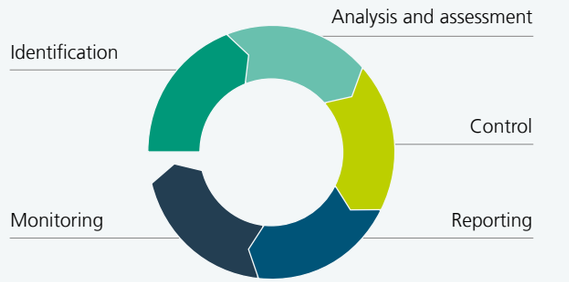
In the cyclical risk management process, risk experts in the specialist departments carry out **systematic, standardized risk assessments on a semiannual basis**. Overarching high-level risk surveys of upper management are also conducted to supplement these efforts. In these surveys, managers identify what they believe to be the biggest risks to the Fraunhofer-Gesellschaft, regardless of the specific topics for which they are responsible, and propose actions to take to mitigate those risks. This information is used along with external risk assessments to review whether the information is complete and to perform plausibility checks. The risk surveys also collect data on sustainability and compliance topics with the aim of integrating the management systems more closely. This facilitates the early development of measures addressing environmental and social risks. It also enables compliance risks to be clearly identified, making them easier to analyze and helping to ensure that the Fraunhofer-Gesellschaft's compliance goals are achieved. The risk committee reviews the significant individual risks identified through the standardized risk inventory every six months along with the associated measures. For the annual report to the executive board, the relevant risks are grouped under the corresponding risk categories and assessed as a whole. Additionally, the specialist departments inform the executive board of relevant risk-related developments—both routinely and on an ad-hoc basis—via the established reporting channels.

In 2025, the **frequency of the risk inventory and risk committee meetings** was increased from once to twice a year. Furthermore, the risk management methodology was realigned to facilitate the planned implementation of a GRC risk management module (GRC = governance, risk and compliance). This has already improved the accuracy and scope of the risk data collection process.

The Fraunhofer-specific **risk classification model** provides a framework for the semiannual risk assessment, which in turn serves as a basis for the risk report presented to the executive board. The first layer of the model consists of four main areas of risk: business model, financing, resources, and business operations. The second layer of the model assigns individual Fraunhofer-specific risks (currently 21) to these four main areas.

Business model risk encompasses types of risk that represent a threat to the continuation and further development of the Fraunhofer business model in specific areas.

Cyclic risk management process



Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

In the context of **financing risks**, the focus is on containing risks that might limit Fraunhofer's access to research funding or its solvency.

Resources risk encompasses those types of risk that may affect the availability of tangible and intangible resources needed to successfully carry out research activities.

Business operations risk comprises those types of risk that may arise from research and administration processes or from conducting specific research projects.

Although the most recent risk inventory did not identify any material risks, the relevant risks are briefly outlined below. The Fraunhofer funding model is based on three revenue streams —industrial revenue, public-sector (project) funding and institutional funding—each of which contribute roughly one third to the organization's revenue. All three revenue streams are associated with specific risks, while an additional challenge is posed by the need to maintain a balance between the different types of funding. Fraunhofer is responding to this situation by pursuing a targeted risk diversification strategy and implementing holistic strategic measures focusing on efficiency, costs and revenue. Adverse economic conditions, including the persistently weak economy, digital disruptions, inflation, the energy crisis and ongoing geopolitical conflicts, are affecting the acquisition of **industry contracts**.

At the same time, budget consolidation measures and the reorganization of the German federal government are making it more difficult to acquire **public research projects**. Nevertheless, the volume of public projects has stabilized at a relatively high level. The HTAD is likely to help stabilize project revenue even further.

The extraordinary item "License-fee revenue reserve for statutory purposes" is invested in securities classified as current assets on the asset side. Fraunhofer's asset management strategy takes a defensive approach to the selection of target investments. The risk of potential losses from future performance is classified as low to very low.

Dynamic developments in AI are transforming the entire research market in terms of both supply and demand. The institutes are actively adapting their business models and work methods to this changed environment with the support of the new directorate at headquarters (see "Opportunity management").

The secure handling of information and data is of paramount importance to any applied research organization. The cybersecurity risk situation is becoming increasingly acute. Against a background of ongoing global conflict and the rapid development of new AI-based methods of attack, cybersecurity threats such as ransomware, cyberespionage and social engineering are rising. Moreover, the legal and regulatory requirements governing information security are becoming more stringent. In view of this, the consistent implementation of the steps set out in Fraunhofer's cybersecurity action plan and the ongoing development of its information security management system (ISMS) are matters of vital importance. The stepwise implementation of these measures is therefore being pursued with particular urgency.

Since **the beginning of the war in Iran** on February 28, 2026, the geopolitical situation has deteriorated further. The fighting and the blockade of the Strait of Hormuz have led to sharp increases in global oil and gas prices and caused further disruption to international shipping. The economic consequences are becoming particularly apparent in the form of rising energy prices, a heightened risk of inflation and a general increase in global uncertainty. The Fraunhofer-Gesellschaft is continuously monitoring this situation as part of its risk management activities.

Fraunhofer risk classification model

Main risk areas	Specific risk types
Business model	■ Grant law / state aid law and nonprofit status ■ IP exploitation, spin-offs ■ Corporate strategy and social responsibility ■ Portfolio management ■ International activities
Finances	■ Institutional funding ■ Funding for public projects ■ Taxes and reporting ■ Liquidity ■ Other financial risks
Resources	■ Human resources ■ IP, know-how ■ IT infrastructure and business processes ■ Research infrastructure ■ Reputation, brand
Business operations	■ Public projects ■ Industrial revenue ■ Service performance, contractual risks ■ Legal affairs and compliance ■ Information security ■ Governance, internal control systems

At present, it does not appear that these developments will bring about any material change in the Fraunhofer-Gesellschaft's risk situation in 2026. Energy costs (electricity, gas) are hedged by existing contracts. Fraunhofer currently expects a moderate increase in energy costs in 2027.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

However, rising prices could have a limited impact on industry projects both in 2026 and in subsequent years, for instance by delaying individual international projects and making restraint or priority shifts necessary in industries that are vulnerable to economic trends.

Public project funding is also potentially subject to risks, particularly as a result of changing political priorities and possible further constraints on public budgets due to inflation and higher energy costs.

Outlook

Fraunhofer is responding to the ongoing economic and political challenges in Germany and abroad by pursuing a policy of forward-looking consolidation, particularly in the core area of contract research.

For 2026, Fraunhofer expects personnel costs to increase at a rate marginally lower than the collectively agreed pay rise due to a slight decline in staff numbers. Planning anticipates a slight year-on-year increase in non-personnel costs based on the assumption that there will be no crisis-related price spikes in major cost items at the Fraunhofer institutes in 2026.

Overall, Fraunhofer expects a significant increase in investment volume, driven primarily by exceptionally strong growth in the funding from the German federal and state governments and the EU invested in Research Fab Microelectronics Germany (FMD) as part of the APECS pilot line under the European Chips Act. Investments in the Fraunhofer Research Institution for Battery Cell Production FFB are likely to be another contributing factor. While large-scale building projects are expected to remain at a similar level to the previous year, current replacement and expansion investments in contract research are showing a marked decline compared to 2025.

Due to the considerable overall increase in investment, Fraunhofer anticipates a slight increase in total business volume for 2026. Without this effect, the Fraunhofer-Gesellschaft's total business volume would only be marginally higher than in the previous year.

With regard to funding for contract research, Fraunhofer currently expects its external revenue to increase slightly in 2026. Industrial revenue is likely to see noticeably slower growth compared to the average achieved in previous years. After the declines seen in the last two years, Fraunhofer again expects a slight upturn in project revenue from the German federal and state governments.

Business developments in 2026, particularly the forward-looking consolidation of contract research, will be supported by the ongoing refinement of Fraunhofer's internal mechanisms for financial and strategic management.

By **transferring scientific results to market-ready innovations**, Fraunhofer aims to play a significant role in strengthening Germany's status as a hub for industry and innovation. This role is rooted in Germany's highly specialized research landscape, in which each organization pursues its own mission and Fraunhofer serves as the bridge between research and industry. Needs-driven innovation is a key factor in economic and social stability and prosperity. Knowledge transfer is consequently a key focus of the German federal government's innovation policy. The **HTAD** in particular sends a strong, clear signal in this direction and speaks directly to **Fraunhofer's core areas of expertise**. With an eye to the markets of today and tomorrow, the Fraunhofer-Gesellschaft's R&D portfolio focuses on key technologies with strong relevance for the future and is consistently aligned with the needs of its customers and partners across a wide range of industries. Fraunhofer institutes serve both established sectors such as **mechanical engineering, production, automation, chemicals, medical technology and energy** and emerging markets such as **quantum and microelectronic technologies, translational medicine, fusion technology, artificial intelligence and smart farming**. Each Fraunhofer institute accordingly operates in highly diverse business fields with equally diverse economic conditions and requirements.

In response to the current economic and geopolitical challenges, Fraunhofer, as a major research organization with close ties to industry, has developed measures to position itself strongly in the future. In doing so, Fraunhofer's executive board sees itself as acting on its responsibility toward the organization's employees and toward Germany as an industrial location. The executive board has been implementing a structured crisis prevention and response process in cooperation with the directors of the Fraunhofer institutes since 2025. Beginning in 2026, this will be supplemented by a transformation process designed to safeguard the balance of the Fraunhofer model in the future. This is part of the framework strategy process launched by the executive board in 2024 to define the strategic direction of the Fraunhofer-Gesellschaft. This process uses tools to analyze and respond to critical situations with the aim of **identifying economic challenges at the earliest possible stage**, making an effective contribution to stabilizing the financial situation and sustainably strengthening the future viability of the Fraunhofer institutes. The underlying point of reference is the Fraunhofer model, which stipulates that each institute's incoming funding must be evenly balanced between industrial revenue and public-sector revenue.

The aim is to perform regular analyses of all Fraunhofer institutes from an overall strategic perspective. Recommendations for each institute's further development are derived from these analyses for **crisis prevention** purposes. In particularly challenging situations, extraordinary governance instruments can be used as part of the **crisis response** process. These are designed to identify appropriate measures and ensure they are implemented effectively. The **strategy hub** platform was created as a key element of the crisis prevention and response processes. Crisis prevention involves the use of objective analysis tools to obtain a systematic and comprehensive analysis and a well-founded evaluation of the Fraunhofer institutes.

Foreword

Contents

Executive board's report
The executive board
2025 management report
Profile, strategy and operating environment
Business report
Sustainability aspects
Opportunities, risks and outlook

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

The goal is to proactively reduce the number of institutes in crisis situations and thus make an effective contribution to stabilizing the financial situation and consistently improving the future viability of the Fraunhofer institutes. The strategy hub processes information objectively and transparently, particularly with the aid of the specially developed TRAX indicator (TRAgfähigkeit im Fraunhofer-Modell IndeX, viability in the Fraunhofer model index). The strategy hub also supports the effective implementation of control processes and ultimately assumes responsibility for quality assurance in crisis prevention and response processes. Furthermore, a multi-stage crisis response process has been established to support institutes in crisis situations and guide them back to compliance with the Fraunhofer model using systematic governance instruments.

Science and innovation are **vital resources for our competitiveness**. The Fraunhofer-Gesellschaft and its researchers stand ready to help shape the future in a spirit of partnership and to step up the transfer of knowledge and technology from science to industry. Standing shoulder to shoulder with our stakeholders, Germany's great strength as a research hub allows us to look to the future with confidence and build on the innovative capacity of Germany and Europe.

The executive board would like to thank the members, supporters and, most of all, the employees of the Fraunhofer-Gesellschaft for their support, dedication and hard work in 2025.

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.

The executive board
Holger Hanselka
Elisabeth Ewen
Constantin Häfner
Sandra Krey
Axel Müller-Groeling

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Senate's report

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

The senate's report on the 2025 financial year

Hildegard Müller,
Chair of the Senate of the
Fraunhofer-Gesellschaft
Photo: Dominik Butzmann

Germany and Europe depend on economic growth to safeguard freedom, values, employment and prosperity in the long term, to strengthen their geopolitical capacity for action and to guarantee the stability of Europe's nation states. In 2025, the innovation report published by the Federation of German Industries (BDI) noted that industrial production had been stagnating for almost two years. Along with speed, determination and local conditions that can compete internationally, the most important factor in reversing this trend is innovation capacity. Fraunhofer institutes have long been key to maintaining the technological superiority of products made in Germany. As a vital link between research and industry, the Fraunhofer-Gesellschaft has played a central role in innovation and technology transfer since it was founded in 1949. The high proportion of contract research and joint research with commercial enterprises is Fraunhofer's unique selling point within the German innovation system. Despite challenging economic conditions, the institutes succeeded in increasing their industrial revenue by 11 percent to €966 million in 2025. Overall, the total business volume amounted to €3.6 billion, €3.2 billion of which came from Fraunhofer's core activity of contract research. This was due in no small part to the commitment of more than 30,000 Fraunhofer employees as well as the dependable cooperation between Fraunhofer, industry and the German federal and state governments.

Outstanding examples of the Fraunhofer-Gesellschaft's innovative capacity in 2025 included the production of the first electrically functional lithium-ion battery cell at the PreFab facility of the Fraunhofer Research Institution for Battery Cell Production FFB. This was the first ever realization of a complete process chain at all stages from electrode manufacture through to the charged cell using technology made exclusively in Europe. World records such as the doubling of the output of a thulium fiber laser developed at the Fraunhofer Institute for Applied Optics and Precision Engineering IOF attest to Fraunhofer's technological excellence. The 29 newly established spin-offs, roughly €200 million in license-fee revenue and the 538 patent applications claiming rights of priority also testify to Fraunhofer's use of all available channels to translate its outstanding applied research into market-ready technologies and realize their potential for value creation. As a driving force, Fraunhofer presented 9 moonshot innovation briefs early on in the implementation of the HTAD as a means of paving the way to innovation leadership for the country as an industrial hub.

Fraunhofer's strategic importance within the economic and scientific landscape has also amplified the need for modern, future-ready governance. The entry into force of the new statutes and supplementary statutes on January 9, 2025, was therefore a significant milestone. Among other things, these strengthened the senate's advisory and supervisory role while forming standing committees—the senate committee for executive board affairs, the audit committee and the nomination committee—to professionalize the senate's work and bring it into line with the organization's expanded role. As part of the Fraunhofer-Gesellschaft's realignment and its commitment to resilient governance, 2025 saw the senate continue to address the conduct of former executive board members during the internal investigation. This task was carried out with due care and foresight in close cooperation with other stakeholders (grant authorities, the general meeting and others). Furthermore, Fraunhofer is continuing to cooperate fully with

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Munich I public prosecutor's office. The senate is gleaning useful insights for the governance and compliance system, which it will implement on an ongoing basis; it is holding regular discussions with the executive board to this end.

2025 accordingly saw the senate fulfill the duties incumbent on it in line with the statutes. In addition to the 18 senate committee meetings, the senate met three times. The first meeting took place on June 4 during the Fraunhofer annual assembly, while the second regular meeting was held on November 6. On March 17, the senate held an extraordinary meeting to discuss various matters including the establishment and funding of TT49 GmbH & Co. KG as a successor to the Fraunhofer Technology Transfer Fund (FTTF).

Furthermore, the senate passed important resolutions on topics such as the following:

- **Governance reform**
  The new statutes also made it necessary to amend the general provisions in the statute of the institutes as well as the regulation governing the appointment of institute managers. Both statutes entered into force by resolution of the senate on June 4, 2025.

- **Election of senate chair and two vice-chairs**
  During its meeting on November 6, the senate proceeded to elect a chair and two vice-chairs. I was re-elected chair of the senate for the duration of my second term as a senate member, which will last from January 1, 2026 until December 31, 2029. Oliver Zipse was re-elected vice-chair and will remain in office from January 1, 2026 until his departure on December 31, 2026 as provided for in the statutes. The other vice-chair is Anna-Katharina Wittenstein, who will serve from January 1, 2026 until December 31, 2030 (subject to her being re-elected to the senate for a third term).

- **Selection of auditor to audit the annual financial statements for 2026 to 2029**
  In 2025, the Fraunhofer-Gesellschaft issued a request for proposals for the annual audit in line with its rotation schedule. In its meeting on November 6, the senate—acting on the recommendation of the standing audit committee—selected KPMG as the new auditing firm for the audit of the 2026 annual financial statements with the option of renewing the appointment annually until 2029.

The management report and annual financial statements of the Fraunhofer-Gesellschaft were last audited in 2025 by the audit firm Rödl Audit GmbH, which again issued an unqualified audit opinion.

The senate would like to express its thanks to the executive board and all employees and partners of the Fraunhofer-Gesellschaft for their successful work during the 2025 fiscal year. I am confident that this commitment, our high degree of expertise and excellence and the creativity shown by our staff will allow us to continue making a crucial and valuable contribution to maintaining the position of Germany and Europe as a hub for industry.

Hildegard Müller
Chair of the Senate of the Fraunhofer-Gesellschaft

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

New senate members

Stefan Hartung, born in Dortmund, studied mechanical engineering at RWTH Aachen University, where he gained his doctoral degree in 1993. He began his career at the Fraunhofer Institute for Production Technology IPT in Aachen, where he spent several years working at the interface between applied research and industrial application. There he gained valuable experience in various areas of responsibility, most recently in a leadership role. Hartung then moved to McKinsey & Company in Düsseldorf, where he advised international corporations, initially in Cleveland (U.S.), and later became a principal and elected partner.

In 2004, Hartung joined Bosch und Siemens Hausgeräte GmbH (now BSH Hausgeräte GmbH) in Munich. He has been chair of the board of management of Robert Bosch GmbH and a shareholder in Robert Bosch Industrietreuhand KG since January 1, 2022. His responsibilities include corporate strategy, corporate communications, government relations and technology development. His remit also includes corporate research and advance engineering, intellectual property rights and the corporate department of Technology Manufacturing. Furthermore, he is responsible for Bosch Healthcare Solutions GmbH, Bosch Business Innovations GmbH and Bosch's business in China. On taking over as chair, Hartung stressed that this new role would be an opportunity for him to channel his enthusiasm for technology even more effectively within the global high-tech company.

Stefan Hartung is leading the company at a time of far-reaching change and profound transformation. Digitalization and AI are central to this process, as is electric mobility as a driver of sustainability. Under his leadership, the corporation's strategy Bosch 2030 has established a clear framework for its future direction. Hartung firmly believes that sustainable economic growth can only be achieved by constant innovation. The corporation is therefore continuing its policy of targeted investment in research and development with the aim of driving pioneering technologies and solutions. Bosch Ventures, for example, provides venture capital for startups around the world that aim to use their technologies to improve people's quality of life or to safeguard natural resources—wholly in keeping with the corporation's claim "Invented for life."

Stefan Hartung has been a member of the board of trustees at the Fraunhofer Institute for Manufacturing Engineering and Automation IPA since 2013 and became a member of the senate of the Fraunhofer-Gesellschaft on January 1, 2026.

Stefan Hartung | Dr.-Ing. | Dipl.-Ing. Mechanical Engineering | Ph. D. (summa cum laude) | Chair of the Board of Management of Robert Bosch GmbH
Photo: Robert Bosch GmbH

"We need more technological solutions to shape the profound transformation taking place in industry. Fraunhofer provides the momentum necessary for the rapid transfer of innovations to real-world applications."

Stefan Hartung

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Ronja Kemmer | Double master's degree in economics (Germany and Italy) | Member of the German Bundestag | Vice-chair of the CDU/CSU parliamentary groups for research, technology and space and for digitalization and public-sector modernization | Vice-chair of the CDU Baden-Württemberg
Photo: Ronja Kemmer/Tobias Koch

"As the German federal government's strategy for the future, the High-Tech Agenda goes straight to the place where the future will be decided: the transfer of knowledge to industry—exactly where Fraunhofer's expertise lies."

Ronja Kemmer, M. Sc. Economics

Ronja Kemmer studied economics in Tübingen and subsequently completed a double master's degree in economics in Germany and Italy. She became involved in the youth organizations of the Christian Democratic Union (CDU) of Germany at an early age, holding a number of executive and leadership positions at various levels from district to federal. Kemmer was appointed vice-chair of the CDU in Baden-Württemberg in December 2025. She has been a member of the German Bundestag and the CDU presidential council since 2014 and is also deputy chair of the CDU/CSU parliamentary group. She became a member of CDU Württemberg-Hohenzollern's regional executive committee in 2015 and was appointed chair of the CDU Alb-Donau/Ulm district association in 2023.

Kemmer is an influential figure in German research and technology policy. Within her parliamentary group, she is responsible for research, technology and space and for digitalization and public-sector modernization. In this role, she plays a key part in shaping the political framework within which scientific excellence, technological innovation and industrial competitiveness can thrive. Her mission is to translate technological progress into practical benefits for society and to strengthen Germany's profile as an innovation hub in the long term.

Science and education have been key areas of Ronja Kemmer's work ever since she started her political career. With her background in economics, she has a sound understanding of innovation processes and their importance in transfer to industry. As spokesperson of the parliamentary study commission for artificial intelligence and a member of the digital transformation committee, she made a vital contribution to initiatives in the areas of AI, quantum computing, data spaces and sustainable digitalization, actively promoting their practical application. Today, she is widely viewed as an expert on digital transformation.

Alongside her parliamentary work, Kemmer serves in a voluntary capacity as a member of the supervisory board of the Federal Agency for Breakthrough Innovation (SPRIND), a member of the advisory board of the Federal Network Agency, a member of the council of Agora Digital Transformation and a member of the board of trustees of the German Trauma Foundation. She became an elected member of the senate of the Fraunhofer-Gesellschaft with effect from January 1, 2026.

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Armin Papperger | Dipl.-Ing. Mechanical Engineering | Chair of the Executive Board of Rheinmetall AG
Photo: Rheinmetall AG

"The capacity for technological leadership originates at the point where responsible research meets the courage to make progress. This is precisely where Fraunhofer provides the momentum that will shape tomorrow's innovation strength."

Armin Papperger

Armin Papperger began his professional career at Rheinmetall after completing his mechanical engineering studies in Duisburg in 1990. He was presented with the VDI sponsorship award that same year. In the years that followed, he held various roles in materials testing and quality management and went on to become managing director of several subsidiaries.

In 2010, he became a member of the defense corporate board, assuming responsibility for both the vehicle systems and the weapon and munitions divisions. Two years later, he became chair of the defense corporate board and a member of the executive board of Rheinmetall AG. In 2013, he was appointed chair of the executive board. Under his leadership, Rheinmetall is being transformed from a European systems supplier into a global market leader in defense technology.

Recent developments, especially the increase in Europe's defense budgets as a result of the Russian war of aggression against Ukraine, are accelerating this process. In 2023 and 2024, Rheinmetall invested almost €9 billion in new systems, strategic acquisitions and supply chain security. 2024 also saw the corporation invest over €500 million in research and development with the aim of strengthening its competitiveness and technological innovation capacity. Revenue growth of 25 to 30 percent was forecast for 2025 (revenue in 2024: €9.8 billion). Papperger emphasizes that further investment will require close cooperation with government, since investments of this scale need a sustainable foundation.

Papperger is a member of the supervisory boards of various Rheinmetall subsidiaries and joint ventures. He is an elected member of the presidential board of the Federation of German Industries (BDI) and has been president of the Federal Association of the German Security and Defense Industry (BDSV) since 2014. Between 2013 and 2017, he was a member—and for some time the chair—of the board of trustees of the Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI in Freiburg. He became an elected member of the senate of the Fraunhofer-Gesellschaft with effect from January 1, 2026.

Foreword

Contents

Executive board's report

Senate's report
The senate's report on the 2025 financial year
New senate members

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Jürgen Stebani | Dr. rer. nat. | Co-founder, co-owner, CEO of Polymaterials AG
Photo: Polymaterials AG

"As CEO of a mid-sized research company, I see how important it is to redesign innovation chains through cooperation between institutional and industrial innovators."

Jürgen Stebani

Jürgen Stebani studied chemistry at the University of Bayreuth, where he completed his doctorate in polymer chemistry in 1993. He began his professional career at Bayer AG, where he gained six years of management experience in Bayer's plastics division, now Covestro. Toward the end of his time there, he was responsible for management accounting, strategic planning and the preparation of executive summaries.

In 1999, Stebani founded Polymaterials together with two research scientists from the Technical University of Munich. The company was established as a service provider specializing in applied polymer research and the development of innovative materials. Under his leadership, Polymaterials has developed into an international partner for SMEs and large corporations seeking to conduct research projects, having earned a reputation for combining scientific expertise with industrial implementation. The company's innovation strength is evident from its technological milestones, among them the new compound screening technology X-Plorator®, which features integrated AI and won an innovation award at the Hannover Messe.

Since its foundation, Polymaterials has successfully realized more than 1,000 research and development projects worldwide. The corporation has developed into an industrial research specialist and integrated service provider for polymer materials with capabilities extending to the production of sample quantities. Its service portfolio currently focuses on the manufacture of specialty polymers, high-performance polymers and biopolymers on scales ranging from kilograms to several hundred tons per year. It also specializes in the creation of new plastics formulations, aided by predictive AI-based models that use high-throughput technology to facilitate compounding—the process of mixing base polymers with additives and fillers.

As the CEO of Polymaterials AG, Jürgen Stebani is also a member of the executive board of Plastics Europe Deutschland, a member of the DIHK committee for industry and research and a member of the executive board of Gesellschaft für Chemische Technik und Biotechnologie e. V. (DECHEMA). He also leads the innovation working group of the Bayerische Chemieverbände (Bavarian Chemical Associations). His goal is to strengthen interaction between innovators in the chemicals industry—scientific organizations, startups and industrial R&D specialists—and turn this into a future advantage for Germany as an industrial location. Stebani has been contributing his expertise at the interface between science and transfer to the senate of the Fraunhofer-Gesellschaft since January 1, 2026.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Review of Fraunhofer research

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Pioneering achievements

Precise simulation of high-energy lasers for inertial confinement fusion

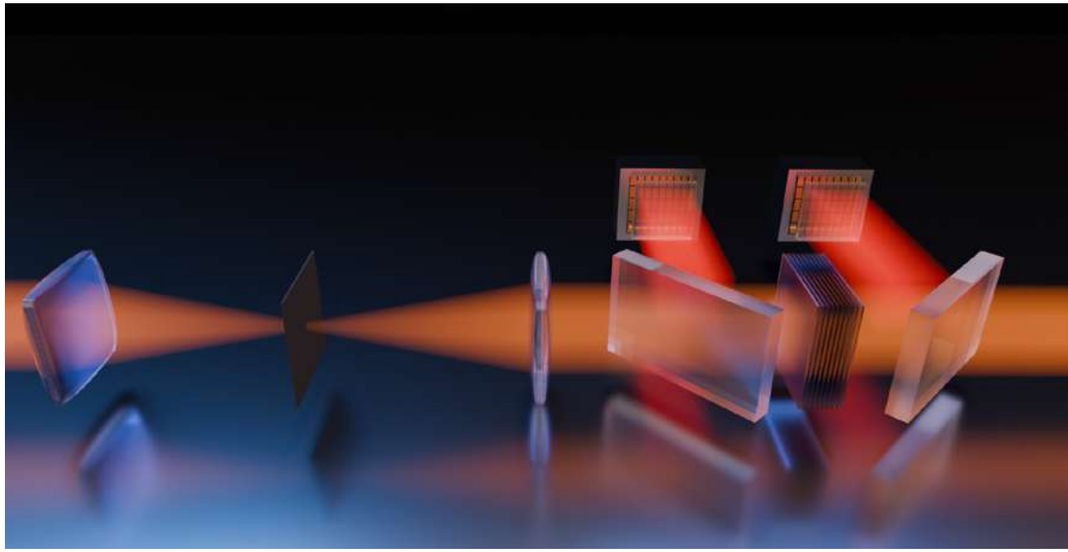
A future inertial confinement fusion power plant will only be able to operate if the fuel capsules are continuously ignited—a process requiring approximately 15 laser pulses per second. This calls for efficient diode-pumped solid-state lasers (DPSSLs) capable of firing dozens of times per second. The Lawrence Livermore National Laboratory (LLNL) in the United States and the Fraunhofer Institute for Laser Technology ILT are combining their complementary expertise to develop these lasers. Their shared goal is to develop high-energy lasers that are not only capable of ignition but can maintain maximum efficiency during round-the-clock operation at the power plant.

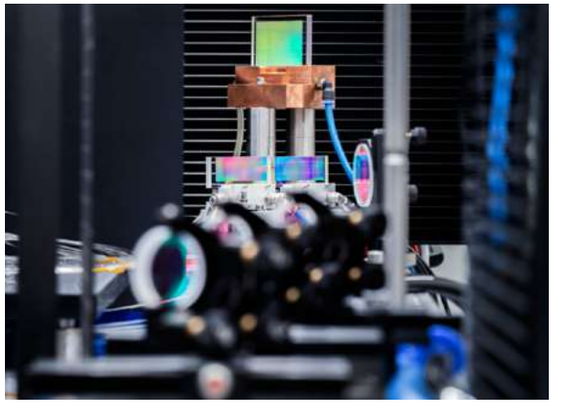
As a first step toward designing a prototype, the partners are simulating the amplification stages of high-energy lasers in the greatest possible detail. They are paying particular attention to laser amplifiers, which take a small laser pulse and boost it to the energy levels required for fusion. The photons in these laser pulses transmit many millions of joules of energy. The laser media consist of stacks of laser glass or crystal plates, which are up to 40 × 40 centimeters in area and just a few millimeters thick. During operation, they are cooled using transparent coolants. The amplifier plates are exposed to enormous thermal and optical stress while in use.

New generation of thulium fiber lasers

Researchers at the Fraunhofer Institute for Applied Optics and Precision Engineering IOF have developed a system consisting of three combined high-performance thulium fiber lasers. The system superimposes beams with a wavelength of 2 micrometers. The researchers focused on a spectral range above 2,030 nanometers, thus targeting applications in hybrid security and civil protection as well as extreme long-distance communication, including satellite links. The system achieved an output power of 1.91 kilowatts (kW), almost twice as high as previously reported systems, which reached around 1.1 kW. This is a performance record. One of the key components is a specially developed diffraction grating with more than 95 percent efficiency and excellent thermal performance.

The individual sources rely on a special connection technology that involves the cold splicing of the fibers. This also improves cooling. The newly developed high-performance thulium fiber lasers could potentially be used in a wide range of further applications, for instance in medical procedures and polymer processing. One important advantage of thulium fiber lasers is their improved eye safety. In the next step, the researchers aim to reach the 20-kW mark.





▲ Visual representation of a multislab amplifier for high-energy lasers Image: Fraunhofer ILT

◀ Three parallel beams are combined by vertically offset reflection gratings to form a single laser beam with a record output power of 1.91 kW Photo: Fraunhofer IOF

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Measuring drug levels from exhaled air

A team of researchers from the Fraunhofer Institute for Toxicology and Experimental Medicine ITEM has demonstrated for the first time that particles in exhaled air can be used to measure drug levels in human lungs. The findings represent a major breakthrough for the targeted development and optimization of treatments for lung diseases. In a clinical study, healthy volunteers received a dose of salbutamol either orally or by inhalation. Salbutamol is an active ingredient used to treat asthma and COPD. The researchers then collected "exhaled breath particles" (PEx)—tiny droplets in exhaled air that form when previously collapsed small airways reopen during inhalation. The analysis showed that clear pharmacokinetic profiles could be derived from these particles following an inhalation.

The study is the outcome of decades of development work, which included a German Research Foundation (DFG) project on the physical characterization of exhaled aerosols and the development of a device for collecting PEx. Jens Hohlfeld and Olaf Holz (Fraunhofer ITEM) received the Willi Stahlhofen Award from the International Society for Aerosols in Medicine (ISAM) for their groundbreaking study.

Pushing back the physical limits of solar cells

An international research team has shown that the next step toward the industrial production of high-efficiency perovskite-silicon tandem solar cells is within reach. In order to produce these cells over large areas, the perovskite top cells must be deposited on the pyramid-textured surface of the silicon. They first succeeded in using industrially viable processes to achieve high-quality surface passivation of the perovskite layer on the pyramid-textured silicon surface in October 2025. Researchers at King Abdullah University of Science and Technology (KAUST), the University of Freiburg and the Fraunhofer Institute for Solar Energy Systems ISE achieved excellent passivation by depositing 1,3-diaminopropane dihydroiodide on the uneven perovskite surface. They also discovered that passivation affects the entire perovskite layer, which is not the case with silicon. This increases efficiency still further. The passivated tandem solar cells achieved efficiencies of up to 33.1 percent, with an open circuit voltage of 2.01 volts. The technological and scientific innovations in the passivation of perovskite top cells were published in the journal *Science*.

Exhaled particles are a fascinating method with great potential for noninvasive lung monitoring
Photo: Fraunhofer ITEM

The passivated tandem solar cells achieved efficiencies of up to 33.1 percent, with an open circuit voltage of 2.01 volts
Photo: University of Freiburg/Silvia Wolf

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Europe's largest vanadium redox flow battery enters research operation

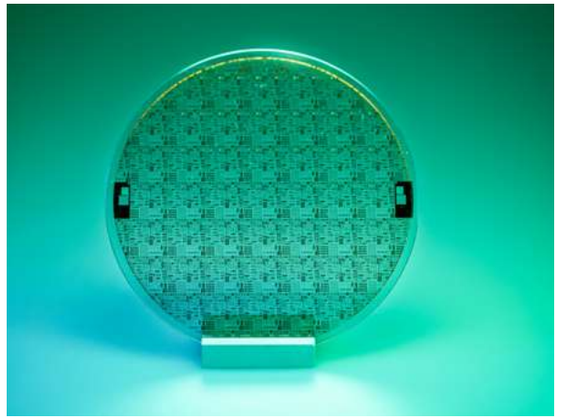
Europe's largest vanadium redox flow battery is located at the Fraunhofer Institute for Chemical Technology ICT. It is supplied with renewable energy from a ground-mounted photovoltaic system and a wind turbine on the institute campus. In June 2025, Fraunhofer demonstrated for the first time how renewable energy can be fed into the power grid in a controlled and predictable manner, regardless of current weather conditions. This marked the large-scale battery's successful transition into research operation. The large-scale battery offers a tangible solution to a key problem associated with the energy transition: Surplus green electricity, which often remained unused when generation was high or even caused negative electricity prices, can now be temporarily stored and retrieved when needed to serve the grid.

The modular vanadium redox flow battery was developed and built using only components and expertise sourced within Germany. It serves as a research and development platform for testing and further developing new storage technologies and components in cooperation with international partners in science and industry. The battery functions not only as a demonstrator but also as a safety element that can help stabilize grids and prevent power outages.

Semiconductor technology for broadband satellite communication

Future global communication networks will need to process high data rates, reach remote regions and function reliably in disaster situations. High-throughput satellites (HTS) in low Earth orbit and/or geostationary orbit offer a promising solution. These satellites use active antennas for electronic beam steering and require highly efficient power amplifiers with high linearity. Until now, however, the compact design required for these antennas has caused thermal problems. Researchers at the Fraunhofer Institute for Applied Solid State Physics IAF have therefore developed high electron mobility transistors (HEMTs) based on gallium nitride (GaN), which have a gate length of 70 nanometers. Under simulated operating conditions, the GaN HEMT technology achieved record efficiency with a PAE of 54.4 percent at 30 gigahertz. This technology will facilitate the development of more compact and energy-efficient communication systems for satellites besides making an important contribution to the establishment and expansion of seamless, resilient global communication networks. The results were obtained as part of the Magellan project, funded by the ESA, and the GANYDEM170 project, funded by the German Federal Ministry for Economic Affairs and Energy (BMWE) and as an Important Project of Common European Interest (IPCEI).

▲ The underground electrolyte tanks for the redox flow battery at Fraunhofer ICT Photo: Fraunhofer ICT



◀ Mobility transistor for active antennas used by future satellite communication networks Photo: Fraunhofer IAF

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Initiatives, structures, funding programs

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- **Initiatives, structures, funding programs**
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Initiatives

Fraunhofer moonshot innovations for the High-Tech Agenda Germany (HTAD)

By adopting the HTAD, the German federal government has placed research and technology at the center of its efforts to strengthen competitiveness, value creation and sovereignty. The High-Tech Agenda of the German Federal Ministry of Research, Technology and Space (BMFTR) focuses on six key technologies and five strategic research fields. Fraunhofer was actively involved in shaping the HTAD's thematic focus and is helping to develop the roadmaps for the six key technologies. Fraunhofer sees the HTAD as a call to turn today's research into tomorrow's value creation.

In support of the key technologies, the Fraunhofer institutes have established nine selected moonshot initiatives in the areas of microelectronics, battery cell production, AI, robotics, quantum technology, biomedicine, nuclear fusion, advanced materials and production, and sustainable systems. The Fraunhofer moonshot initiatives translate the HTAD framework into actionable measures, such as living laboratories, pilot projects, public-private partnerships and transfer instruments for SMEs. They also identify areas where targeted investment is needed. With its focus on applied research, the Fraunhofer-Gesellschaft has first-hand knowledge of industry needs. It is an indispensable link between academia and industry. As an innovation driver, it ensures that scientific findings are not shelved but rather strengthen Germany's competitiveness.

Advanced materials and production	Battery cell production	National alliance for technology transfer in biomedicine
Nuclear fusion	Competitive AI models for Germany's economy	Working and living in a circular system
Microelectronics	Quantum ecosystem	Autonomous AI-driven robotic systems

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Module QNC for novel computing technologies

Module QNC is an initiative of the German Federal Ministry of Research, Technology and Space (BMFTR) that provided targeted funding for investments in infrastructure and equipment until the end of 2025. These investments enable the project partners to develop and manufacture hardware for novel computing technologies such as quantum and neuromorphic computing. Systems of this kind go beyond conventional digital computers and are vital for applications that involve machine learning, edge data processing and complex optimization tasks. They are used, for instance, for traffic flows, production lines or the simulation of chemical processes for medications and battery cells.

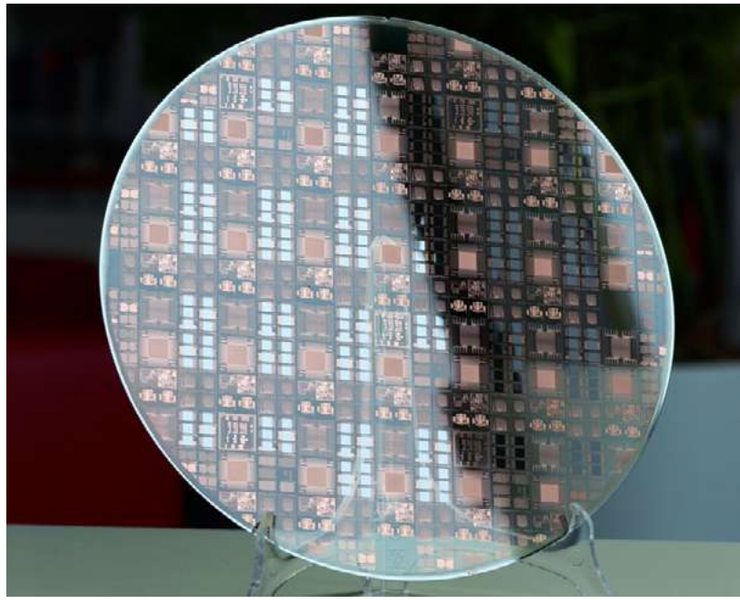
The funding program used the infrastructure provided by Research Fab Microelectronics Germany (FMD). Fraunhofer and Leibniz institutes have been cooperating under the umbrella of FMD-QNC since 2022, as have Forschungszentrum Jülich and AMO GmbH. The new equipment allows the partners to develop, characterize and test different technological approaches to realizing qubits and neuromorphic chip architectures across various research and pilot production lines. Some of these systems are designed for later use under special conditions, for instance at cryogenic temperatures. This bridges the gap between basic research and industrial manufacturing, paving the way for future computing technologies to be scaled up.

In addition to the technological investments, continuing education and advanced training programs for urgently needed specialists were established in cooperation with the Microtec Academy. These programs will be expanded further as a vital contribution to strengthening Germany as an innovation hub in the long term and safeguarding its competitiveness in a dynamic future field.

Chiplet Application Hub for technological resilience

The new Chiplet Application Hub established by Research Fab Microelectronics Germany (FMD) was launched at Hannover Messe in 2025. The hub is designed to accelerate the transfer of chiplet technologies from research into industrial use. The scalability and modular structure of chiplet technologies make it possible to combine various semiconductor technologies with specific applications in mind and to tailor them to actual use cases. This facilitates the development of new system architectures characterized by greater energy efficiency, improved performance and enhanced reusability of individual high-cost design components. Major industry partners were involved in the Chiplet Application Hub right from the start, among them IBM and companies in the German automotive industry. These technologies open up new opportunities, for high-performance computing and AI in particular, as well as in sectors such as industrial electronics and medical technology.

The Chiplet Application Hub complements the FMD's work under the EU Chips Act at national level, thus strengthening the technological resilience of Germany. The Chiplet Application Hub is an important building block for the implementation of the EU Chips Act in Germany and will be closely interlinked with the competence centers that are gradually being established in this context in all European countries. The decision made by the Belgian Interuniversity Microelectronics Centre (imec) to establish a presence at IPAI in Heilbronn emphasizes the close ties between the various stakeholders in the European chip ecosystem. It also shows how the EU Chips Act is bringing together research institutes, companies and competence centers on a joint mission to ensure Europe's technological competitiveness.



▲ Chiplet structure for implementing digital and analog functions—whole wafer before dicing Photo: Fraunhofer IIS

Foreword

Contents

Executive board's report

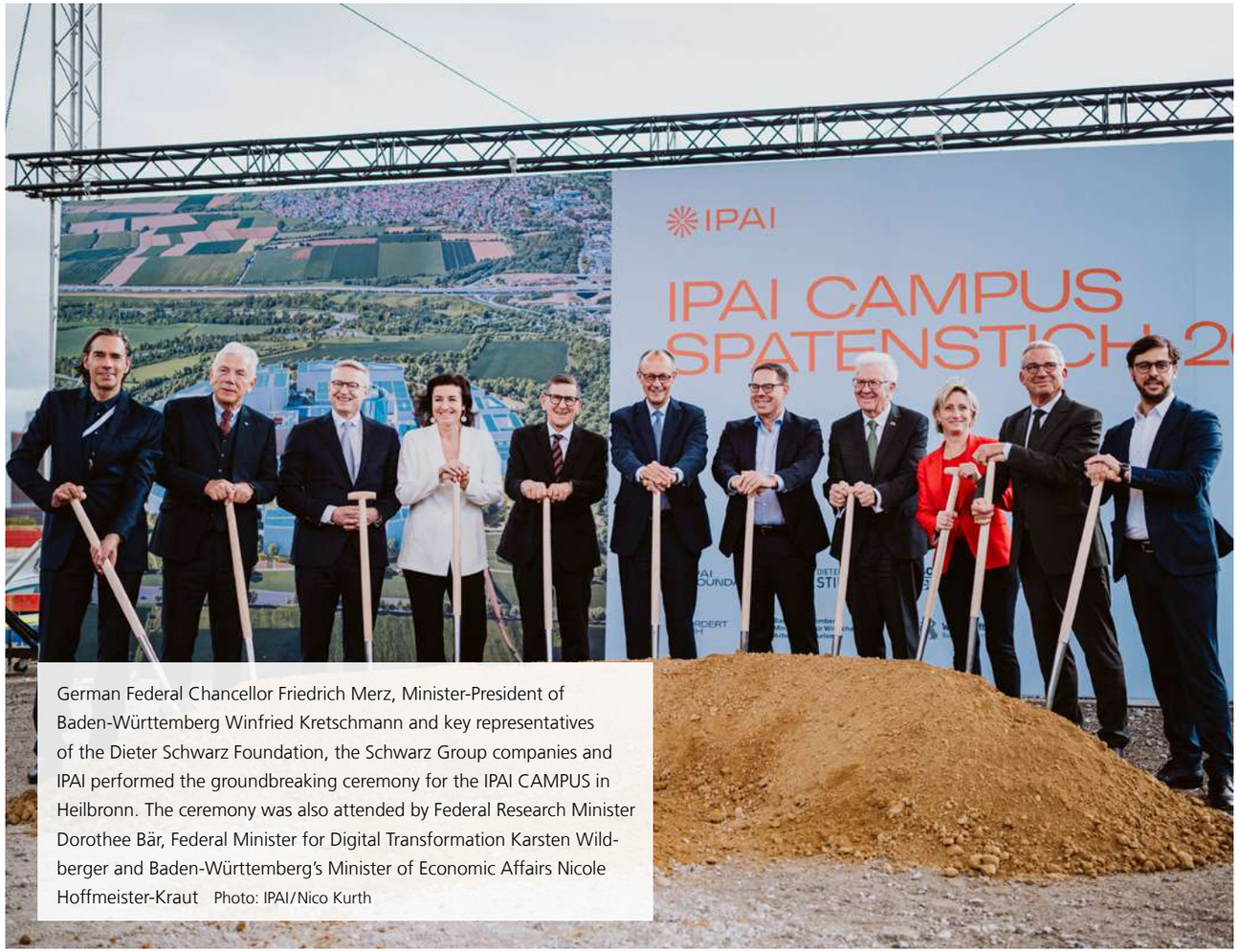
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information



German Federal Chancellor Friedrich Merz, Minister-President of Baden-Württemberg Winfried Kretschmann and key representatives of the Dieter Schwarz Foundation, the Schwarz Group companies and IPAI performed the groundbreaking ceremony for the IPAI CAMPUS in Heilbronn. The ceremony was also attended by Federal Research Minister Dorothee Bär, Federal Minister for Digital Transformation Karsten Wildberger and Baden-Württemberg's Minister of Economic Affairs Nicole Hoffmeister-Kraut Photo: IPAI/Nico Kurth

Heilbronn: a location for AI transformation in Europe

The groundbreaking ceremony for the international campus of the Innovation Park Artificial Intelligence (IPAI) in Heilbronn took place in October 2025. The aim is to create a district that will significantly advance research, specialist training, practical application and industrial transfer in the AI field at the European level. The campus will complement the IPAI modules already established in Heilbronn: The innovation park has been operating on rented premises since 2022. IPAI entered its second phase of development in June 2024 when it opened and moved into IPAI SPACES, the first building it can call its own. Furthermore, an international campus covering approximately 30 hectares is being constructed in the north of Heilbronn and will serve as a European AI hotspot designed to strengthen Europe's digital sovereignty.

The innovation park seeks to provide a European response to global developments in AI. It will create physical space for more than 5,000 employees and help shape the future of applied AI in a responsible and sustainable way, grounded in European sovereignty. More than 80 companies and institutions are already involved with the IPAI platform. They include DAX-listed corporations, innovative SMEs, universities and research institutions such as the Technical University of Munich's Venture Labs, the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS and the Fraunhofer Institute for Industrial Engineering IAO.

IPAI is funded through a public-private partnership model. The largest share is provided by the Dieter Schwarz Foundation, which is contributing more than €100 million for development and basic structures. The state of Baden-Württemberg is also providing funding, while the city of Heilbronn is contributing real estate and site development services. A large proportion of the anticipated investment is expected to come from the long-term commitment of private-sector players at the location.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Pioneering achievements
Initiatives, structures, funding programs
Projects and results
Awards
People behind the research
Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Fraunhofer Heilbronn Research and Innovation Centers HNFIZ for AI and digital transformation

Within the Fraunhofer Heilbronn Research and Innovation Centers HNFIZ, eight Fraunhofer institutes are pooling their expertise in AI and digital transformation at nine centers. In mid-October 2025, the Research and Innovation Center for Transformation and Governance at Fraunhofer HNFIZ achieved maximum visibility with a study on the success factors involved in transformation: The Fraunhofer transformation index made it onto the front page of *Handelsblatt*. The Fraunhofer transformation index is a scientifically validated instrument that makes the key factors for successful change visible and measurable. It shows companies where they stand in comparison with others—and which levers they can use to manage transformation successfully. This enables them to prioritize measures strategically and deploy resources with maximum efficiency. The Research and Innovation Center for Applied Quantum AI reached its first major milestone in the summer of 2025, when it organized an international symposium with the title "ML4QT—Machine Learning to Advance Quantum Technologies." The symposium is intended to mark the start of a new series of annual events on key topics in quantum AI.

JUPITER AI Factory delivers exascale power for industry and the research sector

JUPITER, Europe's first supercomputer of the exascale era, was inaugurated in Jülich in March 2025. It exceeds the threshold of one quintillion (10^{18}) computing operations per second, making it one of the world's most powerful and sustainable AI supercomputers. With more than 60 billion computing operations per watt, JUPITER has set a new efficiency record with the aid of specialized GPUs and optimized computing workloads. JUPITER is a symbol of European sovereignty and is intended to drive a new innovation ecosystem for AI applications that will enable faster scaling. Access to AI models in the cloud is accelerated by the inference module (JUPITER Advanced Research Vehicle for Inference Services): This makes it possible to optimize the models and to implement applications for tasks such as text generation, image analysis and complex calculations.

In addition to the Jülich Supercomputing Centre, which is responsible for coordination, the main partners are RWTH Aachen University, the Fraunhofer Institute for Applied Information Technology FIT, the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, the Lamarr Institute for Machine Learning and Artificial Intelligence and the Hessian Center for Artificial Intelligence. The JUPITER AI Factory (JAIF) also cooperates closely with the German AI service centers WestAI and hessian.AISC as well as the KI Bundesverband (German AI Association). It focuses on strategically important fields of application: healthcare, energy, climate change, education, media, the public sector and finance. Startups, SMEs, industry, research institutions and the public sector will all have access. The AI Factory will also support the training of next-generation language models from scratch. JAIF receives €55 million in funding from the European supercomputing initiative EuroHPC Joint Undertaking, the German Federal Ministry of Research, Technology and Space (BMFTR), North Rhine-Westphalian Ministry of Culture and Science and the Hessian Ministry of Science and Research, Arts and Culture. The JUPITER AI Factory is playing a key role in the implementation of the European Commission's AI Innovation Package to support artificial intelligence startups and SMEs of January 2024. It is also contributing to the HTAD's goal of establishing AI as a key technology and a powerful tool in important fields of research and application.

Graphic representation of the JUPITER supercomputer in Jülich
Image: Forschungszentrum Jülich

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Quantum network for highly secure communication networks

The Quantum Network (QuNET) project, funded by the German Federal Ministry of Research, Technology and Space (BMFTR), has been under way since 2019 and specializes in the development and optimization of critical components and key technologies. Following the first quantum-encrypted video conference between two federal authorities in 2021, it is now focusing on the development of quantum network technologies for multiple users. In October 2025, the successful completion of another key experiment marked a further step toward a future of secure quantum communication. The consortium used an aircraft to demonstrate satellite-based quantum communication with secure encryption over long distances. Satellite-based quantum communication is necessary because quantum states can only be transmitted over distances of a few hundred kilometers when using glass fibers. Quantum-encrypted satellite-based communication could for instance be used to connect quantum memories or quantum computers in a future quantum network.

During the experiment, a research aircraft provided by the German Aerospace Center (DLR) formed a mobile node in a quantum network and established a connection to a ground station (QuBUS). Researchers from the Fraunhofer Institute for Applied Optics and Precision Engineering IOF developed key components for the integrated photon pair source on board the aircraft as well as for the reception and measurement of the photons in the mobile QuBUS. The technologies used in the demonstrated key experiment are groundbreaking for the future of secure quantum communication.

The flight experiment was carried out using a research aircraft provided by the German Aerospace Center (DLR) Photo: DLR

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Fraunhofer Competence Network Quantum Computing

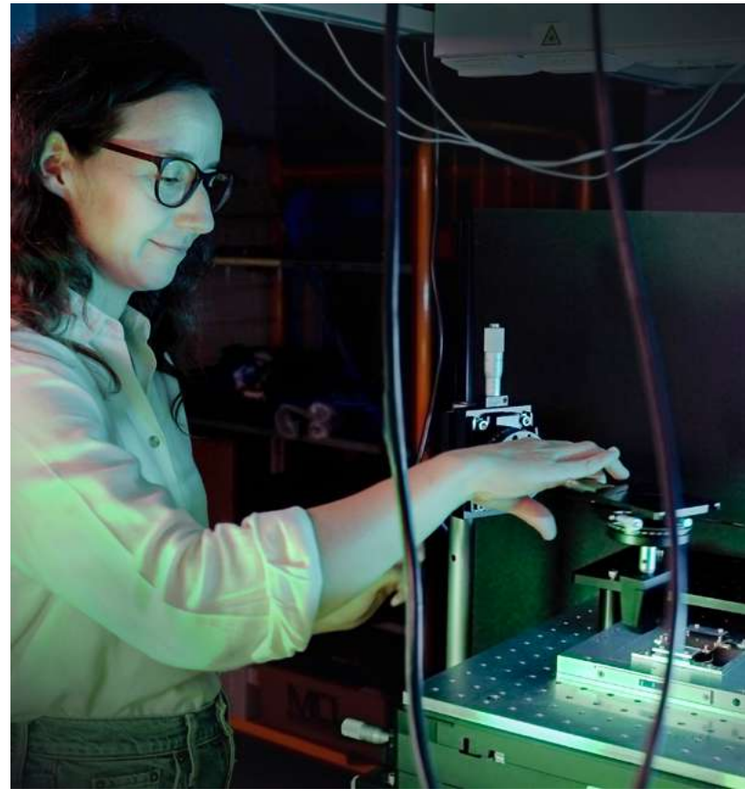
Quantum technologies are one of the six key technologies promoted by the German federal government's HTAD. The Fraunhofer Competence Network Quantum Computing, founded in 2020, has a crucial role to play in this context: 22 Fraunhofer institutes, each with its own research focus, have now come together under its auspices to collaborate on topics such as the development of a software stack. The institutes also cooperate with external partners such as research institutions, businesses and SMEs to facilitate the rapid transfer of research findings. All these stakeholders are working together to research and develop new technological solutions for quantum computing. The continuous exchange of knowledge and practical experience speeds up the development process and helps define practical use cases. It is hoped, for example, that the use of quantum computers will accelerate and improve developments when researching new drugs, optimizing logistic processes and conducting materials research. Advances in quantum computing will therefore strengthen Germany's competitiveness besides increasing its technological expertise. The Fraunhofer Competence Network Quantum Computing is consequently making a vital contribution to realizing the HTAD's goal of positioning Germany as a leading innovation hub.

Munich Quantum Valley: combining quantum computing with AI

Munich Quantum Valley (MQV), an initiative of the Bavarian state government, aims to develop and operate competitive quantum computers and make them available for a wide range of applications. MQV supports efficient knowledge transfer from research to industry and is building a network with international reach. Close collaboration between universities, research institutions, industry and startups is central to this effort. Founding members in addition to Fraunhofer include the Bavarian Academy of Sciences and Humanities, the Technical University of Munich, Ludwig-Maximilians-Universität München, Friedrich-Alexander-Universität Erlangen-Nürnberg, the Max Planck Society and the German Aerospace Center (DLR). The participating Fraunhofer institutes have already used their specialized hardware and software expertise to make contributions in application-oriented areas. Examples include the production of qubits using an industry-compatible manufacturing process, assistance with component design and the development of precise, high-speed pulse generators for neutral atoms. Practical solutions are developed in close collaboration with industry partners, combining quantum computing with AI and addressing complex application problems.

Application lab for quantum computing and supercomputers

At the Fraunhofer Institute for Applied Solid State Physics IAF, a unique quantum computing infrastructure is being developed with a focus on hardware platforms based on solid-state spins in diamond. These nitrogen-vacancy (NV) centers in diamond offer advantages over commercially available cloud quantum computing solutions based on superconducting systems, since they are highly robust, can operate without elaborate cooling systems and facilitate the industrially scalable production of qubits based on individual NV centers. In order to make these advantages available to research and industry partners at an early stage of development, Fraunhofer IAF is setting up a quantum computing application lab that will provide low-barrier access to quantum computing based on NV systems. At its core is an NV-based quantum computer that, in initial benchmarking, outperforms commercially available NV systems and is suitable for proof-of-concept calculations for industrial use cases. The NV-based quantum computer will also be connected to a high-performance computer. This will support hybrid quantum-HPC algorithms while creating structured access for external users and their specific research questions.



Rebekka Eberle setting up the quantum computing application lab Photo: Fraunhofer IAF

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

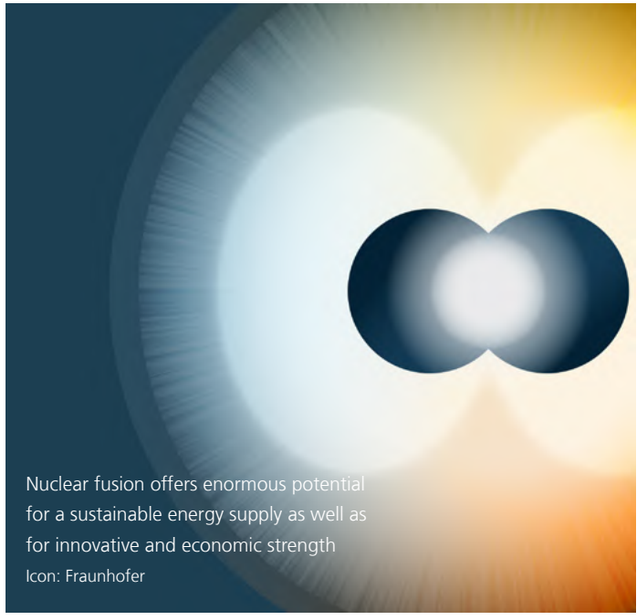
Finances

About Fraunhofer

Publisher's information

Fusion technologies

Fraunhofer has been actively involved in fusion technology for many years. This form of climate-neutral energy generation has seen remarkable scientific breakthroughs in the recent past. These include the world's first ignition of a burning plasma in laser-driven inertial confinement fusion at Lawrence Livermore National Laboratory in the United States, as well as major advances in magnetic confinement fusion. A global technology race has begun, resulting in billions being invested in fusion research. Spillover effects are already tangible today: Technologies such as high-power lasers and modern manufacturing systems are directly benefiting from developments in fusion research. They not only strengthen the industry but also create jobs and open up opportunities for exporting German technology.



Nuclear fusion offers enormous potential for a sustainable energy supply as well as for innovative and economic strength
Icon: Fraunhofer

In one of its moonshot innovation briefs, the Fraunhofer-Gesellschaft therefore calls for the creation of interconnected technology hubs to bring world-class research and industry together with maximum effect, scale applications and secure a leading role in laser fusion. The Fraunhofer Institute for Laser Technology ILT is one of Germany's first movers in this field and is already collaborating closely with the Lawrence Livermore National Laboratory. With its expertise in materials and manufacturing engineering and laser technology, the Fraunhofer-Gesellschaft stands ready to actively contribute to the German federal government's fusion energy action plan. If all stakeholders join forces, it will be possible to develop world-leading laser systems within the next three to five years through coordinated cutting-edge research and investment in infrastructure. The Fraunhofer-Gesellschaft is actively building bridges in this area, thereby establishing a comprehensive innovation ecosystem. The draft of the German federal government's Fusion Action Plan (status as of October 2025) provides for €2 billion in funding for fusion research by 2029. New funding initiatives are intended to span the full range from exploratory approaches in fusion research to basic fusion technologies.

Constantin Häfner, Fraunhofer Executive Board Member for Research and Transfer, was appointed commissioner for fusion energy at the Fraunhofer-Gesellschaft in 2024. He is also a member of the fusion research advisory board of the German Federal Ministry of Research, Technology and Space (BMFTR).

↗ Fraunhofer's contributions to nuclear fusion

SAXFUSION

With SAXFUSION, Saxony is launching its first statewide competence network for future nuclear fusion technologies. The initiative is being coordinated by Helmholtz-Zentrum Dresden-Rossendorf (HZDR), a world leader in the field of plasma experiments and material tests, while the Fraunhofer Institute for Material and Beam Technology IWS has assumed co-leadership. Based on its expertise in manufacturing technology, process engineering and materials development, Fraunhofer IWS will be responsible for transferring the fusion technology into industrial application. The competence network is starting with four core areas of expertise: laser and optical technologies, fuel capsule development including fusion reaction diagnostics, reactor material research, simulations and data analyses.

SAXFUSION will connect with major European research infrastructure. National and international industry partners and startups have pledged their support. The European Union and the Free State of Saxony are funding the initiative with approximately €2.4 million from the European Regional Development Fund (ERDF).

↗ SAXFUSION competence network

Establishment of a biofabrication center for biomedicine and novel foods

A biofabrication center is being established at the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB in Stuttgart. This interdisciplinary technology combines biotechnology, engineering and materials science to create biological systems with defined functions and manufacture them at scale. Complex biological products and tissues are needed, for example, to replace diseased tissue, as alternatives to animal testing or for the biotechnological production of cultivated meat. Researchers at Fraunhofer IGB are already working on reporter skin as an alternative to animal testing and on cell-containing bioinks for bioprinting. In this process, tissue structures are printed layer by layer. In-vitro tissue models are also needed at Fraunhofer IGB's Virus-Based Therapies branch lab in Biberach in order to validate oncolytic viruses for cancer therapy. Oncolytic viruses offer a promising approach to the therapy of tumors that are refractory to other forms of treatment.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

With funding from the state of Baden-Württemberg, the German federal government and the EU, manufacturing processes for biological tissues and products can now be systematically researched, optimized and translated into scalable, marketable solutions at a pilot facility. Fraunhofer IGB, now under the leadership of Petra Kluger, sees the biofabrication center as a milestone in the development and application of innovative processes for customers in the healthcare, pharmaceutical and food industries.

↗ Center for the manufacture of complex biological products and tissues

Integrated Security and Sustainability (I2SN) research network

The Integrated Security and Sustainability (I2SN) research network was established in August 2025 by the Fraunhofer Institutes for Communication, Information Processing and Ergonomics FKIE and for Ceramic Technologies and Systems IKTS, together with the Leibniz Institute for Solid State and Materials Research (IFW Dresden). Its purpose is to translate technology and knowledge in the areas of external, internal and civil security directly into practical civil and military applications. The multidisciplinary network is to be developed and firmly embedded by the end of 2027. IFW Dresden is contributing its expertise in materials research, Fraunhofer IKTS its capabilities in energy technologies and Fraunhofer FKIE its expertise in cybersecurity and IT. The network will establish joint multidisciplinary labs in these fields of expertise in cooperation with associated partners from Saxony's scientific community. It will initially focus on personal and vehicle protection, resilient energy systems and software-defined defense.

TT49: a new technology transfer fund

With the successful first closing of the TT49 technology transfer fund in December 2025, the Fraunhofer-Gesellschaft, together with the European Investment Fund (EIF) and—for the first time—private and further public investors, is taking the first Fraunhofer technology transfer fund (FTTF) to the second generation. The purpose of the TT49 fund is to provide early-stage funding for inventions developed in the German and European research landscape, thus facilitating the transfer of technology to value-creating innovations.

The name TT49 is a combination of TT for technology transfer and 49 from Germany's country code +49. The fund's legal partners will each be providing up to one-third of the envisaged funding volume of €90 million themselves. As a pre-seed fund for financing research teams, TT49 concentrates on funding spin-offs from non-university research institutions such as the Fraunhofer-Gesellschaft, the Helmholtz Association, the Leibniz Association and the Max Planck Society as well as their partner universities. These research institutions offer extensive incubator programs for researchers and prospective startup founders, among them Fraunhofer AHEAD. This gives investors access to attractive, impact-oriented spin-offs with strategic added value. Close collaboration between incubators, founders and TT49 makes it possible to quickly translate innovative research results into marketable, sustainable solutions through startups. Except for drug research, all investments are technology-neutral. The fund is intended to improve financial framework conditions, particularly for deep-tech spin-offs, which are often highly capital-intensive during the pre-seed phase. This will strengthen Germany and Europe as hubs for innovation.

↗ New fund for innovation transfer

New research infrastructure

Fraunhofer institutes have two projects shortlisted for the national prioritization process for new research infrastructures implemented by the German Federal Ministry of Research, Technology and Space (BMFTR). The Center for Gene and Cell Therapy in Regeneration and Transplantation (CREATION), to which the Fraunhofer Institute for Cell Therapy and Immunology IZI is contributing, aims to develop off-the-shelf therapies and use AI-supported automation to improve their production. The large-scale Einstein Telescope (ET) project, involving the Fraunhofer Institutes for Laser Technology ILT, for Applied Optics and Precision Engineering IOF and for Production Technology IPT, aims to develop a revolutionary instrument for detecting gravitational waves, for example to study the formation of black holes. During the prioritization process, the German Federal Ministry of Research, Technology and Space (BMFTR) selects projects whose implementation would strengthen Germany's international competitiveness. An expert panel selected nine projects for the shortlist from among 32 concept papers. These will now be developed further in consultation with the German Science and Humanities Council.

Structures

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

A partnership for the future of medicine (from left): Jaume Collboni (Mayor of Barcelona), Diana Morant (Spain's Minister of Science, Innovation and Universities), Salvador Illa (President of the Government of Catalonia), Holger Hanselka and Núria Montserrat Pulido (Catalonia's Minister of Research and Universities)
Photo: ANDREU PUIG/Departament de Recerca i Universitat

Fraunhofer Spain

In October 2025, representatives of the Fraunhofer-Gesellschaft, the Spanish government, the regional government of Catalonia and the city council of Barcelona signed a declaration of intent to expand the Fraunhofer Spain Research Foundation in Barcelona. It is modeled on the existing Fraunhofer Center for Applied Theragnostic (Fraunhofer CAT) in cooperation with the Fraunhofer Institute for Biomedical Engineering IBMT. The signing grant authorities will provide the institutional funding for the center in Barcelona.

Theranostics is a relatively new research field that combines therapy and diagnostics to provide individualized patient treatment. The research teams will develop innovative technologies designed to support diagnostic, prognostic and therapy selection processes, thus paving the way for precision medicine. The new center will combine the strengths of the Institute of Bioengineering of Catalonia (IBEC) in bioengineering, biosensors and biomimetic systems for biomedical applications with Fraunhofer IBMT's expertise in stem cell process technology and cell-based microsystems. With the highest concentration of pharmaceutical and biotechnology companies in Europe, Catalonia is a key global player in the entire life sciences industry. The initiative by the grant authorities (the Spanish government, the regional government of Catalonia and the city council of Barcelona) and the Fraunhofer-Gesellschaft not only represents a significant step toward enhancing Europe's innovative strength but also offers the opportunity to strengthen the European research area and enhance the performance of Fraunhofer as a whole.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Funding programs

The system allows users to set different flow rates in order to test which process parameters are needed to obtain the desired end product. Photo: Fraunhofer IPT/Guido Flüchter

Flagship projects are designed to unlock Fraunhofer's full synergy potential by bringing together the expertise of multiple institutes to develop solutions for the challenges facing society and industry.

Example: **automated production of mRNA APIs**

Technologies and bioprocesses for the fast, safe and affordable production of mRNA active pharmaceutical ingredients (APIs) were developed as part of the Fraunhofer flagship project RNAuto. mRNA-based vaccines, along with gene and cell therapy medicinal products, are innovative medicines that can be used to prevent or treat infectious diseases, hereditary conditions and cancer, also in cases that had previously been untreatable. However, there are no automated and digitalized production technologies that can manufacture these innovative medicinal products faster and more cost-effectively while complying with the high standards of good manufacturing practice (GMP). Fraunhofer addressed this by bringing together the expertise of various Fraunhofer research units in bioprocess development, smart sensors, digitalization and automation. The result was a set of device technologies combined in a screening unit that enables automated mRNA encapsulation and the integrated quality assurance of mRNA lipid nanoparticles (LNPs). Various bioreactor modules were developed for the manufacture of cell therapeutics such as those used in CAR-T and CAR-NK cell therapies. Looking ahead, this technology could enable the automated production of large batches of cell therapeutics based on donor-derived immune cells. In addition to the technological systems, various processes were developed to enable the scaled manufacture of mRNA molecules and cell therapeutics. These were then applied to two pharmaceutical drug candidates. The results have the potential to make a major contribution to better and more cost-effective healthcare.

Foreword

Contents

Executive board's report

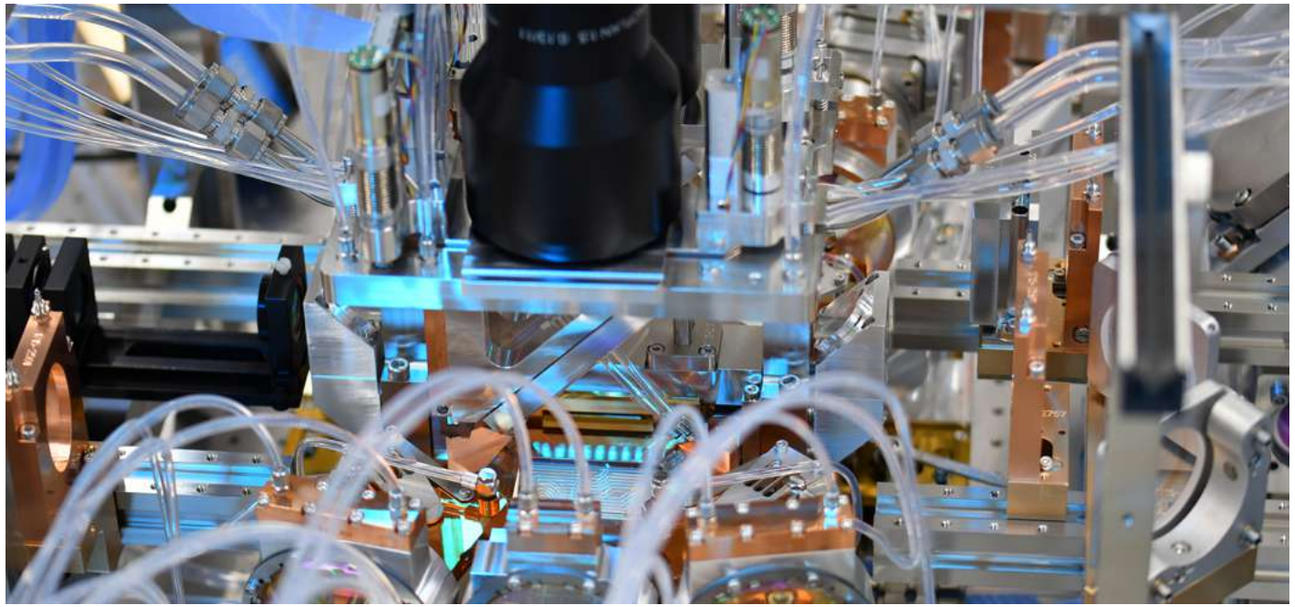
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

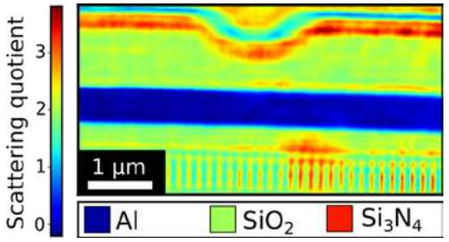
Finances

About Fraunhofer

Publisher's information



View inside the amplifier of an Innoslab laser. The efficiently cooled, cuboid laser crystal of the Innoslab laser enables the amplification of ultrashort laser pulses with multi-kilowatt laser power for applications such as laser materials processing and fusion research Photo: Fraunhofer ILT



Coherent diffraction imaging of a microchip using extreme ultraviolet (EUV) radiation. This makes it possible to identify the different materials in the chip structures
Image: Fraunhofer IOF

Clusters of excellence promote long-term, sustainable collaboration between multiple Fraunhofer institutes on strategic topics such as high-performance laser systems, key technologies for the cognitive internet, programmable materials, research into immune diseases and solutions for the circular economy and the energy transition.

Example: **Advanced Photon Sources CAPS**

In the laboratories of the Fraunhofer Cluster of Excellence Advanced Photon Sources CAPS, researchers are creating ultrafast lasers with average powers that are not yet generally available worldwide. These are then used for practical applications within Fraunhofer and in industry. The cluster is led by the Fraunhofer Institutes for Laser Technology ILT and for Applied Optics and Precision Engineering IOF. While researchers in Aachen are currently focusing on fast, ultra-precise material processing at wavelengths around 1 micrometer and on the generation of x-rays, researchers in Jena are using a 2-micrometer fiber laser for purposes such as the generation of EUV radiation for metrology applications (coherent diffraction imaging). The CAPS user facility offers early access to laser parameters not yet available internationally and expertise in the operation and use of these high-performance lasers. This opens up opportunities to test new approaches at an early stage, thereby generating intellectual property rights. Examples of practical applications from various Fraunhofer institutes include EUV nanoanalysis for new battery cell systems (Fraunhofer Institute for Material and Beam Technology IWS), laser-structured surfaces with high thermal emissivity for rocket engines (Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut, HHI), 3D scaling of battery electrodes (Fraunhofer Institute for Ceramic Technologies and Systems IKTS), hollow light guides in glass substrates for high-frequency applications (Fraunhofer Institute for Silicon Technology ISIT) and blood sample analysis in medical diagnostics (Fraunhofer Institute for Cell Therapy and Immunology IZI).

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

PREPARE is a core element of Fraunhofer's internal funding landscape. In 2025, the total volume amounted to €36.4 million. It comprised 47 ongoing projects, 12 of which were completed. The research results are intended to anticipate the future needs of customers and partners. The institutes are therefore expected to generate revenue equivalent to the funding amount within three years. This must be achieved through contract research for industry, licensing and spin-offs. Another objective of the program is to promote synergistic cooperation among institutes within Fraunhofer.

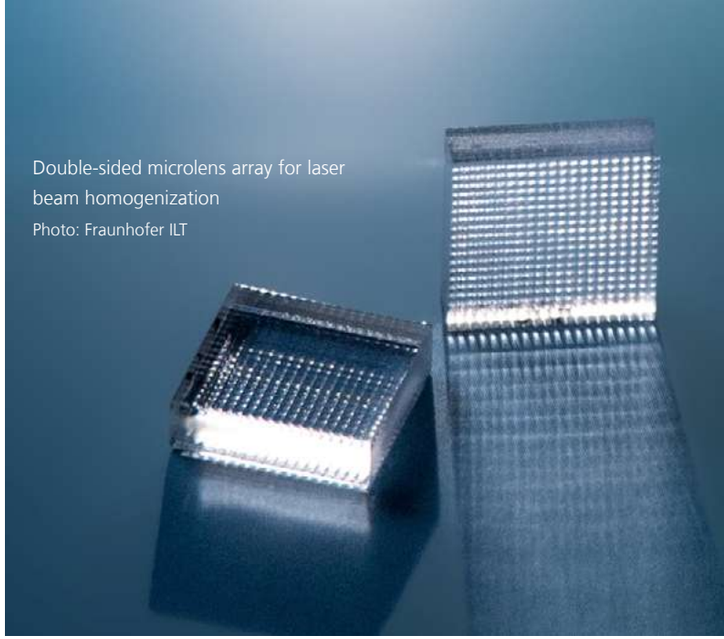
Example: **complex optics manufactured within 48 hours**

In the OPTICS48 project, a consortium was able to demonstrate that, in the future, glass optics could pass through all production stages from design to coating within just 48 hours. This shows that the Fraunhofer institutes are responding to growing demand for customized and increasingly complex optics. Examples of applications include sensors in autonomous driving, medical technology and satellite metrology. To meet the 48-hour manufacturing target, three institutes combined their expertise to create a new process chain. Their work included the development of a new automated process for optic design and laser-based manufacturing. Expertise in glass forming, digital process monitoring and metrology was integrated into the process chain along with innovative coating technologies. By the end of the project, the consortium had succeeded in manufacturing three optics for different applications in less than two days: a color-corrected doublet lens (achromat), a freeform optic for logo projection and a double-sided microlens array for laser beam homogenization.

Rapid SME-oriented in-house research
One key focus of Fraunhofer's mission is to promote innovation among small and medium-sized enterprises in Europe. The Rapid SME-Oriented In-House Research funding line has been serving this customer group since 1976. 2025 saw the further development of 40 promising research approaches for SMEs.

Example: **sustainable packaging with barrier coating**

TransMET—"Transfer metalization for the production of barrier coatings on sensitive substrates" is a project by the Fraunhofer Institute for Process Engineering and Packaging IVV. Cardboard and paper packaging often provide insufficient protection for sensitive foods or pharmaceutical products. The researchers accordingly used a lamination process to transfer an inorganic layer of aluminum (oxide) and a layer of varnish to the fiber-based material. This significantly improved the barrier properties of packaging materials such as paper while achieving the level of protection required for demanding products. By applying a very thin, transparent protective layer to paper or cardboard, the researchers were able to preserve the recyclability of the biodegradable material. Demand for circular packaging solutions is being reinforced by a new EU packaging regulation, which entered into force in 2025 and is to be implemented by 2030. Four different demonstrator solutions illustrate the concept's applicability. The novel coating processes can be implemented on existing systems without significant investment. Fraunhofer is working with companies to test the concept, for instance by manufacturing a lidding film for packaging luxury food products and confectionery.



Double-sided microlens array for laser beam homogenization
Photo: Fraunhofer ILT

▲ Materials experts are developing innovative coating processes for sustainable paper and cardboard packaging.
Photo: Fraunhofer IVV

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

A researcher at the High-Performance Center Smart Production & Materials configures the forming process for producing fiber composites
Photo: ILK-TU Dresden/Andreas Scheunert

High-performance centers were initiated by Fraunhofer as funding platforms to develop region-specific research areas in collaboration with local companies while maintaining a strong focus on practical application. The centers bring together Fraunhofer institutes, universities, non-university research institutions, civil society and companies with the aim of transferring R&D projects to practical applications. All high-performance centers are evaluated annually according to an omnibus principle, meaning that their number remains limited.

Example: **Smart Production & Materials**

The impact of Fraunhofer's diverse transfer activities is demonstrated by the High-Performance Center Smart Production & Materials. Established in 2017, it has gained a reputation as a key intermediary between companies' needs and Fraunhofer expertise in Chemnitz and Dresden. Close collaboration between the Fraunhofer Institutes for Electronic Nano Systems ENAS, for Ceramic Technologies and Systems IKTS, for Material and Beam Technology IWS and for Machine Tools and Forming Technology IWU is central to its work. An advisory board and a central office ensure close cooperation with the institutes and provide long-term support for the development of the High-Performance Center Smart Production & Materials. Awareness of technology transfer and related expertise are strengthened by information services, peer groups and individual consulting. Transfer formats such as the Patentbörse (patent exchange), cUPdates and InnoSpeedDatings were developed and established to increase visibility and promote the commercialization of available expertise. The center's success is reflected for instance by the €315 million in industrial revenue generated in 2025 and the twelve spin-offs formed over the past five years, among them VibroCut, Botfellows and AMAREA Technology.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

The **Fraunhofer-DFG (German Research Foundation) collaboration program** enables DFG-funded research at German universities to be further developed using the technological expertise of Fraunhofer institutes and industrial companies (particularly SMEs). This allows companies to benefit from early access to innovations from science and applied research.

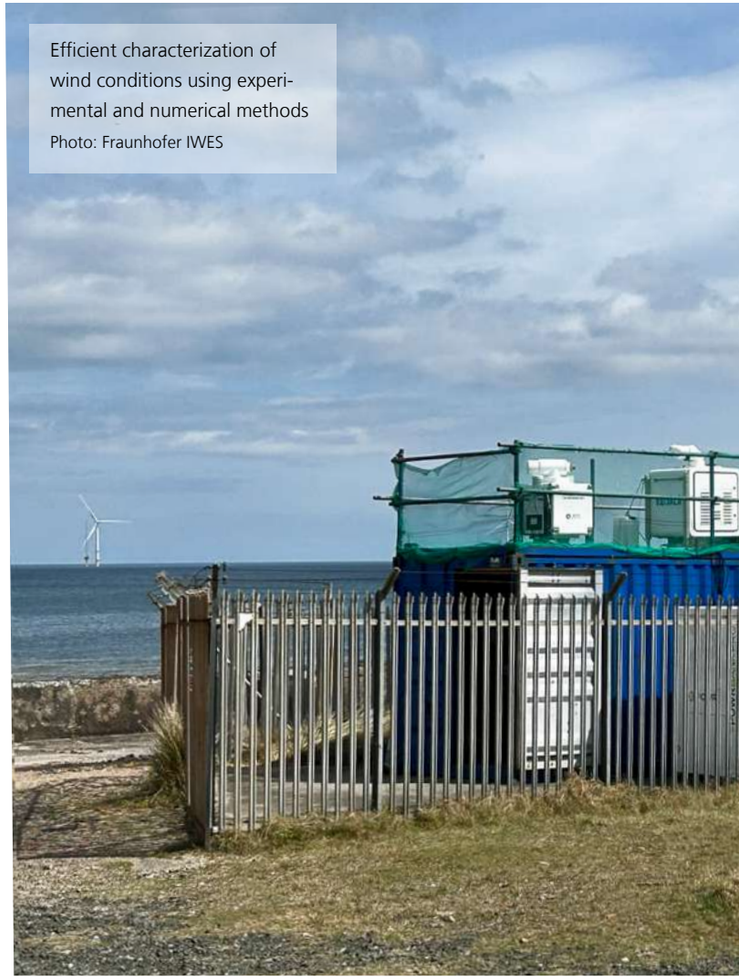
Example: **robust, high-performance ultrafast lasers**

The Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut, HHI, Deutsches Elektronen-Synchrotron (DESY) and TOPTICA SE achieved significantly higher performance and greater reliability in femtosecond laser systems by using improved semiconductor saturable absorber mirrors (SESAMs for short). These systems are central to applications in materials processing, biophotonics, medical technology and quantum sensors. In the SesamUnstrained project, the partners established an end-to-end development process moving from theoretical, nonlinear modeling of complex laser dynamics through the manufacture and optical characterization of novel components to the implementation and testing of a demonstrator. For this, they developed the first SESAMs using strain-free absorber materials with high long-term stability. The SESAMs were precisely matched to the laser architecture through iterative simulation, epitaxial growth and optical characterization. The demonstrator was validated at TOPTICA SE and reliably self-started pulsed laser operation with high long-term stability. The results of this collaboration are laying the foundation for an industrial production line in Germany and strengthening the competitiveness of the domestic laser industry.

International Cooperation and Networking (ICON) enables Fraunhofer institutes to obtain funding for project-based collaboration with outstanding research organizations abroad. The projects pursue ambitious research goals and are intended to strengthen Fraunhofer's knowledge base and service portfolio.

Example: **assessing wind turbulence**

In their project NEMO (New Methods for Turbulence Measurements and Models in Offshore Wind), the Fraunhofer Institute for Wind Energy Systems IWES and the French research institution France Energies Marines are addressing one of the main challenges in developing wind farms at sea: assessing wind turbulence. This is a crucial factor in the optimal planning and design of offshore wind farms. The partners are developing and combining new experimental and numerical methods to characterize wind conditions with maximum accuracy and efficiency, especially at turbulent scales. The core of the project is a comprehensive, high-intensity measurement campaign comparing and calibrating both experimental and numerical methods. The new methods are to be incorporated into standardization processes in order to facilitate their rapid transfer to the offshore wind industry. The results are aimed at developers and operators of offshore wind farms and at wind turbine manufacturers. Commercial enterprises can then improve the lifetime, reliability and performance of offshore wind farms by optimizing their designs. Ultimately, the project results can make wind farms more profitable while cutting investment costs.



Efficient characterization of wind conditions using experimental and numerical methods
Photo: Fraunhofer IWES

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Projects and results

As an applied research organization, Fraunhofer fulfills its responsibility to society to develop solutions for the challenges of our time. As part of this, Fraunhofer works with partners from industry and science to translate research findings into sustainable products and services. This work is guided by the **UN's 17 Sustainable Development Goals (SDGs)**. These ambitious goals address all stakeholders in politics, industry, civil society and science. Fraunhofer has adopted the SDGs as an important guiding framework. Accordingly, the model research projects are allocated to selected SDGs.

Working with and for industry to develop marketable, sustainable innovations is a core task for the Fraunhofer-Gesellschaft. As such, SDG 9 (Industry, innovation and infrastructure) is of particular importance to Fraunhofer. However, its research also addresses the remaining SDGs.

The Fraunhofer group structure guided the choice of projects and findings presented. One publicly funded project and one project (co-)funded by industrial partners is presented from each group. This also applies to the Segment for Defense and Security VVS.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Energy Technologies and Climate Protection

Industrial collaboration
Heat pump with natural refrigerant propane

A new generation of heat pumps that use the environmentally friendly refrigerant R290 (propane) has been available from specialty retailers since mid-2025. Two different models of a space-saving ground-source heat pump for installation in single-family and multifamily homes are available from the ait-group. If refrigerant escapes, no more than 150 grams of the natural refrigerant R290 is released. This allows the heat pump to operate safely indoors without an additional ventilation system. The source temperature range extends from –13°C to +30°C, enabling connection to a wide variety of renewable heat sources, including downhole heat exchangers, groundwater, wastewater, ice storage systems and photovoltaic-thermal (PVT) collectors. The innovative devices achieve energy efficiency class A+++. An optional cooling function can also be integrated.

Research scientists at the Fraunhofer Institute for Solar Energy Systems ISE have been working on heat pumps with reduced refrigerant charge since 2020. As part of the funded project "LC150 – low charge 150g," they collaborated with heat pump manufacturers to identify cost-cutting measures and sustainable refrigerants, then developed a propane refrigerant circuit with a reduced refrigerant charge. In 2020, the consortium set a new efficiency record, achieving a heat output of 12.8 kilowatts with just 124 grams of propane. More than three years of development yielded heat pump concepts and working models based on a significantly reduced refrigerant charge. The ait-group became the first industry partner to successfully translate the project's findings on ultra-low refrigerant charges into production-ready products.

Funded initiative
Environmentally friendly exhibition center in Nuremberg

By 2028, a major consortium of industry and research organizations aims to show in a living energy-transition laboratory, that exhibition operations can be reliably converted to a sustainable, carbon-neutral energy supply. Using the Nuremberg exhibition center as an example, the overall concept is intended to demonstrate that such a transition is technically feasible, economically viable and worthwhile. It is also hoped that others will be encouraged to replicate this approach. The REMBup project has been receiving funding from the German Federal Ministry for Economic Affairs and Energy (BMWE) since the beginning of 2024 in accordance with a resolution passed by the Bundestag.

The project, which is being implemented in close collaboration between industry and research, involves the construction of a sustainable energy system that ensures security of supply and integrates established technologies such as photovoltaics and battery storage. It also includes hydrogen technologies—including liquid hydrogen carriers—and combined heat and power systems fueled by wood gas, which could also be used to process exhibition waste on site. REMBup is a pioneering project that links proven and innovative energy technologies with digital energy management. The core element is a digital twin of the hybrid power plant, which will be used to simulate the energy system. Load forecasts, AI and weather forecasts will help optimize the system in terms of energy and economic efficiency. At the end of the project, the findings and results will be tested under real exhibition operations. The project will also involve the development of new business models for operating sustainable hybrid power plants. The participants include the Fraunhofer Institutes for Integrated Circuits IIS and for Integrated Systems and Device Technology IISB (both headquartered in Erlangen) together with the Fraunhofer Research Institution for Energy Infrastructures and Geotechnologies IEG.

These brine-to-water heat pumps with propane do not require an additional ventilation concept
Photo: ait-deutschland

The first photovoltaic systems have been installed on the roofs of the exhibition halls
Photo: NürnbergMesse GmbH

Health

Foreword

Contents

Executive board's report

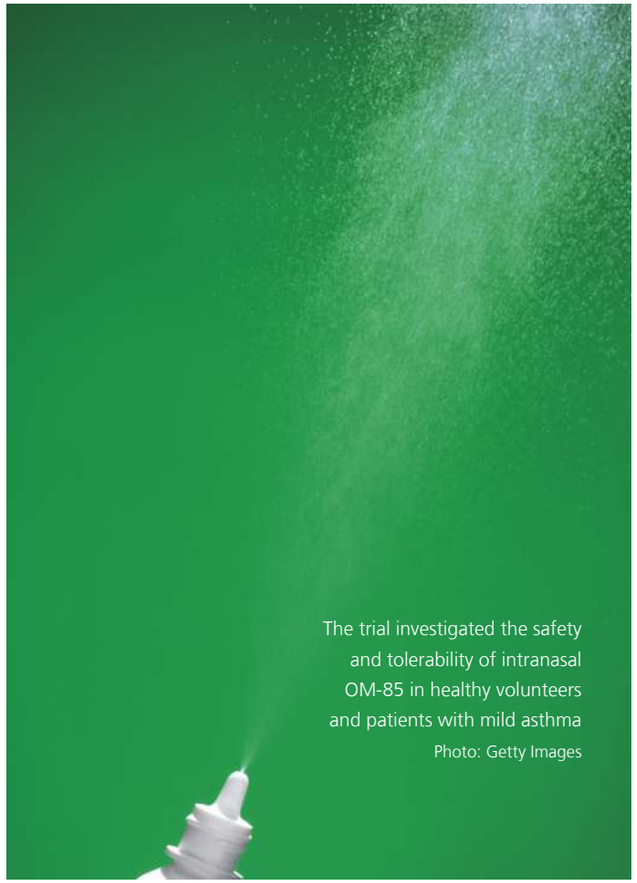
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information



The trial investigated the safety and tolerability of intranasal OM-85 in healthy volunteers and patients with mild asthma
Photo: Getty Images

Industrial collaboration

Development of a nasal spray to treat asthma

Nasal sprays are an attractive method of drug delivery. They are easy for patients to use, and the active ingredients can enter the bloodstream directly without passing through the stomach or liver, as they do when taken orally. The nasal mucosa can also trigger both local and systemic immune responses. The Geneva-based biotech company OM Pharma and the Fraunhofer Institute for Toxicology and Experimental Medicine ITEM in Hannover are developing an asthma nasal spray based on OM-85, an approved drug that has previously only been administered orally. OM-85 consists of a lysate, a purified cell material derived from 21 heat-inactivated bacteria found in the respiratory tract. It acts as an immunomodulator, activating specific immune cells in the mucosa in order to strengthen the immune mechanisms that defend the body from pathogens.

Researchers at Fraunhofer ITEM had previously conducted multiple preclinical studies to investigate the active ingredient's efficacy and distribution in the lungs. The drug is already licensed for oral administration to prevent recurrent respiratory infections. In mid-2024, OM Pharma and Fraunhofer ITEM launched a phase I clinical trial to test intranasal use for the first time. The trial evaluated the safety and tolerability of intranasal OM-85 in healthy volunteers and patients with mild asthma. The aim of the clinical trial is to gain a deeper understanding of intranasal OM-85 and examine its potential impact on asthma management when administered as a nasal spray. This innovative delivery in a nasal spray could potentially increase the therapeutic benefits of OM-85 for asthma patients.

Funded initiative

Standards to improve health data usability

The FHIR Starter project was launched in 2025 to relieve pressure on the healthcare system through AI and data interoperability. Funded as part of the Generative AI for SMEs innovation competition organized by the German Federal Ministry for Economic Affairs and Energy (BMWE), the project brings together the Fraunhofer Institute for Experimental Software Engineering IESE, the Berlin Institute of Health at the Charité and the AI company Insiders Technologies.

FHIR (Fast Healthcare Interoperability Resources) is a standard for structuring and exchanging health data between different IT systems in healthcare. To support this, the project partners are developing a software service that uses large language models (LLMs) and natural language processing (NLP) to analyze full-text documents and automatically convert them into standardized data formats. Standards support data exchange among the many healthcare stakeholders and are essential for effective data use. Benefits include reducing workloads for healthcare professionals and improving patient care. The main challenges are ensuring data reliability—especially by preventing hallucinations—and protecting confidential information. To address this, Fraunhofer IESE has developed an uncertainty wrapper, a tool that quantifies, manages and reduces uncertainties in AI models. To ensure that medical data is processed responsibly in compliance with the GDPR, the software service will be based on open-source LLMs that run on the user's own servers. In the future, it may also be possible to store archived data such as laboratory results or medication lists automatically in electronic patient records.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

ICT

Industrial collaboration
How production robots work safely with AI

AI-supported automated robotics could make production processes significantly more efficient by enabling manufacturing robots, most of which have been statically programmed until now, to react flexibly to deviations during the manufacturing process. This could minimize quality fluctuations and downtime. Safe collaboration between humans and machines is already a major challenge, but integrating AI functions into robotics makes the safety issue even more critical. Hitachi Ltd. commissioned the Fraunhofer Institute for Cognitive Systems IKS to develop a solution,

which used established ISO 31000 risk management practices to identify and assess AI risks before defining risk mitigation measures to address the risk factors. To integrate the measures into the AI system, the researchers used their AI Safety Envelope (AI-E) architecture. This allowed them to implement the risk mitigation measures as self-protection, self-monitoring or self-checking techniques. Together, these three techniques form the AI Safety Envelope around the unreliable AI function, turning it into a reliable subsystem. The AI-E architecture is an implementation of the architectural risk mitigation for AI functions outlined in ISO/IEC TR 5469. The architecture developed by Fraunhofer IKS increases the reliability and safety of AI-controlled systems—a crucial requirement for their use in safety-critical environments. Hitachi Ltd. will use these findings as a basis for further innovations across its applications.

Funded initiative
Monitoring bridges with acoustics and AI

Bridge closures and structural failures across Germany underscore a backlog in infrastructure investment. Until now, industry has lacked a reliable digital solution to facilitate predictive maintenance. Acoustic monitoring can provide valuable information, especially on bridges carrying vehicle traffic. In the summer of 2025, the Fraunhofer Institute for Digital Media Technology IDMT and the engineering firm Marx Krontal Partner launched the project *AIrBSound*.

The partners are developing a monitoring system that is based on airborne sound and AI-based methods. This uses airborne sound sensors and AI-supported analyses to detect structural changes in bridge components, especially bridge expansion joints. These joints are subjected to extreme stress on every bridge and are particularly susceptible to wear. Acoustic monitoring with airborne sound sensors does more than flag damage such as wear, cracking or loosening. It also provides insights into traffic volume and vehicle types. These metrics are important for assessing the actual structural loads and generating a picture of the bridge's health. One key part of the project is preprocessing the recorded audio data. To produce reliable results, the data must first be isolated from background noise and prepared for analysis using neural networks. Initial AIrBSound tests are being carried out on the Wesenitz and Sachsen bridges in Pirna. The project is funded by the German Federal Highway and Transport Research Institute (BASt) through the summer of 2026. Administrative support is being provided by the interdisciplinary network operated by Allianz für Industrie und Forschung (AiF) GmbH.

Reliable person detection for safe cooperation between humans and robots
Photo: Fraunhofer IKS

The research project AIrBSound is using acoustics to investigate bridge expansion joints
Photo: Fraunhofer IDMT

Innovation Research

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Several EU research projects studying forest fires published an integrated wildfire risk management strategy in 2025
Photo: Getty Images

The Simmering power plant generates electricity and district heating for Vienna
Photo: Wien Energie GmbH

Industrial collaboration

Future electricity market design in Austria

Wien Energie and VERBUND, two of Austria's biggest energy companies, commissioned the Fraunhofer Institute for Systems and Innovation Research ISI to investigate what a secure, sustainable Austrian electricity market could look like in the future. Austria's current electricity market generally allows capacity providers to generate sufficient revenue to cover both fixed and variable costs. Appropriate price signals can also create incentives for new investment. However, government interventions during the energy crisis have weakened confidence in the market's ability to generate such incentives.

The study was based on an analysis of investment security in Austria's energy industry alongside developments in European electricity markets. The research team also evaluated various restructuring options for the Austrian energy market, including models in which the existing energy-only market would be supplemented by a capacity market, and estimated the associated cost effects. The result was a proposal for a combined capacity market, combining the maintenance of existing plants, optimal load management integration and centrally organized tendering processes for new plants. The concept is designed to guarantee long-term security, performance and flexibility. Defining and refining the concept at an early stage would make it possible to accelerate the transition to a technology-neutral capacity market if needed. The Austrian Energy Agency, Vienna University of Economics and Business and the law firm Becker Büttner Held, which specializes in customers in the energy sector, were each brought into the project to address specific market concerns and assess the European and national legal framework.

Funded initiative

EU strategy for fighting forest fires

According to the European Forest Fire Information System (EFFIS), more than one million hectares of forest were destroyed in the EU in 2025. Spain was most severely affected, followed by Portugal. Germany also experienced a record wildfire season, with 5,000 hectares destroyed—its largest loss in twenty years. The summer of 2025 was Europe's worst season for forest fires since EFFIS began recording data in 2000.

In 2025, several EU research projects dedicated to forest fires published an integrated wildfire risk management strategy (IWRM). Drawing on examples of good practice, the strategy aims to harmonize Europe's previously fragmented approach to wildfire control and risk reduction and make it easier to share knowledge across the extensive capacities already in place. Backed by more than €70 million in EU funding, the strategy proposes concrete measures, including the design of fire-tolerant landscape mosaics, incentives for fire-smart bioeconomies and public-private partnerships. Cooperative landscape planning, education on wildfire risks and new financing mechanisms are needed to support adaptation. The strategy rests on four pillars: risk assessment and evaluation, risk management and adaptive planning, interest group involvement and communication, and integrative governance. The recommendations were compiled by contributors working on the EU Green Deal research projects Firelogue, FIRE-RES, TREEADS and SILVANUS. The Firelogue coordination project was led by the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE (known until 2025 as Fraunhofer INT) and involved fifteen partner organizations from nine countries.

Light & Surfaces

Foreword

Contents

Executive board's report

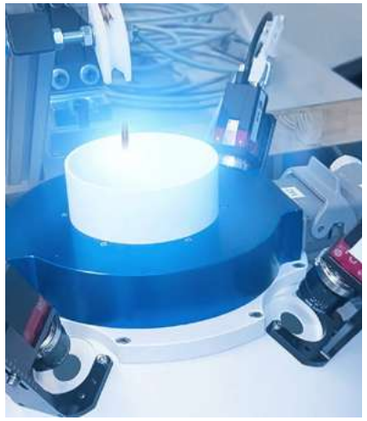
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

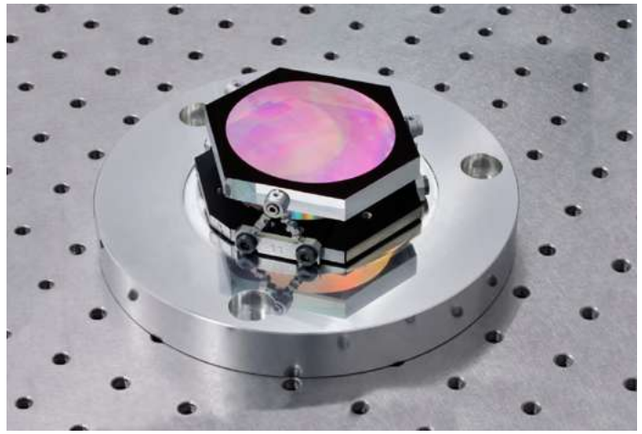
Finances

About Fraunhofer

Publisher's information



Several hundred stamped parts per minute are captured in free fall by 16 cameras. This facilitates the detection of geometric defects within a range of 100 micrometers
Photo: Fraunhofer IPM



The nanostructured grating for ESA's Copernicus Sentinel-4 instrument is mounted with micrometer precision
Photo: Fraunhofer IOF

Industrial collaboration

Optical inspection verifies the precision of stamped parts

Stamped parts such as connectors, circuit boards, sleeves, clips and pins are used in many high-tech products. Especially in the automotive, electrical, medical technology and telecommunications industries, these parts are manufactured at rates of several hundred units per minute. Until now, quality assurance methods have been unable to keep pace with the high throughput of stamping processes. Inspections have typically been performed by random sampling, either visually or using CT scans.

Researchers from the Fraunhofer Institute for Physical Measurement Techniques IPM have partnered with the mid-sized stamped parts manufacturer Quittenbaum GmbH to implement a new optical testing system. For the first time, a free-fall inspection system makes it possible to check the geometric dimensional accuracy of 3D precision parts within a range of 100 micrometers at production speeds measured in seconds. The system was tested using copper sheet connectors at a production rate of 330 parts per minute. A component guide developed by Quittenbaum feeds parts measuring up to 40 millimeters from the stamping machine into a test sphere one by one. At the moment of free fall, 16 high-resolution cameras then capture each part from different angles. Indirect LED flash illumination ensures that the images are free of shadows or reflections. Comparisons between the measurement data and the reference CAD model trigger the immediate rejection of defective parts. To achieve the high throughput for this computationally intensive analysis, the system uses fast inspection algorithms, parallelized camera control and multiple evaluation computers. Next, the partners plan to develop an efficient method for inspecting the surfaces of stamped parts.

Funded initiative

Measuring air quality from space

In 2025, the European Space Agency (ESA) launched the Sentinel-4 and Sentinel-5 missions in continuation of the Copernicus climate research program. Several optical components developed by the Fraunhofer Institute for Applied Optics and Precision Engineering IOF were installed on board the satellites and integrated into specialized spectrometers.

Sentinel-4 is the EU's contribution to the global constellation of geostationary air quality sensors. The satellite supplements air quality data from a Korean sensor for Asia and a NASA sensor for North America. The first European spectrometer has been improving data accuracy for weather forecasting and air pollution monitoring over Europe and Africa since mid-2025. Fraunhofer IOF designed and manufactured a high-precision diffraction grating for this purpose. Since August 2025, Sentinel-5's ultraviolet visible near-infrared shortwave spectrometer has made it possible to monitor air quality, trace gases and aerosols worldwide. With a spatial resolution of up to 7 × 7 square kilometers, climate researchers can identify and analyze emission sources much more precisely than before. Fraunhofer IOF developed several optical components for the near-infrared channel (685–710 nm): a highly efficient transmission grating with a diffraction efficiency of more than 95 percent and polarization sensitivity of less than 2 percent, space-qualified mounts and an adjustable lens group. Fraunhofer IOF is also contributing components to the ESA's FORUM and CO2M missions. Starting in 2027, these missions are expected to provide the first comprehensive measurements of the thermal radiation emitted by Earth and of the atmosphere's CO_2 content.

Materials and Components

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Industrial collaboration

Efficient production of sandwich components

Researchers from the Fraunhofer Institute for Microstructure of Materials and Systems IMWS, working in collaboration with industry partners such as Daimler Truck AG, have developed a manufacturing process for plastic sandwich components that can be used for mass production. They used thermoplastic sandwich molding technology to produce a storage compartment flap for a truck cab. The lightweight sandwich design significantly improves sustainability by reducing weight and material requirements while allowing for the use of recyclable materials.

The sandwich structure combines highly rigid, exceptionally strong face sheets with a lightweight core. This makes highly efficient use of materials while achieving very high bending and buckling stiffness relative to weight. The semi-finished products, made from a thermoplastic honeycomb core and face layers of fiber-reinforced thermoplastic unidirectional tape laminates supplied by partner ThermHex, are formed by thermoforming and then finished by injection molding to integrate the required functional features. The design is also suitable for high-load structural components in vehicle and aerospace applications. Compared with monolithic structures, it offers weight-saving potential of up to 70 percent, while the load-bearing capacity of the components is at least equivalent to that of metal parts. The development won the JEC Composites Innovation Award for 2025 in the Automotive & Road Transportation—Process category. The award recognized the entire consortium involved in the HyWaSand project: Besides Fraunhofer IMWS and Daimler Truck AG, the other members were ElringKlinger AG, ENGEL Austria GmbH, ThermHex Waben GmbH and Edevis GmbH.

Funded initiative

Compostable disposable tableware made from sugar beet

Partners in science and industry are developing compostable disposable tableware designed to protect the environment and the oceans. The material is based on residues from sugar beet production in Germany, which are processed into compounds and polymer films by a consortium consisting of the Fraunhofer Institute for Wood Research, Wilhelm-Klauditz-Institut, WKI, the Institute for Biotechnology at RWTH Aachen University and Pfeifer & Langen GmbH & Co. KG. The material is produced by mixing ground sugar beet pulp with natural polymers, such as cornstarch or pectin from sugar beets, then adding water and glycerin. The resulting compounds are processed into pellets, pressed into film, coated and formed into plates. Initial tests have shown that the materials are more stable than paper plates and biodegrade faster, breaking down within twelve weeks. An ecotoxicological assessment confirmed that the compounds are safe for contact with food.

German sugar producers generate millions of metric tons of sugar beet pulp during harvesting. Processing the pulp into compounds locally can shorten transport routes, reduce CO_2 emissions and strengthen regional markets. Plates have already been produced as demonstration prototypes. Materials for disposable cutlery, which is to be manufactured by injection molding, are being developed, as are bio-based coatings for contact with fatty and oily foods. In the next step, the project partners aim to transfer production to existing industrial facilities. The project has laid the foundation for a sustainable, biodegradable solution for disposable tableware like that widely used at trade fairs and festivals.

Photo: Getty Images

This plate was produced during pilot trials using a film made of sugar beet pulp Photo: Fraunhofer WKI

Demonstrator of a storage compartment flap for use in a truck cab
Photo: Fraunhofer IMWS

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Microelectronics

Industrial collaboration
Complex mask structures in just a few hours

The Fraunhofer Institute for Silicon Technology ISIT is working with IMS Nanofabrication, a global leader in electron multi-beam mask writers headquartered in Austria, to develop the TROM chip, a revolutionary technology for producing high-resolution EUV photomasks for semiconductor manufacturing. These photomasks are needed to create highly precise structures in the nanometer range using increasingly advanced processes. The TROM chip takes miniaturization to a new level. By combining innovative MEMS and CMOS technologies, the chip can control hundreds of thousands of electron beams simultaneously, without compromising precision and efficiency. This makes it possible to produce complex mask structures within just a few hours, an unprecedented improvement over conventional single-beam mask writers. This achievement earned the project a Fraunhofer Prize in 2021.

The MEMS process jointly developed by the partners comprises more than 200 individual steps and combines multiple state-of-the-art manufacturing technologies, including complex electroplating processes, deep reactive ion etching (DRIE) and silicon etching with potassium hydroxide. These high-precision processes ensure defect-free, electrostatically optimized structures on the chips. At the beginning of 2025, Fraunhofer ISIT took first place in the organization's internal Best Customer Acquisition of the Month award with a contract from IMS Nanofabrication worth several million euros. The institute in Itzehoe has since received a follow-up order: The next technological leap will take semiconductor manufacturing beyond the 3-nanometer node using the TROM3 chip.

Funded initiative
High-tech early warning system for biodiversity

The Leibniz Institute for Zoo and Wildlife Research (Leibniz-IZW) and the Fraunhofer Institute for Integrated Circuits IIS have joined forces in the GAIA initiative, which aims to protect biodiversity. To that end, the partners are harnessing the natural intelligence of white-backed vultures (Gyps africanus), which detect dead animals in the savanna. By using the vultures to monitor entire swaths of land, the research consortium is creating a high-tech early warning system that can detect ecological changes and critical environmental events rapidly and accurately.

The researchers at Fraunhofer IIS developed camera tags with near-sensor AI, which are ideally suited for use in animal transmitters due to their extremely low power consumption and small size and weight. This part of the project was supported by Vectronic Aerospace GmbH. The satellite-based communication system, which is essential for transmitting data from remote areas, was developed in cooperation with Rapid Cubes GmbH. The efficient AI algorithms were developed by Fraunhofer IIS in cooperation with Leibniz-IZW. In this approach, the team consistently leverages edge computing: The collected raw data is preprocessed directly in the processor unit attached to the vulture, which means that only the extracted information has to be transmitted via satellite.

Building on this, the researchers are taking the technology one step further: When the vultures gather around a dead animal, their transmitters connect with one another and form a temporary ad hoc network. This distributes the computing load efficiently, improves data analysis performance and achieves even greater reliability.

TROM chip: unrivaled process for manufacturing microchips with structures smaller than 10 nanometers
Photo: Fraunhofer/photocompany Itzehoe

What does the vulture know (and what can it do)? GAIA combines natural intelligence and AI in the service of wildlife research and species conservation Photo: Jon A. Juarez

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Production

Industrial collaboration
Assistance system for safe crane control

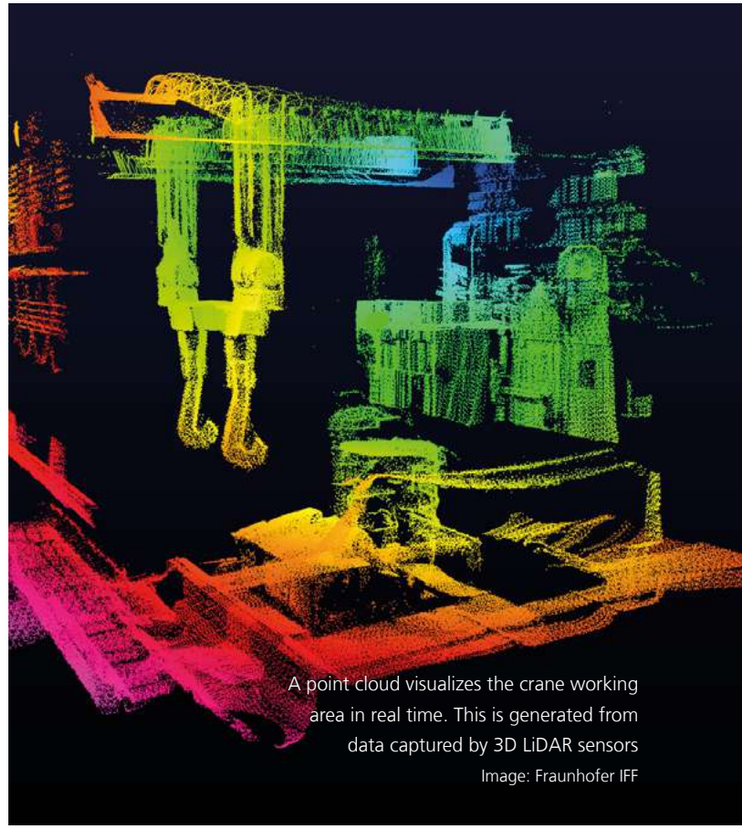
Process cranes are used in the steel and process industries to transport heavy and sometimes dangerous loads, including hazardous materials. In the steel industry, for instance, cranes move casting ladles that weigh 350 tons and are filled with molten metal. For the crane operator, visibility is often limited, especially when picking up a load. The currently available wired sensor systems designed to reduce the risk of dropped loads are only of limited use in extreme heat or when exposed to flames.

The Fraunhofer Institute for Factory Operation and Automation IFF, in collaboration with Kranbau Köthen GmbH, has now brought the Pro-Kran-Assist assistance system to production-ready status. The system is based on powerful 3D LiDAR sensors that generate more than one million measurement points per second. This allows the movements of the crane hook and the load sway to be analyzed in real time while picking up the load. The system status determined from this data is represented in a digital twin and transmitted to the crane operator. The clear visualization of the current positions of the crane hook and the casting ladle's trunnion, together with visual alerts of critical situations, enables loads to be picked up and set down safely—even in complex conditions with poor visibility. The Pro-Kran-Assist system operates autonomously and does not intervene in crane control. The system has proven itself under the harsh conditions of steel mills and is already in use at several steel plants operated by different companies. In all of these settings, it has significantly reduced hazards and improved employee working conditions.

Funded initiative
Centralized sustainability data from a single IT platform

A service-oriented IT platform enables production companies in particular to collect and process their sustainability data centrally and integrate it into their reporting. In the EcoHub project, funded by the German Federal Ministry of Research, Technology and Space (BMFTR), companies in the paper, chemical, recycling, metalworking, agriculture and food industries teamed up with research partners to develop an IT platform that records and processes sustainability data centrally. This includes data on energy consumption, greenhouse gas emissions and supply chains. The Fraunhofer Institute for Manufacturing Engineering and Automation IPA and the Wuppertal Institute for Climate, Environment and Energy were involved as project partners.

Collecting the sustainability information that measures a company's environmental, social and economic impact is an extremely time-consuming process. This is because the data required—such as how much electricity or gas certain machines use or the volume of exhaust air that needs to be filtered—has to be extracted from the pool of machine data. The IT platform developed during the project collects the data while accounting for aspects such as data security and access permissions. It then presents the information clearly together with AI-based forecasts. This can help identify material waste, for example, or reduce energy consumption and pollutant emissions. The platform can also support lifecycle analyses of lifespan and material flows as well as reporting and other services. A prototype of the platform is hosted and licensed by project partner ConAct GmbH. A demo version is planned for release.



A point cloud visualizes the crane working area in real time. This is generated from data captured by 3D LiDAR sensors
Image: Fraunhofer IFF

Resource Technologies and Bioeconomy

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Development of a palm oil-free compound in the lab
Photo: Mibelle Group, 2025

Modern processes help keep plastics in useful circulation while maintaining the quality required by industry and consumers Photo: Fraunhofer IVV

Industrial collaboration

Palm oil substitute from CO_2 recycling

After many years of research in the field of modern biotechnology, the Mibelle Group, LanzaTech and the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB have succeeded in producing palm oil-free fat from CO_2. The greenhouse gas CO_2 is converted into a palm oil-free fat blend by combining two successive fermentation processes. The novel fat blend is so similar in composition to palm oil that it could in the future replace tropical oils in a wide range of applications, including food, cosmetics, cleaning products and biofuels. Given that large areas of rainforest are still being cleared for palm oil cultivation, this groundbreaking innovation is a major opportunity for environmental and climate protection.

In the first stage of the fermentation processes, gas that would otherwise have been emitted as CO_2 is biotechnologically converted into alcohol using a gas fermentation process developed by LanzaTech. This process is loosely similar to brewing beer, except that CO_2 is used as the starting material rather than grain. During the second fermentation process, which was largely developed by Fraunhofer IGB, the alcohol produced from the CO_2 is converted into the required fats using specialized oleaginous yeasts. Both fermentation processes use only naturally occurring, non-genetically modified microorganisms. The end product is a versatile, high-quality fat that is 100 percent palm oil-free and natural. Following the development work at Fraunhofer IGB's Straubing branch and application testing by the Mibelle Group, the partners produced the first product samples at kilogram scale at the Fraunhofer Center for Chemical-Biotechnological Processes CBP in Leuna.

Funded initiative

Packaging made of recycled plastics

One of the targets set by the European Green Deal is that packaging will contain up to 30 percent recycled plastics by 2030. However, recycled plastics are not yet available in sufficient quantities. It is particularly important to produce recycled materials that are as pure and odor-neutral as possible. This can only be achieved by measures such as the implementation of new sorting technologies that can separate materials by type in order to improve recyclate quality. AI methods offer significant potential in this area, which is why the German Federal Ministry of Research, Technology and Space (BMFTR) launched the grant initiative AI Application Hub on Plastic Packaging—Sustainable Circular Economy Through Artificial Intelligence in 2022.

Numerous Fraunhofer institutes are also involved in the hub's two innovation labs: KIOptiPack, which focuses on design and production, and K3I-Cycling, which focuses on closing cycles. The innovation ecosystems for the circular economy created by Fraunhofer are contributing, for example, to the development and optimization of packaging and plastic recycling materials. Fraunhofer institutes are also involved in projects relating to digital twins and product passports. Other Fraunhofer activities focus on material identification to improve sorting quality. Overall, more than 50 partners from industry, science and society are involved in the hub, where they pursue the shared goal of closing the value chain and keeping plastic packaging in the loop. Milestones already achieved include a software solution for packaging development and IT models that connect stakeholders in the plastic packaging industry in a virtual data space.

Defense and Security

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

In collaboration with contracting authorities

AI against cyberattacks on companies

The threat of cyberattacks and industrial espionage has continued to rise in recent years. Many companies and government agencies therefore depend on security information and event management (SIEM) systems, which use detection rules and signature recognition to protect users from cyberattacks. However, attackers can bypass these with relative ease. A team of experts at the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE has now developed an open-source system named AMIDES (Adaptive Misuse Detection System), which uses AI to identify attacks often missed by conventional signature checks. In order to achieve maximum efficiency in real-world situations, supervised machine learning was used to train AMIDES to detect attacks that resemble existing signatures. The system was also optimized to keep false alarms to a minimum. AMIDES uses adaptive misuse detection to correctly distinguish potential attacks from harmless events. Analysts can also use AMIDES to assign rules to detected events—something that is not usually possible with machine learning approaches.

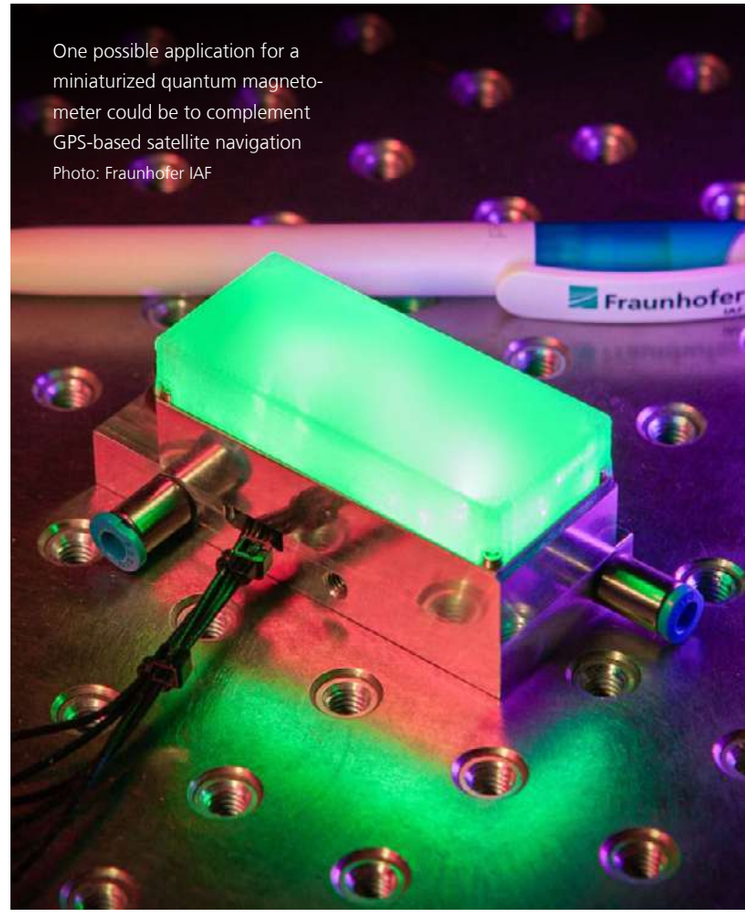
AMIDES has already been evaluated through extensive testing using real-world data from a German government agency. When set to standard sensitivity, the system successfully detected 70 percent of evasion attempts without false alarms. Measurements showed that the system is also fast enough for live operation in very large corporate networks. The freely available open-source software is aimed primarily at larger organizations that already have central security monitoring systems and processes in place and are now looking to improve them.

Funded initiative

Redefining measurement with quantum magnetometers

A compact integrated vector magnetometer offers the potential for extremely high measurement precision and entirely new applications. The quantum sensor developed at the Fraunhofer Institute for Applied Solid State Physics IAF is based on nitrogen-vacancy centers (NV) in diamond and can access even the weakest magnetic fields with exceptional precision and unprecedented flexibility. New applications are emerging wherever exact measurement is needed with minimal interference, for instance as an alternative to GPS navigation, to locate deeply buried objects such as unexploded ordnance or metal ore deposits, for biochemical measurements in nerve pathways and for materials testing in microelectronics. The researchers at Fraunhofer IAF achieved a 30-fold reduction in the size of their integrated quantum magnetometer within just one year. The sensor head was reduced to roughly the size of a conventional optically pumped gas-cell magnetometer. The measurement system is extremely robust, requires minimal calibration and is easy to use, while offering high sensitivity in the picotesla range. Water cooling is available as an option.

One example of a new application is an autonomous navigation system that is based on Earth's magnetic field and does not depend on satellite signals. This could complement GPS-based satellite navigation. The vector magnetometer also works in environments such as underground, underwater, in canyons, inside buildings or in tunnels. The compact integrated quantum magnetometer was presented at World of Quantum at the LASER trade show. The researchers are working on additional improvements. The ADEQUADE project receives funding from the European Union's European Defence Fund (EDF).



One possible application for a miniaturized quantum magnetometer could be to complement GPS-based satellite navigation
Photo: Fraunhofer IAF

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- **Awards**
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Awards

Fraunhofer science prizes in 2025

Joseph von Fraunhofer Prize

Since 1978, the Fraunhofer-Gesellschaft has awarded the Joseph von Fraunhofer Prize annually to its employees for outstanding scientific achievements that solve practical problems. Criteria for awarding the prize include how new and innovative the scientific and methodical approach is, the advancement of knowledge and the implementation of the scientific results in practical applications. Three Joseph von Fraunhofer Prizes were awarded in 2025, each endowed with €50,000 in prize money.

Innovations for a Better Future Award from the Fraunhofer Future Foundation

The Fraunhofer Future Foundation supports technological research projects that aim to overcome global challenges. It therefore supports Fraunhofer researchers in developing products, services and business models that enhance people's quality of life and that focus on more than purely economic benefits. In 2025, the Fraunhofer Future Foundation presented the Innovations for a Better Future award for the first time. This award recognizes the achievements of a Fraunhofer team that has succeeded in translating a technological solution into practice, thereby making a special contribution to sustainable development in line with the UN Sustainable Development Goals (SDGs). The prize is endowed with €50,000 and made possible by generous support from private donors. This project-specific funding will be used to further develop the project.

Fraunhofer Founder Award

The High-Tech Gründerfonds and the Fraunhofer-Gesellschaft have awarded the Fraunhofer Founder Award, endowed with €50,000, every year since 2016. The award goes to a successful spin-off that generates direct benefits for society through its products and services. The High-Tech Gründerfonds was founded in 2005 by representatives of the German Federal Ministry for Economic Affairs and Energy (BMWE), the industrial sector and industry experts.

Hugo Geiger Prize

The Bavarian Ministry of Economic Affairs, Regional Development and Energy awards the Hugo Geiger Prize for outstanding doctoral theses written in collaboration with Fraunhofer institutes. The award is named after the Bavarian State Secretary Hugo Geiger, who sponsored the inaugural assembly of the Fraunhofer-Gesellschaft on March 26, 1949.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Photo: Fraunhofer/Piotr Banczerowski

(From left) Benjamin Schumm, Stefan Kaskel and Holger Althues

2025 Joseph von Fraunhofer Prize

Energy transition—sustainable, low-cost batteries for the electric vehicle of tomorrow

Electric mobility and the associated sustainable, low-cost production of lithium-ion batteries are crucial to the transformation of the energy sector. To compete with manufacturers based in Asia, German automotive firms and battery cell producers are working on alternatives to the costly and energy-intensive process of coating electrodes.

Benjamin Schumm, Holger Althues and Stefan Kaskel from the Fraunhofer Institute for Material and Beam Technology IWS in Dresden have succeeded in developing an efficient and scalable alternative to conventional electrode coating. Their DRYtraec method reduces energy demand, thereby also lowering the costs of producing battery electrodes. This may help boost the competitiveness of battery production in Germany. DRYtraec technology, which is protected by basic patents, involves creating an electrode coating directly from a dry mixture consisting of active material, conductive carbon and binders. Unlike the conventional method, no solvents are used in the process. This eliminates the energy-intensive drying step, and coating systems can be made about 50 percent more compact. The innovative method is an outstanding step forward in sustainable production of current and future batteries and has already attracted great interest from businesses along the battery value chain. The jury highlighted the "high potential for independent battery production in Germany and Europe."

Foreword

Contents

Executive board's report

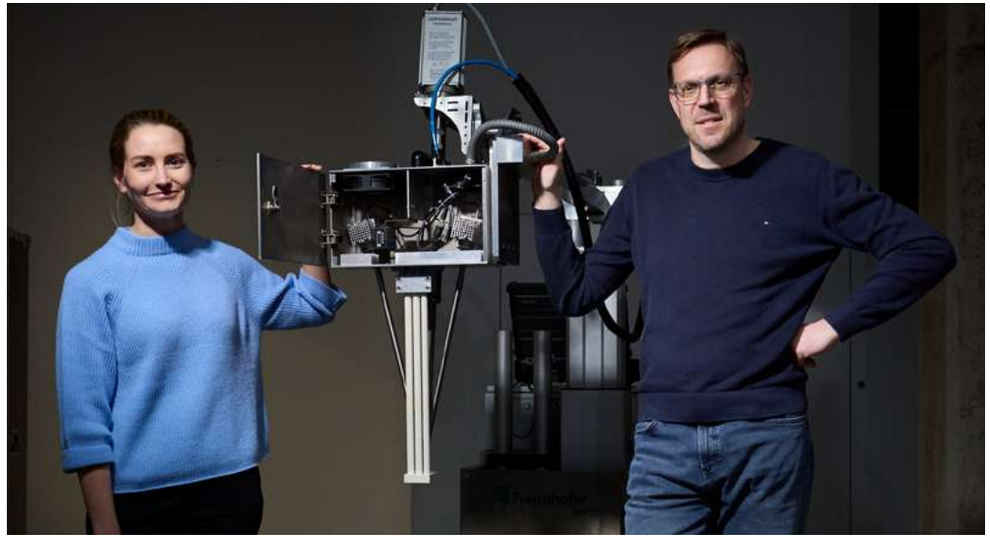
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information



Andrea Mross (left) and Thomas Waschkies were awarded the 2025 Joseph von Fraunhofer Prize for their development of the mobile, ultrasound-based measuring system AloX

2025 Joseph von Fraunhofer Prize

Aluminum production—ultrasound reliably detects inclusions

Aluminum is a raw material that can be used strategically to achieve climate neutrality. The use of secondary aluminum contributes to the circular economy—but only if the recycled raw material is sufficiently pure. The Fraunhofer Institute for Nondestructive Testing IZFP addressed this issue by developing AloX, an ultrasound-based measurement system, and adapting it to the extreme conditions found in molten aluminum. This cost-effective tool enables fast, continuous and precise measurement of nonmetallic inclusions in molten aluminum. In its statement, the jury emphasized that the team had entered "uncharted territory" by adapting ultrasonic measurement technology to the conditions involved in working with molten aluminum.

Thomas Richter, Joachim Keinert and Siegfried Fössel (from left) have established an internationally recognized ISO standard with their comprehensive software and patent portfolio Photos: Fraunhofer/Piotr Banczerowski

2025 Joseph von Fraunhofer Prize

JPEG XS—pioneering standard for All-IP video production

JPEG XS, developed by the Fraunhofer Institute for Integrated Circuits IIS, is a next-generation image compression format that transmits high-quality images to production environments with minimal latency, low resource consumption and virtually no loss of quality. Beyond its unique role in transmitting very high-quality images, it also offers economic advantages for studio technology and other fields, such as machine vision and self-driving vehicles. Among the points noted by the jury was the fact that this groundbreaking standard has already been implemented in devices produced by various manufacturers. The developers of JPEG XS also won a Technology & Engineering Emmy® Award.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Innovations for a Better Future Award from the Fraunhofer Future Foundation

A healthcare platform for off-road vehicles

As part of the PreCare project, research teams from the Fraunhofer Institute for Surface Engineering and Thin Films IST and the Fraunhofer Institute for Solar Energy Systems ISE have developed a solution enabling people in remote regions to access comprehensive medical care. It consists of a flexible, modular healthcare platform that can be mounted on off-road vehicles and is already in use in South Africa and Namibia. The health platform, mounted on the bed of a pickup truck, offers the infrastructure needed for a medical examination in a very compact space. Electrical equipment, such as the refrigeration system for medications and blood samples, is operated via an independent solar power supply. There is even a water purification system on board. A system based on diamond-coated electrodes makes it possible to produce disinfectants from a simple sodium chloride solution while in the field. The first prototype was delivered to an NGO in South Africa in 2023. Funding from the Fraunhofer Future Foundation then made it possible to develop a second prototype in Namibia. S Mile Solutions (Pty) Ltd, which was founded during the project, is now handling the manufacturing, sales and maintenance. It is Fraunhofer's first spin-off in South Africa.

PreCare combines innovation with the needs of communities in rural areas. Its adaptability to medical requirements sets new standards for mobile healthcare. In their remarks praising this year's winner, the jury highlighted the network of researchers, companies, non-governmental organizations and government agencies and the focused efforts made by the partners, which can be extended to areas such as disaster aid and veterinary medicine.

(From left) Frank Neumann, Ricarda-Laura Sack, Joachim Koschikowski and Simone Kondruweit-Reinema

Photo: Fraunhofer/Piotr Banczerowski

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Arik Lämmle (Cellios CEO, center) with Nils Lang (right), High-Tech-Gründerfonds, and Fraunhofer President Holger Hanselka at the presentation of the 2025 Fraunhofer Founder Award
Photo: Fraunhofer / Markus Jürgens

Fraunhofer Founder Award

Cellios offers automated cable assembly

The Fraunhofer spin-off Cellios GmbH has won the Fraunhofer Founder Award, which is endowed with €50,000. The spin-off of the Fraunhofer Institute for Manufacturing Engineering and Automation IPA impressed the jury with a robotics solution that closes an automation gap for Industry 4.0. Cellios is revolutionizing industrial production with an application for fully automated cable assembly. Its force-control software enables robots to insert and route cables with almost the same sensitivity as human hands. The solution addresses key challenges facing domestic industry: skills shortages, high labor costs and fragile global supply chains. Its intelligent Robotic Assembly Cell (intRAC) is a turnkey hardware and software solution. Its applications range from demanding cable assembly tasks to the assembly of complex wiring harnesses for the automotive industry. Thanks to its modular design, the solution can be adapted to operational requirements and deployed immediately. It also offers significant potential for cost savings for industrial companies: Until now, manual assembly has accounted for around 75 percent of total costs, forcing many companies to relocate their manufacturing operations abroad. Cellios robot cells achieve an automation level of more than 90 percent and can be operated by the company's current staff at competitive cost. The investment pays off after two to three years.

At the award ceremony, the jury acknowledged the strong message this sends for Germany as an industrial base: Cellios is a prime example of what Fraunhofer aims to achieve through technology transfer—cutting-edge research that solves real-world problems and gives small and medium-sized enterprises (SMEs) a competitive edge.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

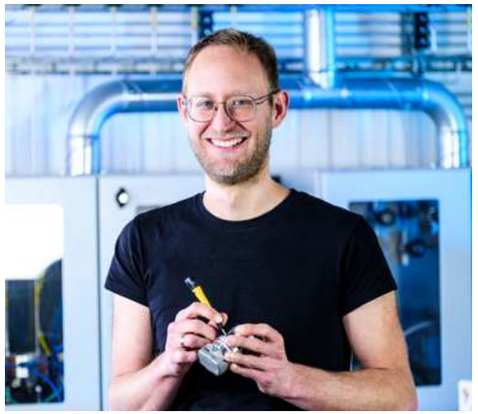
About Fraunhofer

Publisher's information

Christopher Spiess, Fraunhofer IOF
Photo: Fraunhofer IOF

2025 Hugo Geiger Prize | First place
Synchronization in picoseconds with single photons

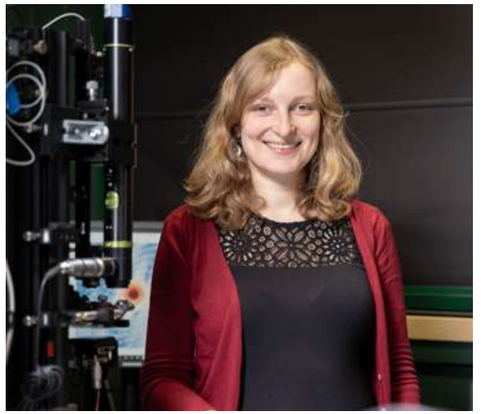
High-precision time synchronization is key to the security and efficiency of modern technologies—including quantum communication, the secure counterpart to conventional data transmission. In his dissertation at the Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Christopher Spiess developed a process that does not require additional synchronization lasers or ultra-stable atomic clocks and can be seamlessly integrated into existing quantum communication systems. His approach relies solely on the single photons already present in the system, thus enabling picosecond accuracy with minimal resources—both in turbulent free-space links and in fiber-optic links several kilometers long.



Christian Weber, Fraunhofer IPM
Photo: Fraunhofer IPM

2025 Hugo Geiger Prize | 2nd place
Innovative trace-gas sensors using the photoacoustic effect

For his doctorate with the Fraunhofer Institute for Physical Measurement Techniques IPM, Christian Weber developed measurement techniques for monitoring harmful trace gases such as CO_2 and NO_2 reliably and cost-effectively over large areas. These are based on the photoacoustic effect: light generates sound, the intensity of which delivers precise information about gas concentrations. Weber developed a small CO_2 sensor with low power consumption and low maintenance requirements along with a compact, highly sensitive NO_2 sensor. The sensors can detect these gases much more reliably and cost-effectively than before, for instance in tunnels, in medical technology or when searching for leaks. The sensor technology has already been integrated into more than ten industry projects.



Anne-Sophie Munser, Fraunhofer IOF
Photo: Fraunhofer IOF

2025 Hugo Geiger Prize | 3rd place
Detecting bacteria and resistance more quickly

Anne-Sophie Munser's doctoral work with the Fraunhofer Institute for Applied Optics and Precision Engineering IOF involved applying angle-resolved scattered-light analysis, a measurement technique used in photonics, to microbiological samples. This makes it possible to visualize even small numbers of bacterial cells within just a few hours, thus eliminating the need for time-consuming cultivation. The method is based on characteristic light scattering, which provides information about cell structure and aggregation. It is suitable for compact high-throughput systems and can be integrated into a lab-on-a-chip. It can help detect dangerous antibiotic resistance at an early stage and is also useful for monitoring food and drinking water.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

National and international research prizes

Photo: Fraunhofer IIS

At the 2025 Emmy® Awards, where the JPEG XS took a prize: (from left) Thomas Richter, Wolfgang Heppner and Siegfried Fössel

Technologies for the dream factory

Fraunhofer researchers have now received a Technology & Engineering Emmy® Award for the sixth time. The award, presented in October 2025, honored the development of JPEG XS and the implementation of the video codec in products used in next-generation media production workflows (see page 71). In December, the team led by Ingo Hoffmann of the Fraunhofer Institute for Integrated Circuits IIS was delighted to receive a second Emmy. Together with the MPEG (Moving Picture Experts Group) systems group, he accepted a Technology & Engineering Emmy® Award in New York. The award was given in recognition of the Common Media Application Format (CMAF), which helped standardize the fragmented streaming landscape of the 2010s, when content still had to be adapted to different protocols and playback devices.

Four awards had previously been presented for developments in which researchers from the Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut, HHI played a major role. In 2008 and 2009, Emmys were awarded in recognition of the video coding standard H.264 (MPEG-4 AVC), which enables a significant reduction in video data and serves as the technical basis for digital video distribution across formats ranging from HDTV to streaming and social media services. In 2014, MPEG was honored for developing the MPEG-2 transport stream. In 2017, this was followed by an Emmy® Engineering Award for the HEVC standard, which enables videos to be transmitted efficiently in ultra-high definition. In 2012, a team of researchers from ARRI® and the Fraunhofer Institute for Physical Measurement Techniques IPM had accepted an Academy Award of Merit from the Academy of Motion Picture Arts and Sciences for the design and development of ARRILASER, a laser film recorder.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

The Synergy Grants awarded by the European Research Council (ERC) are among Europe's most prestigious and highest-funded research awards. They are granted exclusively to teams whose members come from different disciplines and are combining their expertise to pursue a particularly ambitious research goal with potentially groundbreaking impact.

Stefan Glunz
Photo: Fraunhofer ISE

ERC Synergy Grant
Solar cells of the future: resource-saving and more efficient

Stefan Glunz's aim with the UltimatePV—Ultimative Photovoltaics project is to develop a future generation of resource-efficient photovoltaic technologies with maximum conversion efficiency. Photonic structures will greatly improve the optical properties of the solar cells while reducing material consumption tenfold. This will make it possible to create ultrathin solar cells with a significantly higher concentration of charge carriers. Once excited by light, the charge carriers can be extracted using energy-selective contacts before they lose part of their energy through thermalization. Glunz is professor of photovoltaic energy conversion at the Institute for Sustainable Systems Engineering (INATECH) at the University of Freiburg and heads the photovoltaics research division at the Fraunhofer Institute for Solar Energy Systems ISE. The other scientists involved in the Ultimative Photovoltaics project are Christoph Ballif from EPFL (École polytechnique fédérale de Lausanne, Switzerland) and Stéphane Collin from the National Centre for Scientific Research (CNRS, Paris, France). The partner institutes include the Centre Suisse d'Electronique et de Microtechnique (CSEM), the Center for Nanoscience and Nanotechnology (C2N) and the Institut Photovoltaïque d'Île-de-France (IPVF).

Rüdiger Quay
Photo: Fraunhofer IAF

ERC Synergy Grant
Future mobile networks: using half the energy

A revolutionary technology for digital high-frequency amplifiers could help counteract the growing energy demand of future mobile networks. As part of the DISRUPT (Digital RF Power) project, Rüdiger Quay, Director of the Fraunhofer Institute for Applied Solid State Physics IAF, will be working with an international team of experts from TU Delft and University College Dublin to develop a revolutionary digital high-frequency amplifier technology designed to substantially reduce the rising energy demand of future mobile networks. DISRUPT addresses the growing environmental impact of wireless communication. The current carbon footprint of global wireless communication networks is comparable to that of aviation, accounting for 2 to 3 percent of CO_2 emissions. Without significant innovations, this figure will rise sharply as 5G and 6G communication systems become more widespread. DISRUPT aims to develop a groundbreaking digital high-frequency architecture for power amplifiers that could reduce the energy consumption of next-generation mobile networks by up to 50 percent. The consortium will work closely with industry partners to ensure rapid technology transfer and long-term benefits for society.

Foreword

Contents

Executive board's report

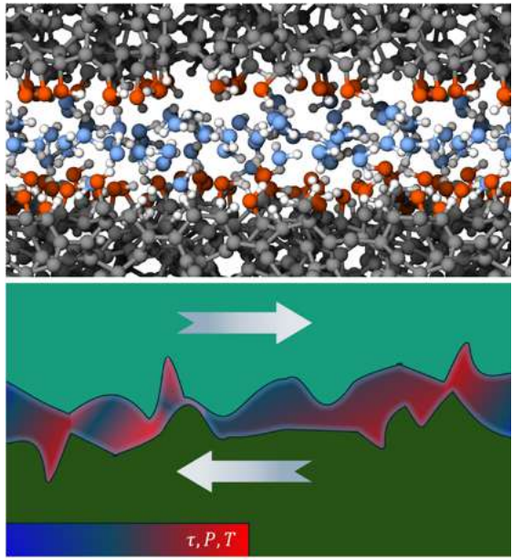
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information



Simulation of a friction contact: The digital twin for lubricants in highly loaded friction contacts establishes a mathematical link between macroscopic friction and the atomic dynamics in the lubrication gap. A better understanding of the fundamental causes of friction-related energy consumption in technical systems such as bearings and drives would facilitate the construction of more energy-efficient machines, industrial systems and vehicles.
Image: Fraunhofer IWM

Michael Moseler
Photo: Kai Wudtke/
Fraunhofer IWM

ERC Advanced Grant
Digital twin for reducing friction losses in industrial systems

The ERC Advanced Grant enables Europe's leading researchers to continue pursuing their research projects by awarding €2.5 million per project. In 2025, one such grant was awarded to Michael Moseler, Business Unit Head at the Fraunhofer Institute for Mechanics of Materials IWM and professor of simulation of functional nanosystems at the University of Freiburg. Moseler's work focuses on modeling friction, lubrication and wear at the atomic level. In systems where components move against one another, calculations suggest that friction losses can account for up to 20 percent of their energy consumption. Michael Moseler aims to leverage this potential for energy savings and sustainability by developing a digital twin (LubeTwin) for lubricated friction contacts. In order to gain virtual insight into friction mechanisms that have so far remained unexplored and inaccessible, the project will, for instance, generate extreme-scale atomistic simulations using data from up to one billion atoms and combine them with machine-learning-based AI models. The project will place particular emphasis on classical and quantum-mechanical molecular dynamics simulations of tribologically induced phase transitions, as well as the rheology and reactivity of lubricants.

Lucie Flek
Photo: Maximilian Waidhas/
University of Bonn

ERC Starting Grant
AI systems with social intelligence

Lucie Flek has received one of the starting grants awarded by the European Research Council (ERC) worth €1.5 million. The computer science professor conducts research at the Lamarr Institute, involving the Fraunhofer Institutes for Intelligent Analysis and Information Systems IAIS and for Material Flow and Logistics IML, as well as at the Bonn-Aachen International Center for Information Technology (b-it). Flek will use the grant to advance a project aimed at making AI more socially intelligent. The LLMpathy project aims to train AI systems to analyze and correctly explain human thoughts and emotions, much as they already handle mathematical problems. AI systems are increasingly taking on social roles such as counselors or conversational partners in difficult situations. Until now, however, they have often failed at moments when empathy, judgment and social understanding matter most. Socially intelligent AI systems could also help uncover unethical forms of personalization, such as AI exerting emotional pressure in advertising, and ensure that future AI systems meet high standards of transparency, trustworthiness and ethical conduct—in line with the upcoming EU AI Act.

Foreword

Contents

Executive board's report

Senate's report

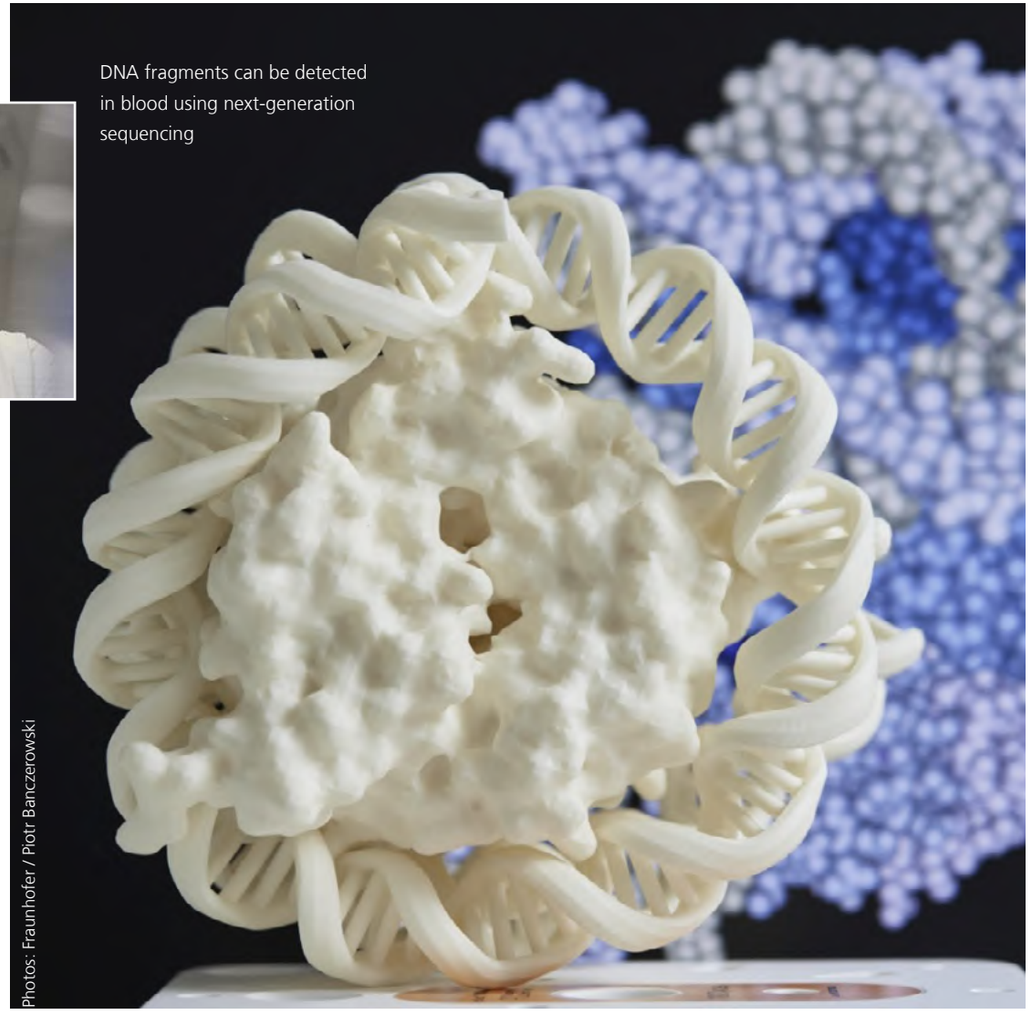
Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Kai Sohn



DNA fragments can be detected in blood using next-generation sequencing

Photos: Fraunhofer / Piotr Banczerowski

EARTO Innovation Award—Impact Delivered
New procedure for diagnosing sepsis

The European Association of Research and Technology Organisations (EARTO) presents annual awards for innovations with significant economic and social impact. In 2025, a high-throughput method for identifying sepsis pathogens won second prize in the Impact Delivered category. This novel method is based on next-generation sequencing (NGS) and was developed at the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB.

The conventional method of culturing pathogens from a blood sample in the laboratory not only takes time but also delivers a positive result in only 30 percent of cases. The new Fraunhofer method uses the genetic material of the pathogens present in the blood and enables the isolation and sequencing of up to 30 million DNA fragments. For DNA fragments of non-human origin, the sequencing results are compared with a specially developed database containing genome sequences from bacteria, viruses, fungi and parasites. This allows pathogens to be reliably identified within just 24 hours. Clinical studies led by Universitätsklinikum Essen (University Hospital Essen) confirm that the new approach clearly outperforms previous diagnostic standards. Faster diagnostics combined with precisely targeted therapy allow patients to recover more quickly, thus reducing costs for the healthcare system. The diagnostic method is marketed commercially by Noscendo GmbH, a Fraunhofer IGB spin-off. Hospitals can also send samples to the startup and have them analyzed within a very short time. Blood samples from more than 15,000 patients have been analyzed in this way over the last five years.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

EU Commission RegioStars Award

New mobility on old tracks

At the EU Commission's RegioStars Awards for 2025, the transportation project MONOCAB with its vision "New Mobility on Old Tracks" was announced as the winner of the category A "Connected Europe." The aim is to use a gyroscopically stabilized, self-driving monorail vehicle (MONOCAB) to bring disused railway lines in rural areas back into service and provide flexible local passenger transport. The vehicle is designed as a single cabin for 4 to 8 passengers that runs on just one rail, allowing vehicles traveling in opposite directions to pass each other on a single track. This could help preserve rural communities. According to the jury, this project shows how social innovation and technological excellence can go hand in hand. MONOCAB started out as a voluntary initiative and has attracted numerous supporters and sponsors. The project partners are the universities of Ostwestfalen-Lippe and Bielefeld and the Lemgo institute branch of the Fraunhofer Institute for Optronics, System Technologies and Image Exploitation IOSB. A family of MONOCAB projects has now been established at the Fraunhofer location in Lemgo. The goal is for MONOCAB vehicles to be production ready by 2032.

Self-driving monorail vehicle on the test track in Extertal
Photo: MONOCAB

JEC Composites Innovation Awards 2025

Novel lightweight designs for transportation

The Multi-Functional Fuselage Demonstrator (MFFD) received the JEC Composites Innovation Award for 2025 in the Aerospace—Parts category. Fraunhofer played a significant role in the development of the MFFD as part of the EU's Clean Sky 2 and Clean Aviation programs. With the MFFD, a consortium of industry and research partners became the first in the world to demonstrate that thermoplastic construction methods suitable for automated manufacturing can increase production efficiency in high-rate aircraft fuselage production while significantly reducing weight. The demonstrator achieved a 10 percent reduction in weight, thereby reducing CO_2 emissions while cutting production costs by 10 percent. Fraunhofer contributed by automating the assembly of the upper and lower shells of the MFFD's eight-meter-long fuselage section and developing the laser welding and gap-filling processes used for thermoplastic CFRP joints. A storage compartment flap for a truck cab made using a lightweight sandwich design won a JEC Innovation Award in the Automotive and Road Transportation—Process category (see page 67).

The aircraft fuselage section at Fraunhofer in Stade, fully joined by thermoplastic welding
Photo: Fraunhofer IFAM

Awards for digital airfreight

How airfreight is becoming more digital

The achievements of the Digital Testbed Air Cargo (DTAC) project have been recognized by several awards at high-level industry events. In 2025, the consortium, led by the Fraunhofer Institute for Material Flow and Logistics IML, was presented with the STAT Times International Award for Excellence in Air Cargo in Nairobi (Kenya). Competitors included big-name industry stakeholders. The award was given out at air cargo Africa 2025, a leading industry trade show and conference. It marks a milestone in the air cargo project's success story. The STAT Times International Awards for Excellence in Air Cargo are prestigious awards in the air cargo industry. They recognize significant contributions, innovations and leadership, helping inspire further innovation and growth within the air cargo community. Later, the International Air Cargo Association (TIACA) presented the Air Cargo Sustainability Award to the consortium at a ceremony in Hong Kong. This prize is awarded to outstanding companies and industry initiatives aimed at making air cargo more sustainable. The jury was also impressed by the consortium's social engagement in various school projects.

Digitalization and automation in action for more sustainable air freight
Photo: Fraunhofer IML/Vinzenz Neugebauer

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Sustainability Award in Automotive
Electric semitrailer tractors

The Sustainability Award in Automotive is awarded annually by the ATZ/MTZ publishing group in collaboration with experts from Arthur D. Little. It recognizes sustainable solutions that help achieve climate protection and sustainability goals. The winner of the Open Innovation category was a project funded by the German Federal Ministry for Economic Affairs and Energy (BMWE) and involving the Fraunhofer Institute for Structural Durability and System Reliability LBF. The evTrailer2 research project assesses the potential of various technologies for electrified semitrailer systems in long-distance transport (N3 vehicles, meaning goods vehicles over twelve metric tons) and for driving safety. The aim is to develop efficient technologies to reduce fuel consumption and greenhouse gas (GHG) emissions from semitrailer tractors. The research group identified and successfully combined highly efficient technologies for reducing fuel consumption and GHG emissions. By optimizing an electrically powered semitrailer to reinforce the tractor unit's traction, the project cut GHG emissions by up to 40 percent.

Autonomous electric drive collaboration system for truck and vehicle trailers
Image: evTrailer Zeichnung/ CuroCon GmbH

Werner Siemens Foundation funds tandem photovoltaics
Cutting material and manufacturing costs

Every year, the Swiss-based Werner Siemens Foundation provides funding for a small number of pioneering technical and scientific research projects that address major challenges of our time. The Foundation awards substantial grants to finance the initial phase of outstanding, innovative technical and scientific projects with strong application potential. The funded projects should then be able to continue independently after a few years, while the resulting innovations should be ready for industrial use. In 2025, a team from the Fraunhofer Institute for Solar Energy Systems ISE qualified for funding with its Sustainable Energy Transition Through High Efficiency Tandem Photovoltaics project. The Werner Siemens Foundation will be providing €14 million by 2032 to help this promising technology achieve commercial success.

Researchers at Fraunhofer ISE have been working on high-efficiency III-V multi-junction solar cells for more than twenty years. This type of cell stacks two to six subcells made of III-V compound semiconductors or germanium on top of one another to make optimal use of sunlight. Fraunhofer ISE holds numerous records in this field, including for the world's most efficient solar cell, with an efficiency of 47 percent, and for the most efficient hybrid concentrator PV module, with an output of 350 W/m^2. III-V multi-junction solar cells achieve the highest efficiencies of any photovoltaic technology. They are robust and remain stable over long periods, which is why they have been used by satellites in space for more than twenty years. However, they have not yet gained a foothold in the market because their material and manufacturing costs are around 100 times higher than those of standard solar cells.

Over the next few years, Fraunhofer ISE aims to significantly reduce the manufacturing costs of these cells and make their use in concentrator and flat-plate modules more economically viable. In the years ahead, the technological work will focus on two areas: reusable substrates for III-V epitaxy and very low-cost, scalable processes for epitaxy and solar cell manufacturing. The team also plans to demonstrate next-generation concentrator PV modules. The Fraunhofer-Gesellschaft will be providing another €1.4 million for the upcoming research work.

Frank Dimroth (left) and Andreas Bett with high-efficiency multi-junction solar cells
Photo: Fraunhofer ISE/Dirk Mahler

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Factory Innovation Award

Factories that save energy and resources

The Smart E-Factory project won a Factory Innovation Award for 2025 in the category "Research / Sustainable Factory." The project enables factories to improve their energy efficiency and conserve more resources during production, thus pursuing an important goal designed to safeguard the competitiveness of German manufacturing companies. By developing innovative technologies, for instance to optimize the use of renewable energy, AI and DC grids, the project is making a vital contribution to the UN's Sustainable Development Goals, especially in the areas of clean energy (SDG 7) and climate action (SDG 13). The award recognized the SmartFactory OWL consortium and the Lemgo institute branch of the Fraunhofer Institute for Optronics, System Technologies and Image Exploitation IOSB. The Smart E-Factory project is funded by the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN). The award is presented in cooperation with Hannover Messe and the organizer GITO Verlag. Each year, the Factory Innovation Award is presented to the best smart factory software solutions in Europe.

Living laboratory for Industry 4.0 at SmartFactory OWL in Ostwestfalen-Lippe
Photo: Fraunhofer IOSB

German Sustainability Award

Solar institute demonstrates sustainability in operation

The Fraunhofer Institute for Solar Energy Systems ISE won the German Sustainability Award in the Research and Development category. This award recognizes Fraunhofer ISE's sustainability research and its commitment to integrating sustainability into its operational processes. In its statement, the jury highlighted the institute's Energy Charts and the record-breaking efficiency of its photovoltaic (PV) modules, with particular emphasis on the restructuring of Europe's largest solar research institute: "Its own infrastructure serves as a living laboratory for pioneering technologies, including building-integrated photovoltaics and innovative heating and cooling systems. This is complemented by a clear governance system, energy management certified to ISO 50001, regular greenhouse gas emission inventories and active resource management, ranging from chemical sharing platforms to IT hardware reuse." The German Aerospace Center (DLR) and GEOMAR Helmholtz Centre for Ocean Research were honored alongside Fraunhofer ISE in the same award category.

PV modules with a green MorphoColor® structural layer on the wall of the Fraunhofer ISE building
Photo: Fraunhofer ISE
Benedikt Bläsi

Award for 3D printer drivers

Global licensing demonstrates demand

One way in which the German Federal Ministry of Research, Technology and Space (BMFTR) promotes the transfer of scientific results into application and commercialization is through its program "Validation of the Technological and Societal Innovation Potential of Scientific Research (VIP+)." One of the 2025 validation awards went to a development from the Fraunhofer Institute for Computer Graphics Research IGD: Researchers working on the Robust3D project advanced the development of a technology for the automated preparation of complex graphical 3D models for 3D printing and successfully validated its ability to guarantee printability. The method automatically corrects structural model errors such as holes, non-manifold edges and geometries that are too thin. This can reduce the number of manual corrections required. The technology has been integrated into the Cuttlefish® 3D printer driver and is licensed worldwide, for instance to big tech companies, Hollywood studios, 3D printer manufacturers, game developers and healthcare companies that produce cosmetic prosthetics. The 3D printer driver is an important step toward individualized mass production in 3D printing, even when the input models contain errors.

Cuttlefish® has already been used to produce hundreds of thousands of PolyJet 3D prints for customers in a range of industries
Photo: Fraunhofer IGD

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- **People behind the research**
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

People behind the research

Here we spotlight researchers whose enthusiasm and expertise reflect Fraunhofer's work. Through their research, Fraunhofer is making a key contribution to securing Germany's future as an industrial base.

Top: (From left) Claudia Eckert, Diego Collarana and Manuela Junghähnel
Bottom: (From left) Wolfgang Koch, Sarah Klein and Hans-Martin Henning

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

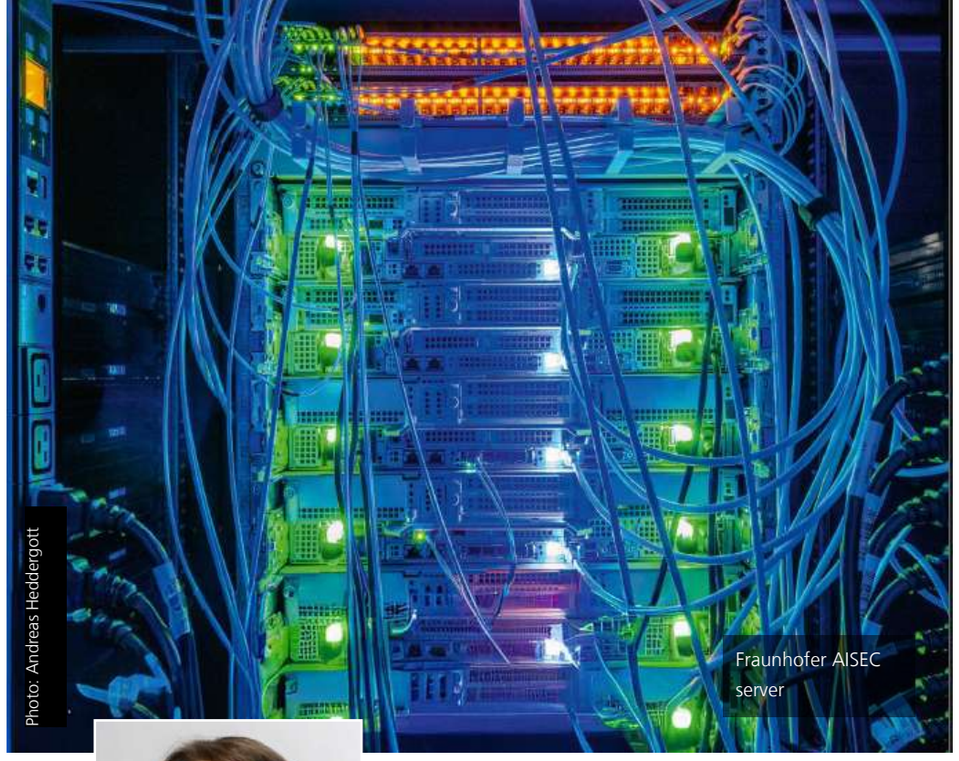


Photo: Andreas Heddergott

Fraunhofer AISEC server

Photo: Bernd Müller

"We have reason to be optimistic. We have outstanding research, we have highly successful small and medium-sized companies that are willing to innovate, and we also have startups."

Claudia Eckert

Digital sovereignty as a lifelong mission

Digital systems control production, transportation and healthcare systems—in fact, almost every aspect of our lives. However, while these systems create new possibilities and opportunities, they also entail risks, especially given the rise of AI and quantum-based systems. Countless cyber incidents—with numbers still rising—have shown what would be at stake without reliable security architectures, whether in the energy sector or in healthcare, industrial production, corporate services or public administration. Few research scientists in Germany have devoted their lives and careers as tirelessly to the security of digital systems as Claudia Eckert. For decades, she has played a major role in shaping IT and cybersecurity in Germany and Europe, both in the scientific community and as an advisor to ministries and companies. As a professor, she has trained generations of security experts. As director of the Fraunhofer Institute for Applied and Integrated Security AISEC, she has shaped the debate around a new security culture, in which security requirements are integrated into the development, operation and use of digital services from the outset with the aim of improving the security of mainstream commercial products in the long term.

Claudia Eckert has served as scientific president of acatech (German National Academy of Science and Engineering) since June 2025. In April 2026, Siegfried Russwurm joined her as co-president representing industry. As a bridge between engineering and industry, acatech focuses on expertise, innovation and growth, all of which are urgently needed today. This was made very clear at acatech's ceremony at the end of 2025, which was held in the presence of the German Chancellor. Friedrich Merz emphasized that the future of Germany and Europe depends on the strength of their research and development activities, since they would determine "how prosperous, how free and how safe we will be." Claudia Eckert is well aware that innovation has to be translated into value creation more quickly. At the same time, she emphasizes that disruptive key technologies require endurance. And because Eckert is described as a dedicated scientist with a strong commitment to supporting young talent, she closed the ceremony with an appeal: "We have reason to be optimistic. We have outstanding research, we have highly successful small and medium-sized companies that are willing to innovate, and we also have startups. We need to combine all of this with courage and a willingness to take risks."

Claudia Eckert
Director of the Fraunhofer Institute for Applied and Integrated Security AISEC | Professor of Security in Computer Science, Technical University of Munich | Scientific President of acatech—German National Academy of Science and Engineering

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

TEUKEN is multilingual: 24 European languages reflect European diversity
Image: Fraunhofer IAIS

"Germany's economy needs to reclaim its position at the global forefront of AI development. The necessary scientific expertise is there."

Diego Collarana

Photo: Fraunhofer FIT

Part of a remarkable story

Diego Collarana is an expert in AI reliability, especially in large language models. He specializes in knowledge graphs, which can be used to structure, verify and refine the content of language models for specific contexts. The group manager at the Fraunhofer Institute for Applied Information Technology FIT previously worked at two other Fraunhofer institutes and fully embraces the mission of supporting innovations all the way to market: "I am truly excited to work for Fraunhofer and to be part of this remarkable story." In the early 2020s, for instance, he and his Fraunhofer team at that time developed semantic models for intelligent and AI-based data analyses for ZF Friedrichshafen.

His scientific publications focus on commercial relevance. His 2016 IEEE paper on the importance of semantic asset administration shells for Industry 4.0 is considered a seminal work in this field. In 2025, he made a significant contribution to a DIN SPEC, a standardization document designed to accelerate the commercialization of new technologies or processes. This addressed the question of how language models can create value for companies. The answer: with automation and the development of new business models based on context-specific language models. This is where Diego Collarana sees opportunities that could rekindle Germany's economic growth.

Computer scientist Collarana first came to Europe from his native Bolivia in 2011 through the ERASMUS program, initially spending time in Madrid, then moving to Geneva and finally to Kaiserslautern. From 2019 to 2023, he worked at the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, contributing to the development of the SPEAKER conversational AI platform and the TEUKEN language model. His current research group at Fraunhofer FIT is developing methods facilitating the knowledge-guided generation of language models with the aim of reducing hallucinations and increasing explainability.

Collarana says that discipline and the indefatigable pursuit of his goals, even when faced with resistance, are what brought him to where he is today: "In Bolivia, structural obstacles strengthen your resilience." Since 2020, he has been teaching Bolivian AI students part-time to support those in his home country who are working hard to drive progress and growth. As for the country that has become his second home, he says: "Germany's economy needs to reclaim its position at the global forefront of AI development." In Diego Collarana's opinion, the scientific expertise needed to achieve this goal is already present.

Diego Collarana
Group Manager for Knowledge-Enhanced Large Language Models, Fraunhofer Institute for Applied Information Technology FIT | Dr. rer. nat. (magna cum laude) University of Bonn | Director of the Institute for Computational Intelligence, Universidad Privada Boliviana

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

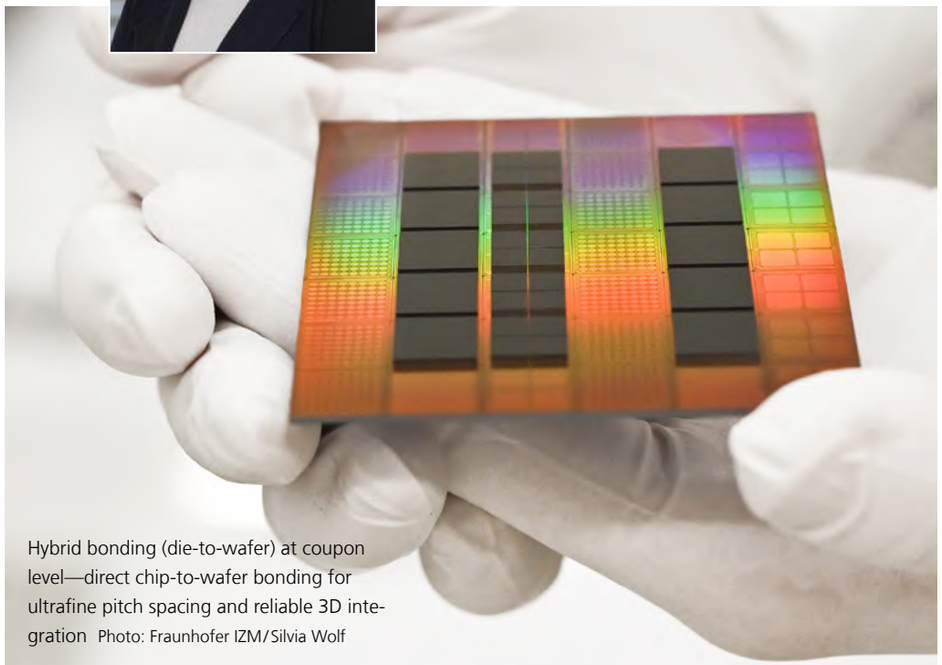
About Fraunhofer

Publisher's information

"Technological sovereignty begins where we not only master the integration of functionalities, but also actively shape it."

Manuela Junghähnel

Photo: Silvia Wolf



Hybrid bonding (die-to-wafer) at coupon level—direct chip-to-wafer bonding for ultrafine pitch spacing and reliable 3D integration Photo: Fraunhofer IZM/Silvia Wolf

A face of European resilience

One of physicist Manuela Junghähnel's central projects right now is APECS. This large-scale project is a key component of the European Chips Act. Since 2024, a consortium has been collaborating within Research Fab Microelectronics Germany (FMD) with the aim of redefining innovative semiconductor technologies. In this context, sovereignty in microelectronics does not mean conventional chip production, as practiced for instance in Asia or the United States; it means packaging, stacking and integrating circuits at the highest technological level. Why is this so important? Because in the future, computing processes will run on high-performance (HPC), neuromorphic and quantum computers. And because AI applications are no longer centered on monolithic chips, but on modular chiplets: processors are assembled to specification, almost like building blocks. The necessary expertise—knowing how sensors, logic, memory and optics can be combined in a tightly integrated stack through heterogeneous 3D integration—has now become crucial to technological sovereignty in microelectronics. The head of the All Silicon System Integration Dresden—ASSID institute branch of the Fraunhofer Institute for Reliability and Microintegration IZM firmly believes: "Technological sovereignty begins where we not only master the integration of functionalities, but also actively shape it."

ASSID has been part of a strong microelectronics cluster since 2010, alongside companies such as GlobalFoundries, Bosch and Infineon, as well as the planned ESMC megafab in northern Dresden. Junghähnel took over as head of this Fraunhofer IZM institute branch in 2022. Her enthusiasm for complex technical systems began while she was studying technical physics. She later moved to a Fraunhofer institute in Dresden, where she became head of department for flat substrate coating and the primary contact for customers. This means she brings together precisely what is needed now: expertise in building chip components and the ability to implement custom specifications under public funding rules.

After a presentation by Junghähnel at Silicon Saxony Day 2025, the trade journal EE Times Europe wrote: "It was a snapshot of what European resilience looks like: disciplined, focused, and built on engineering that lasts."

Manuela Junghähnel
Manager of ASSID institute branch, Fraunhofer Institute for Reliability and Microintegration IZM | Ph.D. in Technical Physics

Foreword

Contents

Executive board's report

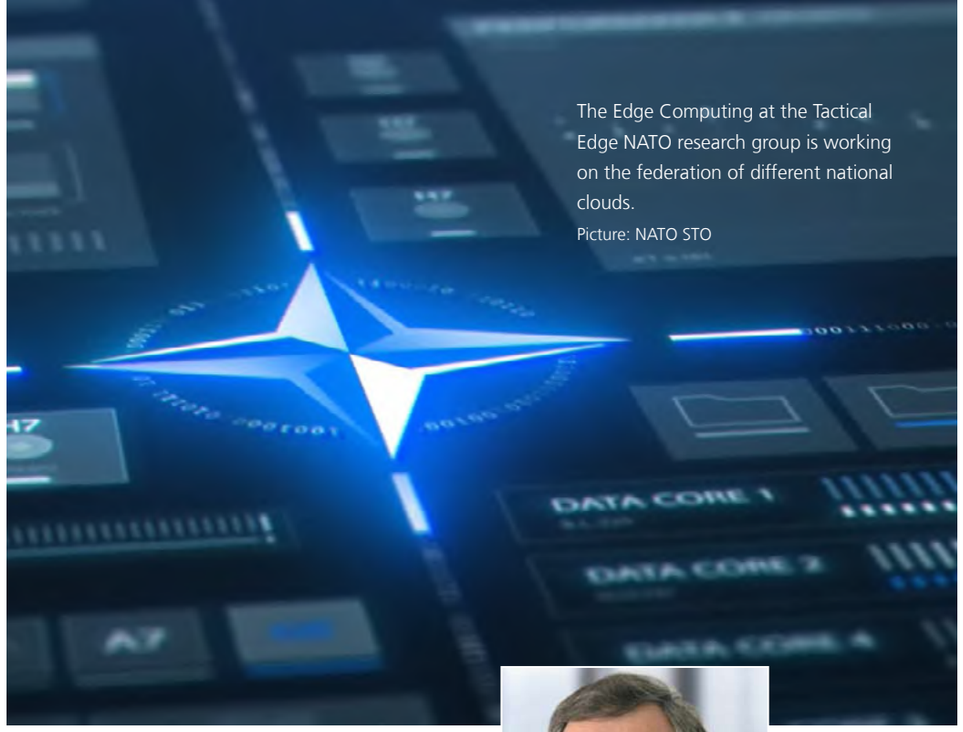
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information



The Edge Computing at the Tactical Edge NATO research group is working on the federation of different national clouds.
Picture: NATO STO

"Technology is a prerequisite for cultural development and a life lived in security."

Wolfgang Koch

Photo: Fraunhofer FKIE

Protecting freedom and values

Wolfgang Koch knew even as a child that he wanted to study physics. To round out his interests, he spent his school years immersed in the humanities. Reading the ancient Greek thinkers greatly helped him develop a philosophical understanding, says the expert in sensor data and information fusion, ergonomic human-machine systems and the use of AI in military contexts. As a research scientist and a Catholic, Koch firmly believes that his research work must be accompanied by ethical reflection on the responsible use of technology. He is involved, for instance, in the development of the European Future Combat Air System (FCAS) program. In 2019, he was one of the initiators of a working group on the responsible use of new technologies in FCAS. In the fall of 2025, the Federation of German Security and Defence Industries (BDSV) published a position paper on the limits of AI when used in defense technologies, to which he made a substantial contribution.

Koch also hosted HISTELCON 2025 in Bonn, a conference organized by the Institute of Electrical and Electronics Engineers (IEEE) with the aim of inspiring passion for technology. The world's largest professional association brings together 500,000 experts in electrical engineering, information technology and similar disciplines. As co-chair of this prestigious event, Koch contributed not only his expertise as chief scientist at the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE and as a member of the NATO Science and Technology Organization, but also his contacts in the cultural world. For Koch, technology is also a prerequisite for cultural development and a life lived in security. Reflecting this conviction, Koch arranged for conference's 120 participants to attend a musical dinner with internationally renowned pianist Julia Rinderle. The conference theme, "Knowing the Past for Preparing the Future," allowed Koch to connect the 100th anniversary of quantum mechanics with the 200th anniversary (in 2026) of the death of Fraunhofer's eponym. It is well known that Fraunhofer's refractors and the discovery of the lines in the solar spectrum laid the foundations for spectroscopy. However, according to Koch, accurate maps could be created by using precision optics in surveying instruments. During the wars of liberation against Napoleon, this was to prove an advantage for the Prussian army. Dual use—the deployment of technology for both civilian and military purposes—was already a reality at the time, even though the term itself did not yet exist.

Wolfgang Koch
Chief Scientist and Department Head for Sensor Data and Information Fusion, Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE | Dr. rer. nat. in physics | Adjunct Professor of Applied Computer Science, University of Bonn | Panel Member of NATO Science and Technology Organization (STO)

Foreword

Contents

Executive board's report

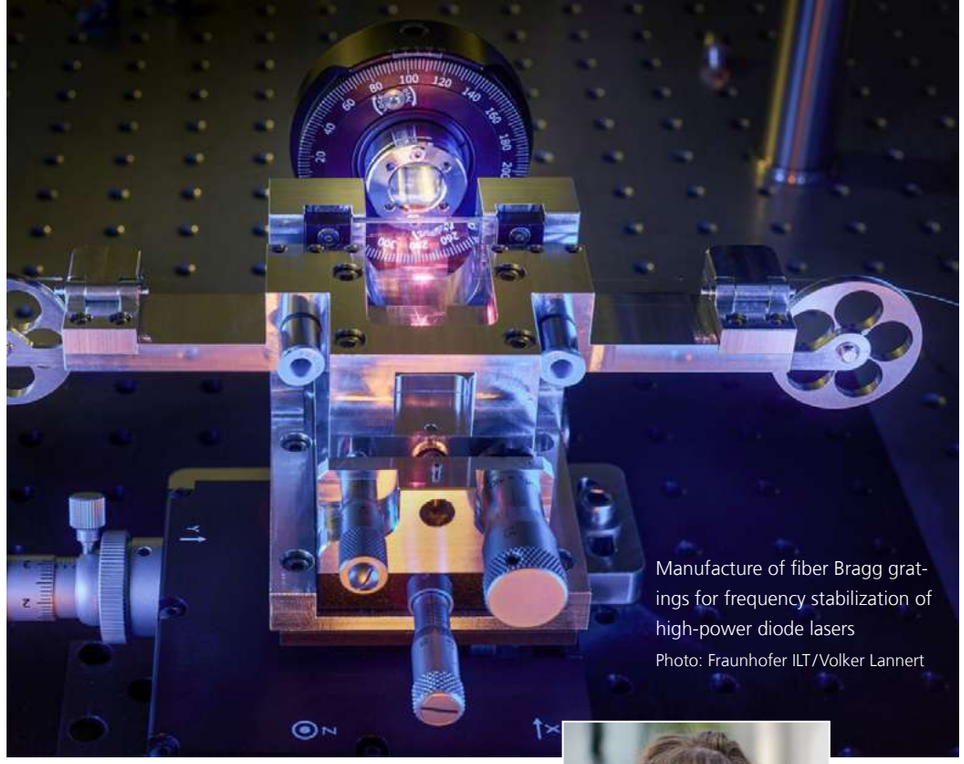
Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information



Manufacture of fiber Bragg gratings for frequency stabilization of high-power diode lasers
Photo: Fraunhofer ILT/Volker Lannert

"Nuclear fusion is the energy source of the stars. We are on the verge of making it usable here on Earth."

Sarah Klein

Photo: Fraunhofer ILT

Networking for the energy of the stars

Sarah Klein is a Fraunhofer scientist through and through. Before she started studying physics, she completed vocational training as an electronics technician at the Fraunhofer Institute for Laser Technology ILT through RWTH Aachen University. "I have always been drawn to innovations with a strong practical focus," Klein explains. "That's why the combination of research and transfer at Fraunhofer ILT was perfect for me, even after I'd completed my physics degree."

During her doctorate, in collaboration with the Lasers and Optical Systems department at Fraunhofer ILT, Sarah Klein made significant advances in the development of efficient, frequency-stabilized high-power diode lasers, for which she was awarded the Hugo Geiger Prize in February 2025. In October 2025, the successful amateur powerlifter took charge of the Fraunhofer fusion technology task force. In this capacity, Klein is building up the field of fusion research at Fraunhofer and sees herself as the connector between Fraunhofer's internal network and external partners.

"Nuclear fusion is taking us into uncharted territory that previously only existed in science fiction," the physicist says enthusiastically. "This is technology that makes the seemingly impossible possible. Fusion energy is the key to an energy future that is clean, safe and almost limitless."

However, there are still many challenges to overcome before fusion technology can be used commercially. The German federal government's Fusion Action Plan not only earmarks €2 billion in funding for this purpose but also pledges to commission an industry-led consortium made up primarily of German companies to build a fusion power plant in Germany. "Fraunhofer offers a vast range of expertise for this undertaking, both in laser fusion and magnetic confinement fusion spanning everything from laser and optics development, sensors, simulation and robotics to materials research. And we always maintain strong ties to industry," Klein explains. She believes that Germany, as an industrial location, is optimally equipped to play a major role in shaping this market. "We need to connect and pool all our capabilities meaningfully if we are to secure a strong position in this emerging market right from the start," Klein emphasizes. "Nuclear fusion is the energy source of the stars. We are on the verge of making it usable here on Earth."

Sarah Klein
Head of Fraunhofer Fusion Technology Task Force, Fraunhofer Institute for Laser Technology ILT | Dr. rer. nat. in physics | Winner of Hugo Geiger Prize 2025

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Energy research as a life's work

Floods, landslides, droughts, fires, storms, hail: Europe is one of the world's regions most severely affected by climate change. The German Federal Climate Change Act (Klimaschutzgesetz, KSG) entered into force at the end of 2019. The German Council of Experts on Climate Change has been monitoring compliance and advising the German federal government on corresponding measures since 2020. Hans-Martin Henning chaired the council until September 2025. His recommendation: "Climate action must be central to any national development strategy."

In the fall of 2025, the physicist stepped down from several roles, most notably the leadership of the Fraunhofer Institute for Solar Energy Systems ISE, which he had shared with Andreas Bett since 2017. He also resigned his professorship at the University of Freiburg. Hans-Martin Henning was a defining figure in German energy research, and not only because of his role as spokesperson for the German Council of Experts on Climate Change. As chair of the Fraunhofer Group for Energy Technologies and Climate Protection and spokesperson for the Fraunhofer Energy Alliance with its 20 member institutes, he positioned Fraunhofer as a partner for industry, government and society. One project especially close to Henning's heart was the establishment of Fraunhofer ENIQ in Berlin as a showroom and hub for science outreach in Fraunhofer's energy research. Henning was spokesperson for the Renewable Energy Research Association (FVEE) and will continue to be involved in the Energy Systems of the Future project as a member and deputy chair of the board of directors. The project operates under the umbrella of acatech—the German National Academy of Science and Engineering, the German National Academy of Sciences Leopoldina and the Union of the German Academies of Sciences and Humanities.

Hans-Martin Henning's physics doctorate on adsorbent regeneration using solar-assisted process heat (1993) laid the foundation for his career as a driving force behind the energy transition and the shift to sustainable heating. His doctoral supervisor was Joachim Luther, who took over as head of Fraunhofer ISE in 1993; Henning joined him there in 1994. Henning initially worked on solar cooling systems, later turning to energy-efficient buildings, heat pumps and systems-level questions. He recognized early on that thinking in terms of individual technologies would not be sufficient to drive the energy transition. As early as the 2000s, he developed a cross-sector energy system model to optimize transition pathways for the energy transition. Fraunhofer ISE is continuing to develop the energy system module REMod, which is currently being expanded across Europe.

Hans-Martin Henning
Emeritus Director of the Fraunhofer Institute for Solar Energy Systems ISE | Emeritus Professor of Solar Energy Systems | University of Freiburg | Member of the advisory committee for the energy research program of the German Federal Ministry for Economic Affairs and Energy

Solar hybrid modules on the roof of the Stühlinger city hall in Freiburg generate electricity and heat Photo: Fraunhofer ISE

Photo: Fraunhofer ISE/Dirk Mahler

"Climate action must be central to any national development strategy."

Hans-Martin Henning

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

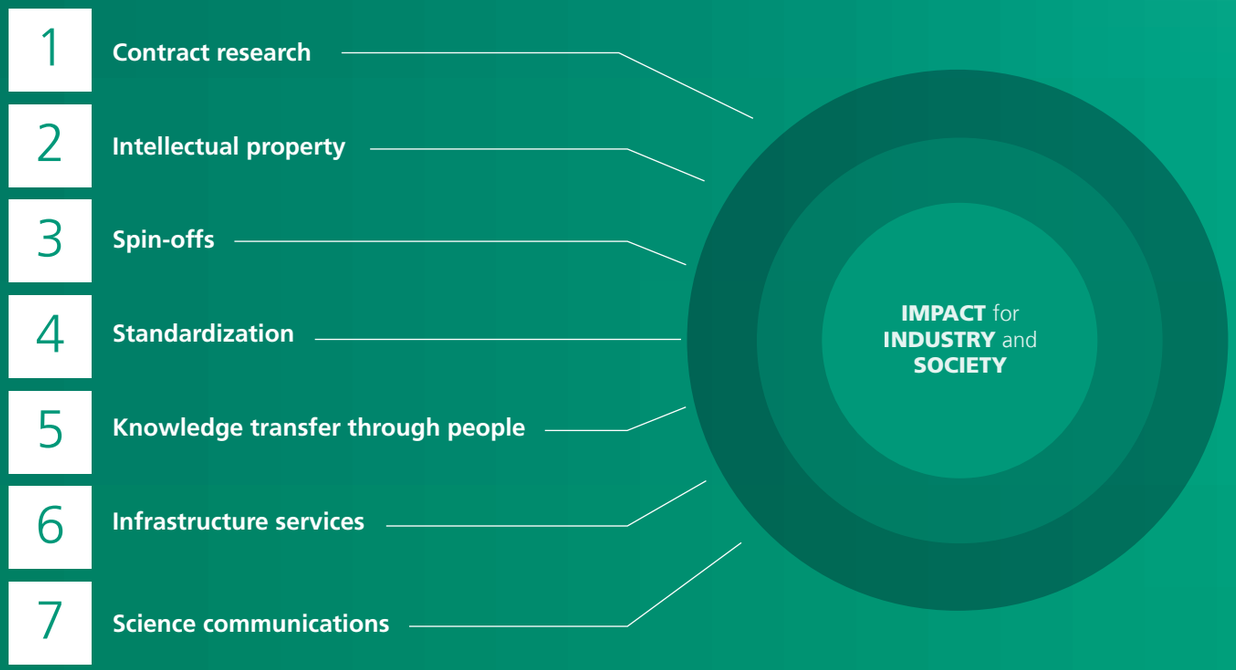
Finances

About Fraunhofer

Publisher's information

Technology transfer activities

Technology transfer paths



Putting research into practice:
Results that find their place in industry and society

Turning scientific findings into practical applications for industry and society is the Fraunhofer-Gesellschaft's defining objective in Germany's specialized research landscape. The Fraunhofer institutes have spent more than 75 years fulfilling their responsibility to translate technological knowledge into practical application in cooperation with partners from industry and science. This results in innovative applications, services and products that benefit people and markets.

Turning knowledge into impact requires transfer paths that are both clearly structured and differentiated. These paths guide the journey from research to real-world application —because research creates social and economic value when it is put into practice.

Click here for the Fraunhofer transfer paths

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Selected transfer activities

1 Transfer path **Contract research**

New technologies for defense wearables

Two areas helped stabilize Germany's economic strength in 2025: firstly, rapid developments in AI, and secondly, growth in the defense industry, supported by the Off-Budget Fund for the Bundeswehr. In 2025, Rheinmetall, the market leader in the defense sector, commissioned 16 Fraunhofer institutes to carry out further research and development work with a total volume of €10.7 million.

One of the largest contracts went to the Fraunhofer Institute for Reliability and Microintegration IZM for the development of electronic clothing for military applications. In the STILEX project, researchers are developing textile-based, stretchable cable structures that can be seamlessly integrated into military uniforms and clothing systems to improve the wearer's comfort and freedom of movement. These novel textile cables reduce interference and increase the wearer's safety in the field. The project is also establishing an interlayer concept that standardizes energy and sensor connections through multiple layers of clothing and enables different smart textile components to be connected in modular form. The project addresses specific use scenarios in challenging operational environments. STILEX is thus transforming technology transfer activities based on Fraunhofer-research into an industrial value chain and delivering tangible, scalable solutions for modular wearables in the defense industry.

2 Transfer path **Intellectual property**

Ceramics and metal from a 3D printer

Multi-material jetting (MMJ) technology makes it possible to produce multi-material components by 3D printing. The Fraunhofer Institute for Ceramic Technologies and Systems IKTS has developed a special process that enables multi-material printing with ceramic and metallic materials. This facilitates the production of components that previously could only be manufactured using complex, multi-stage processes—if at all.

With the establishment of AMAREA GmbH in 2023, Fraunhofer IKTS transferred its powerful MMJ technology from the laboratory to a highly dynamic spin-off that offers its customers highly flexible and particularly resource-efficient manufacturing processes for multi-material components and the associated materials. In 2025, AMAREA GmbH launched the MMJ ProX 3D printer, which operates without tools and can significantly reduce waste. The spin-off's parent institute Fraunhofer IKTS acquired one of the printers in order to open up further fields of application for ceramic 3D printing. The new application is expected to benefit companies in aerospace, electronics, mechanical engineering, energy and medical technology in particular, as well as the jewelry and watchmaking industries. These are all fields in which the greatest possible design flexibility, multifunctional performance and the integration of different material properties are essential. This technology transfer won Fraunhofer IKTS and AMAREA GmbH the 2025 Saxon Transfer Award in the patent commercialization category.

3 Transfer path **Spin-offs**

A toothpaste tube full of innovation

Periodontitis is one of the most common infectious diseases in humans. Caused by an imbalance in the oral microbiome, it affects roughly one in two adults in Germany. A solution may now be within reach in the form of a new ingredient, S-0636, discovered during an EU project in which the Fraunhofer Institute for Cell Therapy and Immunology IZI in Halle took part. In 2019, Mirko Buchholz and Pierre Tangermann took the leap of founding a spin-off with this patented substance. Since then, PerioTrap Pharmaceuticals GmbH has been developing the microbiome modulator, which selectively inhibits harmful bacteria while supporting healthy bacteria to maintain a natural microbiome. The spin-off is also working with Fraunhofer IZI, the Fraunhofer Institute for Microstructure of Materials and Systems IMWS and other partners to develop another product for advanced stages of the disease. The idea is to deliver an already approved antibiotic directly into inflamed periodontal pockets using short threads.

The company gained market traction through pitch competitions and funding rounds. After raising €3 million at the end of 2020, PerioTrap secured a further €2.7 million in early 2025, including more than €1 million from crowdinvesting. PerioTrap microbiome toothpaste for home use and a prophylactic gel for use in dental practices have been available at several pharmacies in Halle and online (apozilla.de) since mid-2025.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

4 Transfer path **Standardization**

DIN 35255: quality in composite processes
DIN 35255, "Quality requirements for composite processes," makes an important contribution to industrial standardization in lightweight design. Supported by the German Institute for Standardization (DIN), the standard was developed at the initiative of the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in collaboration with industry partners and published at the end of October 2025.

Fiber-reinforced composites are key materials in lightweight design and are used for instance in automotive manufacturing, aviation, rail vehicles, shipbuilding and wind turbines. Processing these materials is technically challenging, which means that specific quality requirements must be defined in accordance with DIN EN ISO 9001. The new standard builds on the successful DIN EN ISO 21368 for quality assurance in adhesive bonding technology, to which Fraunhofer IFAM also made a major contribution. Core elements include the classification of composite components according to safety requirements, requirements for qualified personnel (composite supervisors) and process safety verification, which requires that actual loads may never exceed the maximum permissible. DIN 35255 is the first standard to define the state of the art for organizing, implementing and assuring the quality of fiber-reinforced composite processes. With this, it lays the foundation for reliable, consistent quality in industrial applications.

5 Transfer path **Knowledge transfer through people**

5.1 Continuing education for industry specialists and managers

Security champions for enhanced cyber resilience
The Bitkom study 2024 Economic Protection reported €178.6 billion in losses as a result of cybercrime. Ransomware and phishing were the most common types of attack, while 74 percent of companies were victims of data theft. In order to strengthen cyber resilience in an increasingly connected world, the Fraunhofer Institute for Mechatronic Systems Design IEM developed the intensive Certified Security Champion Training program for secure software. More than 700 participants in 7 countries have undergone training in secure software development since 2022. As part of the Fraunhofer Cybersecurity Training Lab, this intensive part-time program is aimed not only at large corporations but was also designed with small and medium-sized enterprises in mind. The blended learning program consists of four blocks and runs for around 13 weeks. Part of the training takes place at Fraunhofer IEM in Paderborn. The program combines lectures, interactive exercises and self-study phases. The course can take the form of open training or in-house training for developer teams. The continuing education program concludes with an optional hackathon and an examination leading to the qualification of security champion. Successful participants receive a certificate from the Fraunhofer Personnel Certification Authority showing their examination result. Fraunhofer IEM trainers also adapt the training for individual companies or evaluate the security status of the company's software by performing a software security assessment.

5.2 Individuals and careers

Training for positions of responsibility
In 2025, around 2,250 people left Fraunhofer to pursue their careers further—in industry, research or their own independent endeavors. One key aspect of Fraunhofer's mission is the training phase that scientific staff in particular complete during their period of employment with Fraunhofer. Fraunhofer had a 10.3 percent turnover rate in its scientific section. As part of the exit interviews, departing employees were asked where they were planning to go next in their careers. Approximately 70 percent of these departing employees said they were moving on to roles in industry.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

6 Transfer path **Infrastructure services**

Hydrogen Lab Bremerhaven
To expand renewable energy and establish hydrogen production through water electrolysis, it is essential to integrate the required systems into a cohesive unit. A well-defined, compatible performance of individual components in hybrid wind-photovoltaic-hydrogen systems is a key requirement for developing flexible and stable power supply systems.

The ERDF-funded Hydrogen Lab Bremerhaven, part of the Fraunhofer Institute for Wind Energy Systems IWES, provides a unique test environment that offers numerous opportunities to explore this interplay across a wide range of scenarios. The first major industrial test campaign was launched in 2026 together with Shell Global Solutions. The partners in the EnergyHyNet project are investigating the integration challenges that arise when renewable energy sources and electrolyzers are coupled with weak grid connections. To that end, the capabilities of the Hydrogen Lab Bremerhaven are combined with the PQ4Wind converter test bench and a wind-turbine/converter test bench. Special operating scenarios include, for example, tests to assess the influence of available grid short-circuit power and system operation during temporary voltage disturbances in the power grid (fault ride-through tests).

7 Transfer path **Science communications**

The space community meets heavy metal
Premiere for Fraunhofer at Wacken Open Air | W:O:A 2025:
The organizers of Wacken Open Air added a space camp to the program of Germany's largest heavy metal festival, which attracts around 85,000 fans each year. Insights into current projects and challenges in spaceflight and space research were provided by the Fraunhofer SPACE & AVIATION Alliance together with the Public Liaison Office, the German Aerospace Industries Association (BDLI) with partners including ArianeGroup and OHB, the German Society for Aeronautics and Astronautics (DGLR) and the German Astronomical Society, represented by members such as the Max Planck Institute for Radio Astronomy.

For six days, the Fraunhofer crew was on hand in rain boots to speak with festivalgoers who were both curious and well informed. The tent featured exhibits including a model of the ERNST Earth observation satellite and Rudi, the stuffed vulture from the GAIA initiative (see page 64), which combines AI and satellite communication with species conservation. After the event, Fraunhofer calculated that there had been around 18,000 visitors, including many distinguished guests. The AVIATION & SPACE Alliance likened the outreach impact to that of major trade show locations such as Hannover. Wacken proved to be a popular leisure destination for space enthusiasts of all ages. A broad cross-section of the scientific community, spanning disciplines from rocket science and neuroscience to geoscience, gathered on the muddy festival ground, a setting quite different from the usual conference venues. This unusual dialogue format turned out to be a highly successful experiment.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research
- Pioneering achievements
- Initiatives, structures, funding programs
- Projects and results
- Awards
- People behind the research
- Technology transfer activities

Finances

About Fraunhofer

Publisher's information

Key figures on transfer activities in 2025

€768 **million** from national and international industry contracts

29 spin-offs

83 shareholdings

1,464 standardization activities

€198 **million** in license-fee revenue from industry

around 7,000 active patent families

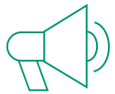
589 reported inventions

538 patent applications

over 8,000 participants in continuing education programs

€8.1 million in revenue from continuing education programs offered by the Fraunhofer Academy

13,439 contributions according to media resonance analysis



6,020 **million** contacts (reach)

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances
- Balance sheet
- Income statement
- Excerpts from the notes to the financial statements
- Auditor's report

About Fraunhofer

Publisher's information

Finances

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances
Balance sheet
Income statement
Excerpts from the notes to the financial statements
Auditor's report

About Fraunhofer

Publisher's information

Balance sheet

Balance sheet at December 31, 2025	2025	Previous year
ASSETS	in T€	in T€
A. Noncurrent assets	**3,242,964**	**3,157,935**
I. Intangible assets	25,319	31,662
II. Property, plant and equipment	3,168,507	3,080,422
III. Financial assets	49,138	45,851
B. Current assets	**1,497,524**	**1,621,755**
I. Inventories	228,486	99,834
II. Accounts receivable and other current assets	1,013,064	1,180,130
1. Trade receivables	242,476	255,129
2. Receivables from the federal and state governments	657,047	815,348
3. Accounts receivable from affiliated companies	1,071	373
4. Other current assets	112,470	109,280
III. Other securities	231,247	323,566
IV. Cash and cash equivalents	24,727	18,225
C. Prepaid expenses and deferred charges	**68,352**	**56,739**
Total assets	**4,808,840**	**4,836,429**
Trust assets	35,318	77,477

EQUITY AND LIABILITIES	in T€	in T€
A. Equity	**15,741**	**15,701**
I. Nonprofit organization capital	15,741	15,689
II. Reserves for statutory purposes	–	12
B. Extraordinary items	**3,703,442**	**3,687,095**
1. License-fee revenue reserve for statutory purposes	231,366	328,766
2. Grants relating to noncurrent assets	3,231,223	3,146,846
3. Financing of current assets	222,443	175,473
4. Payments from patent sales	18,410	26,023
5. Financing restructuring measures	–	9,987
C. Provisions	**354,188**	**394,354**
D. Liabilities	**729,276**	**732,478**
1. Trade payables	98,397	80,295
2. Unappropriated grants from the federal and state governments	598,456	624,305
3. Accounts payable to affiliated companies	5,646	992
4. Other current liabilities	26,777	26,886
E. Accrued expenses and deferred income	**6,193**	**6,801**
Total assets	**4,808,840**	**4,836,429**
Trust liabilities	35,318	77,477

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances
- Balance sheet
- Income statement
- Excerpts from the notes to the financial statements
- Auditor's report

About Fraunhofer

Publisher's information

Income statement

Income statement for the 2025 financial year	2025	Previous year
	in T€	in T€
1. Revenue from base funding	1,177,898	1,116,283
2. Revenue from own activities	2,346,610	2,302,155
Revenue	2,082,413	2,175,851
Work in progress, inventory increase (+) / inventory decrease (–)	198,969	67,570
Other revenue	65,228	58,734
3. License-fee revenue reserve, increase (–) / decrease (+)	97,400	43,472
Total revenue	**3,621,908**	**3,461,910**
4. Personnel expenses	2,105,643	2,055,278
5. Cost of materials	448,364	495,938
6. Other operating expenses	503,902	477,677
7. Interest and similar expenses	505	384
8. Amortization of intangible assets and depreciation of property, plant and equipment	430,153	418,958
9. Write-downs of financial assets and securities classified as current assets	3,046	1,793
10. Change in extraordinary items		
Grants relating to noncurrent assets, depreciation and amortization (–)	-432,902	-420,586
Grants relating to noncurrent assets, capital expenditure (+)	526,172	584,230
Financing of current assets, increase (+) / decrease (–)	46,970	-144,954
Financing restructuring measures, increase (+) / decrease (–)	-9,986	-6,859
Total expenditure	**3,621,867**	**3,461,859**
11. Net income for the year	**40**	**51**
12. Change in reserves for statutory purposes	12	0
13. Annual result	**52**	**51**
14. Allocation to nonprofit organization capital	-52	-51

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances
- Balance sheet
- Income statement
- Excerpts from the notes to the financial statements
- Auditor's report

About Fraunhofer

Publisher's information

Excerpts from the notes to the financial statements

1. General disclosures

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., headquartered in Munich, is a nonprofit organization registered with the local court of Munich under the reference code VR 4461.

The annual financial statements for the year ending December 31, 2025, are prepared voluntarily, taking into account the principles of German commercial law and in accordance with the organization's constitution as a nonprofit organization and grant recipient. The regulations for large corporations under German commercial law are applied. The income statement was prepared in accordance with the total cost method.

The basis of the Fraunhofer-Gesellschaft's accounting method is the performance statement, from which the annual financial statements are derived.

The performance statement is adapted to the requirements of the public funding authorities in terms of format and reconciliation. It provides a breakdown of operating expenses and capital expenditure at three different levels: individual institutes, headquarters and the organization as a whole. The components of the operating budget are presented as revenue or expenses in accordance with generally accepted accounting principles. Capital expenditure on property, plant and equipment and on financial assets, on the other hand, is recognized at cost on acquisition of the assets. Therefore, the operating budget does not include any depreciation and amortization expenses on these items.

In order to account for grants received from grant authorities, the performance statement for the organization as a whole is reconciled to the statement of receipts and expenditures by eliminating the effect of cash-neutral revenue and expense items. The income statement includes these changes in payables and receivables over the previous year as well as depreciation and amortization charges. In the balance sheet, these reconciliation items are included under the extraordinary items "Financing of current assets" and "Grants relating to noncurrent assets." In the management report, the figures are explained separately according to the three areas of contract research, additional research funding and major infrastructure.

In 2025, the order of the items in the income statement was adjusted to improve the clarity and transparency of the annual financial statements in accordance with section 265(6) German Commercial Code (Handelsgesetzbuch, HGB).

Annual financial statements of the Fraunhofer-Gesellschaft			Reconciliation to the statement of receipts and expenditures
Balance sheet	Income statement		
	Reconciliation between income statement and performance statement		
Management report	**Performance statement**		
	Operating budget and capital expenditure at Fraunhofer-Gesellschaft "Total business volume" level		
Notes to the financial statements	**Separate financial statements of the institutes/headquarters**		
	Operating budget	Capital expenditure budget	
	Costs (excluding depreciation and amortization)	Expenses	
	Revenue	Revenue	

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

Balance sheet
Income statement
Excerpts from the notes to the financial statements
Auditor's report

About Fraunhofer

Publisher's information

2. Recognition and measurement methods

Intangible assets and property, plant and equipment are measured at amortized cost, i.e., the cost of acquisition or production less depreciation and amortization calculated on a straight-line basis.

Intangible assets are amortized over a useful life of three years.

Institute buildings on Fraunhofer and third-party land are depreciated as follows:

- Added before April 1985 at 2 percent
- Added between April 1, 1985, and December 31, 2000, at 4 percent
- Added after January 1, 2001, at 3 percent

A useful life of 5 years is applied to movable items of property, plant and equipment. However, a useful life of 4 years is assumed for communication, video and audio systems, and 3 years for IT hardware. Motor vehicles are depreciated over a useful life of 4 years.

Financial assets are recognized at cost. Where the reduction in value is expected to be permanent, write-down to the lower fair value is recognized.

Since the noncurrent assets presented in the ordinary accounts are financed by government grants, the extraordinary item "Grants relating to noncurrent assets" is reduced by an amount corresponding to the depreciation and amortization of these assets. Therefore, these adjustments have no impact on the income statement.

Raw, auxiliary and operating materials reported under inventories are recognized at acquisition or manufacturing cost or at fair value. In the 2025 fiscal year, inventories were recognized for the first time; these were recorded as part of a physical inventory taken as of the reporting date. Initial measurement was carried out using the FIFO method, applying the strict Lower of Cost or Market method.

Work in progress is measured at the cost of production or fair value, whichever is lower. Production costs include applicable personnel expenses, cost of materials, general administrative expenses and depreciation charges. Advance payments received (including VAT) are openly deducted under inventories.

Trade receivables and other assets are recognized at their nominal value. Irrecoverable debts are remeasured at the reporting date. The overall non-payment risk is limited by creating a provision for doubtful debts corresponding to 2 percent of the total amount of accounts receivable.

Securities classified as current assets are measured at cost or, on the reporting date, at lower fair value.

Cash and cash equivalents are recognized at their nominal value.

Payments made before the reporting date for which the associated benefits will be received in a future period are recognized in the balance sheet as prepaid expenses and deferred charges.

The Fraunhofer-Gesellschaft makes use of the instrument provided for in its financial statutes of recognizing a balance sheet reserve in particular for liquidity and risk safeguards.

Funding used to finance noncurrent assets is allocated to the extraordinary item "Grants relating to noncurrent assets." A separate extraordinary item is used to account for grants used to finance current assets.

Provisions for pensions for which the Fraunhofer-Gesellschaft has a reinsurance policy in place are measured on the basis of the capitalized amount calculated by R+V Lebensversicherung AG at the reporting date. The capitalized amounts are calculated in accordance with the information provided by the insurance company and on the basis of the DAV 2004 R guideline tables. Adjustments to current pensions and to applicable earnings are not taken into account. If there is no reinsurance policy in place, or if the settlement cost of the pension obligations exceeds the capitalized amount calculated by the reinsurer, the amount recognized as a provision is calculated in accordance with an expert opinion based on actuarial evidence. The settlement amount of the pension obligation is calculated using the present value method (method for calculating current single premiums). A 10-year-average actuarial interest rate of 2.06 percent was used in the calculation in accordance with section 253(2) of the German Commercial Code (Handelsgesetzbuch, HGB), along with the 2018 G Heubeck guideline tables.

Other provisions comprise amounts set aside to cover all identifiable risks and contingent liabilities. These provisions are measured in accordance with section 253(1) HGB on the basis of a reasonable estimate of the most probable outcome. Other provisions for liabilities due in more than one year are discounted at the average market interest rate for loans of a similar maturity as calculated by the Deutsche Bundesbank in December 2025, pursuant to section 253(2) HGB. Provisions for partial retirement are calculated on the basis of the policies already concluded.

Liabilities are measured at the settlement amount.

Payments received before the reporting date for benefits to be delivered in a future period are recognized in the balance sheet as accrued expenses and deferred income.

Amounts recognized for transactions in foreign currencies are translated at the applicable hedging rates of the respective currencies. In the annual financial statements, foreign currency holdings are translated at the average spot exchange rate prevailing on the reporting date.

Items in transit are noted as trust assets and trust liabilities in a separate line at the foot of the Fraunhofer-Gesellschaft balance sheet.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances
Balance sheet
Income statement
Excerpts from the notes to the financial statements
Auditor's report

About Fraunhofer

Publisher's information

Convenience translation of the German independent auditor's report

This is a convenience translation of the German auditor's report. Solely the original text in the German language is authoritative. The auditor's report is based on the balance sheet at December 31, 2025, the income statement for the 2025 financial year and the full notes to the 2025 financial statements and the 2025 management report.

"To Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Munich

Audit opinion

We have audited the annual financial statements prepared by Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Munich, comprising the balance sheet as at December 31, 2025, the income statement for the financial year from January 1 to December 31, 2025, and the notes to the financial statements, including the presentation of the applied recognition and measurement methods. In addition, we have audited the management report of Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Munich, for the financial year from January 1, 2025, to December 31, 2025.

According to our opinion, as based on the results of the audit:

- The attached annual financial statements comply in all material respects with the provisions of the German Commercial Code (Handelsgesetzbuch, HGB) as applicable to large corporate entities, the organization's statute, and those of German generally accepted accounting principles (GAAP). Together, this information presents a true and fair view of the organization's net assets and financial position as at December 31, 2025, and of its operating results for the financial year commencing January 1, 2025, and ending December 31, 2025.
- The attached management report provides a true and fair view of the organization's current operating situation. In all material respects, the management report is consistent with the annual financial statements, complies with German statutory requirements and provides an appropriate picture of the organization's future opportunities and risks.

In accordance with section 322(3) sentence 1 HGB, we declare that our audit of the annual financial statements and management report did not lead to any reservations/observations.

Basis for opinion

We conducted our audit of the annual financial statements and the management report in accordance with section 317 HGB and the German generally accepted standards for the audit of financial statements set by the Institute of Public Auditors in Germany (IDW). Our responsibilities under those standards are further described below under the heading "Auditors' responsibility for the audit of the annual financial statements and management report." We declare that we are independent auditors as defined by German commercial law and that we exercise our other duties in Germany in compliance with the relevant professional code of conduct, with no other connection to or interests in the Fraunhofer-Gesellschaft. It is our considered opinion that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion on the annual financial statements and the management report.

Responsibility of the legal representatives and the senate for the annual financial statements and management report

The legal representatives are responsible for preparing the annual financial statements in accordance with the provisions of the HGB as applicable to large corporate entities, and for ensuring that they comply with German generally accepted accounting principles (GAAP) and present a true and fair view of the organization's net assets, financial position and operating results. Furthermore, the legal representatives are responsible for carrying out internal audits to the extent that these are considered necessary to comply with German GAAP, as a basis for preparing annual financial statements in such a way that they are free of material misstatements, whether due to fraud (i.e., fraudulent accounting manipulations and misappropriations of assets) or error.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

Balance sheet
Income statement
Excerpts from the notes to the financial statements
Auditor's report

About Fraunhofer

Publisher's information

In preparing the annual financial statements, the legal representatives are also responsible for determining the organization's ability to continue operating as a going concern, which includes disclosing any relevant information concerning this matter. Moreover, they are responsible for applying methods of accounting that allow assessment of the organization's continuing existence as a going concern, insofar as there are no material or legal circumstances that might contradict this assessment.

Another of the legal representatives' responsibilities is the preparation of a management report, which must be consistent with all material aspects of the annual financial statements, comply with German statutory requirements, provide a true reflection of the organization's financial position and provide a realistic assessment of the organization's future opportunities and risks. In addition, the legal representatives are responsible for such arrangements and measures (systems) as they have considered necessary to enable the preparation of a management report that is in accordance with the applicable German legal requirements, and provision of sufficient appropriate evidence for the statements made in the management report.

The senate is responsible for monitoring the organization's accounting process for the preparation of the annual financial statements and management report.

Auditor's responsibility for the audit of the annual financial statements and management report

Our objectives are to obtain reasonable assurance about whether the annual financial statements as a whole are free from material misstatement due to fraudulent activities or errors and whether the management report as a whole provides an appropriate view of the organization's position and, in all material respects, is consistent with the annual financial statements and the knowledge obtained in the audit, complies with German legal requirements and appropriately presents the opportunities and risks of the organization's future development as well as to issue an auditor's report comprising our audit opinion on the annual financial statements and on the management report.

Reasonable assurance implies a high level of confidence but does not guarantee that an audit conducted in full compliance with the provisions of section 317 HGB and of the generally accepted accounting principles set by the Institute of Public Auditors in Germany (IDW) will always detect a material misstatement when it exists. Misstatements may result from fraudulent activities or errors and are deemed to be material if it can be reasonably expected that they might individually or severally influence business decisions made by the reader on the basis of the annual financial statements or management report.

Throughout the audit process, we exercise professional judgment and maintain a neutral but critical attitude. We also:

- Identify and assess the risks associated with material misstatements in the annual financial statements and management report due to fraudulent activities or errors, plan and carry out our auditing activities in response to these risks and collect sufficient, appropriate documentary evidence to substantiate our audit opinion. The risk that a material misstatement resulting from fraudulent activities is not detected is higher than the risk that a material misstatement resulting from errors is not detected since fraudulent activities may involve collusion, forgery, intentional omissions, misleading representations, or the override of internal controls.

- Familiarize ourselves with the internal controls and other instruments and measures insofar as they affect the auditing of the annual financial statements and management report, in order to design audit procedures that are appropriate in the circumstances. However, it is not the purpose of the audit to judge the effectiveness of the organization's internal controls or of these instruments and measures.

- Assess the appropriateness of the accounting principles applied by the legal representatives and the extent to which their estimated values and the associated information they specify are backed up by documented evidence.

- Draw conclusions as to the appropriateness of the accounting principles applied by the legal representatives to determine the organization's ability to continue as a going concern and, on the basis of the audit evidence, to determine whether material uncertainties exist about events or conditions that may cast significant doubt on the organization's ability to continue as a going concern. If our investigations lead to the conclusion that material uncertainties do exist, it is our duty to comment on this fact in our independent auditor's report, providing references to the relevant disclosures in the annual financial statements and/or management report. Alternatively, if such comments are inappropriate, it is our duty to modify our audit opinion accordingly. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the organization to cease to continue as a going concern.

- Verify that the overall presentation, structure and content of the entire annual financial statements, including the disclosures and the presentation of underlying business transactions and events, comply with German generally accepted accounting principles (GAAP) and present a true and fair view of the organization's net assets, financial position and operating results.

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

Balance sheet
Income statement
Excerpts from the notes to the financial statements
Auditor's report

About Fraunhofer

Publisher's information

- Confirm that the management report complies with the annual financial statements, meets legal requirements and conveys a true image of the organization's situation.

- Perform audit procedures on the prospective information presented by the legal representatives in the management report. On the basis of sufficient appropriate audit evidence we evaluate, in particular, the significant assumptions used by management as a basis for the prospective information and evaluate the proper derivation of the prospective information from these assumptions. We have not provided an independent audit opinion on the prospective information or the data on which it is based. There is a substantial unavoidable risk that future events will differ materially from the prospective information.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal controls that we identify during our audit.

Nuremberg, April 16, 2026
Rödl Audit GmbH
Wirtschaftsprüfungsgesellschaft

Signature: Grässle
Auditor

Signature: Horst
Auditor

(End of convenience translation of the German auditor's report.)"

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer
- Structure
- Members, governing and advisory bodies
- Locations

Publisher's information

About Fraunhofer

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer
Structure
Members, governing and advisory bodies
Locations in Germany

Publisher's information

Structure of the Fraunhofer-Gesellschaft

Governance: governing and advisory bodies

The **executive board** of the Fraunhofer-Gesellschaft consists of the president and up to four other full-time members. Its duties include managing the Fraunhofer-Gesellschaft and establishing the essential elements of its strategy, particularly in the areas of research, transfer, major infrastructure, human resources and finances. The executive board ensures, within the scope of its responsibilities under the statutes, that these are observed, and shapes the Fraunhofer corporate culture with its values and positions on issues. It ensures that the research portfolio of the institutes is coherent for the Fraunhofer-Gesellschaft as a whole, and creates the conditions for the lawful, proper and cost-effective management of the organization's activities and those of its institutes and other research units. The executive board ensures that these are observed through actions including but not limited to enacting guidelines and establishing the relevant control systems. The executive board acts as a **collective body**. The president represents the organization both internally and externally and coordinates the work of the executive board.

The **senate** comprises up to 26 voting members from the worlds of industry, science and public life, representatives of the federal and state governments, and members of the scientific and technical council (STC). The senate functions as a supervisory and advisory body to the executive board of the Fraunhofer-Gesellschaft. Its responsibilities include appointing the president and other members of the executive board. The adoption of the financial plan, including the financial planning, the establishment of the central elements of the science and research strategy, and the research and expansion planning are subject to the approval of the senate. It also handles the establishment, transformation or dissolution of research units belonging to the Fraunhofer-Gesellschaft.

The **general meeting** is made up of the members of the Fraunhofer-Gesellschaft. Ex officio membership is open to members of the senate and the executive board, institute directors and senior managers, and members of the boards of trustees. Applications for ordinary membership may be submitted by individuals and legal entities who wish to support the work of the Fraunhofer-Gesellschaft. Honorary members may be elected from among the research staff and patrons of the Fraunhofer-Gesellschaft in recognition of outstanding services to the organization. The general meeting elects the members of the senate, discharges the executive board and senate of their functions and formulates decisions concerning amendments to the statutes.

The **scientific and technical council** (STC) is the organization's internal advisory committee. It consists of the directors and senior managers of the institutes and an elected representative of the scientific and technical staff of each institute. The STC advises the governing and advisory bodies on scientific and technical matters of essential importance. It makes recommendations concerning the central elements of the Fraunhofer-Gesellschaft's science and research strategy and strategic HR development, expresses its opinions regarding the establishment of new institutes or the closure of existing institutes, and participates in the appointment of new institute directors.

There are currently 74 institutes and independent research units working under the umbrella of the Fraunhofer-Gesellschaft at locations throughout Germany. They are the entities responsible for carrying out the Fraunhofer-Gesellschaft's research work, and each one cultivates its own market presence and manages its own budget. They do not generally have their own legal capacity, so they manage their activities in line with the overall Fraunhofer strategy and the planning and management processes established by the executive board. They can form **groups based on specific areas of expertise** and be tasked with coordinating their research within the Fraunhofer-Gesellschaft and harmonizing the market presence of the respective group members.

The chairs of these groups, together with the executive board and the chair of the Segment for Defense and Security VVS, form the **presidential council** of the Fraunhofer-Gesellschaft. The presidential council participates in executive board decision-making processes, supports the implementation of the executive board's decisions, and is entitled to make proposals and recommendations to and has the right to be heard by the board.

The **boards of trustees** are external advisory bodies of the institutes. They include representatives from the science, industry and public sectors, who are appointed by the executive board. The boards of trustees advise the institute management, the executive board and, if necessary, the other governing and advisory bodies of the organization on matters including the institute's scientific and entrepreneurial alignment and any structural changes at the institute.

Report valid as at January 2026

Foreword

Contents

Executive board's report

Senate's report

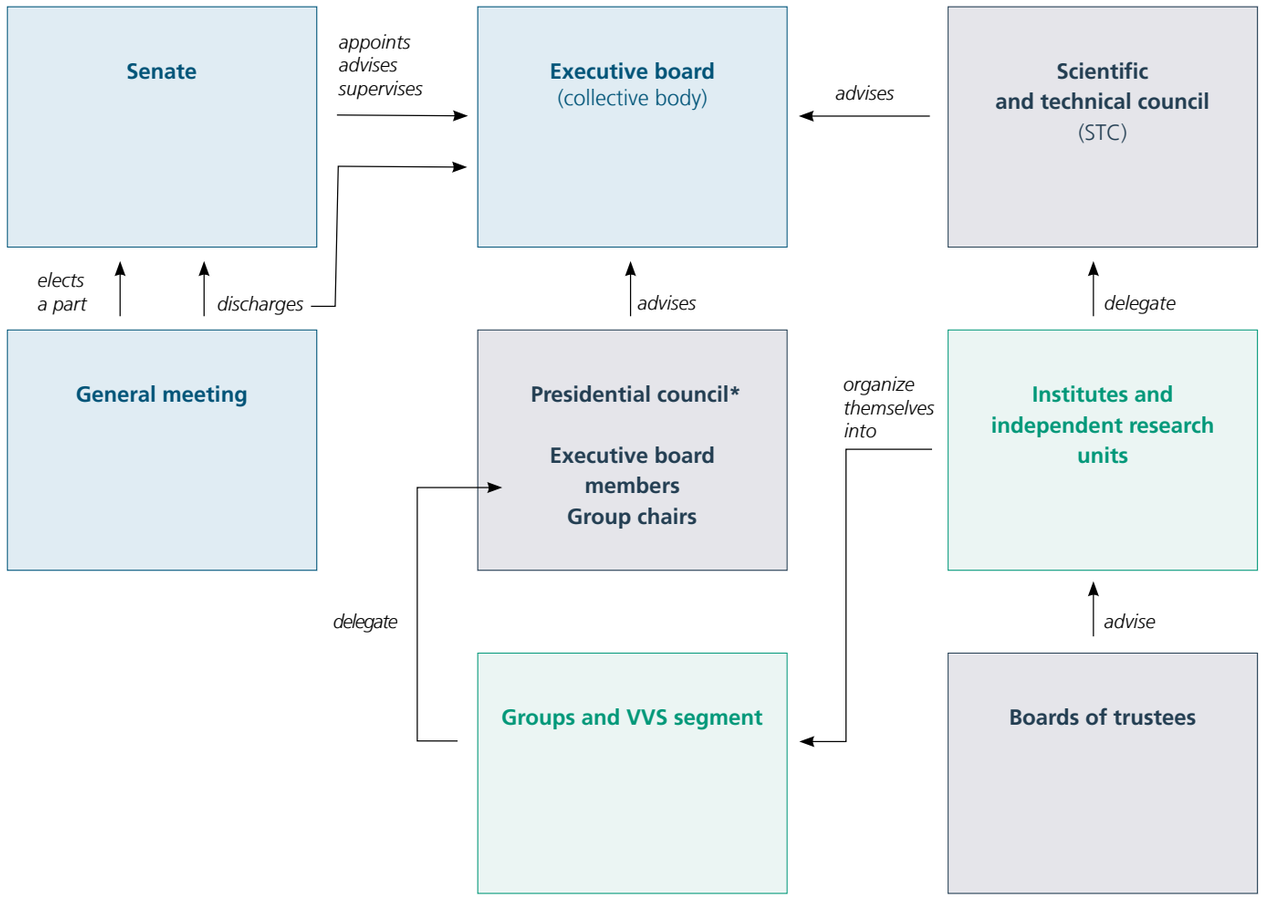
Review of Fraunhofer research

Finances

About Fraunhofer
Structure
Members, governing and advisory bodies
Locations in Germany

Publisher's information

Structure of the Fraunhofer-Gesellschaft



- Governing bodies
- Advisory bodies
- Research structures

The Fraunhofer-Gesellschaft is organized as **one** legal entity; all institutes are therefore legally dependent.

Legal form: association registered under German law (e. V.)

Tax status: nonprofit

* Advisory committee, not an extended executive board

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer
Structure
Members, governing and advisory bodies
Locations in Germany

Publisher's information

Members, governing and advisory bodies

Members

The Fraunhofer-Gesellschaft has 1,103 members, comprising legal entity members, 74 natural person members, 1,001 ex officio members and 6 honorary members. Some members have multiple functions.

Honorary members
Peter Draheim

Dr.-Ing. Horst Nasko

Dr. Dirk-Meints Polter

Prof. Dr.-Ing. Dr.-Ing. E.h. Dr. h. c.
Ekkehard D. Schulz

Dr. rer. pol. Hans-Ulrich Wiese

Dr. jur. Markus Söder

Senate

Members from the science and industry communities, and from public life

Hildegard Müller
Chair of the Senate of the Fraunhofer-Gesellschaft, President of Verband der Automobilindustrie e. V. (VDA) (German Association of the Automotive Industry)

Kerstin Grosse
Deputy Chair of the Senate of the Fraunhofer-Gesellschaft, Managing Director of DEROSSI Invest GmbH

Prof. Dipl.-Ing. Oliver Zipse
Deputy Chair of the Senate of the Fraunhofer-Gesellschaft, Chairman of the Board of Management of BMW AG

Dr. Annette Beller
Member of the Administrative Board of GFT Technologies SE

Dr.-Ing. Oliver Blume
Chairman of the Board of Management of Volkswagen AG, Chairman of the Executive Board of Dr. Ing. h.c. F. Porsche AG

Dr. rer. nat. Roland Busch
President and Chief Executive Officer of Siemens AG

Otto Fricke
Chair of the Board of Directors of the German Olympic Sports Federation (DOSB)

Sabine Herold
Managing Partner of DELO Industrie Klebstoffe GmbH & Co. KGaA

Bernard Meyer
Chair of the Management Board of the Meyer Neptun Foundation

Prof. Dr. phil. Anja Reinalter
Member of the German Federal Parliament (Bundestag) and Parliamentary Business Manager of the Alliance 90/The Greens Parliamentary Group, Professor of Social Work at Kempten University of Applied Sciences

Sönke Rix (until March 31, 2025)
Member of the German Federal Parliament (Bundestag) and Deputy Chair of the Social Democratic Party (SPD) Bundestag Parliamentary Group

Prof. Dr. rer. nat. Dr. h. c. mult. Ulrich Rüdiger
Rector of RWTH Aachen University

Dr.-Ing. Karl Tragl
Chairman of the Executive Board and Chief Executive Officer of Wacker Neuson SE

Grazia Vittadini
Lufthansa Chief Technology Officer and Member of the Executive Board

Dr.-Ing. Anna-Katharina Wittenstein
Member of the Supervisory Board of WITTENSTEIN SE

Prof. Vanessa Wood Ph. D.
Vice President for Knowledge Transfer and Corporate Relations of ETH Zurich

Members representing government institutions
Representatives at federal level

State Secretary Stephan Ertner
(until July 28, 2025)
German Federal Ministry of Education and Research (BMBF)

Parliamentary State Secretary Matthias Hauer
(from July 29, 2025)
German Federal Ministry of Research, Technology and Space (BMFTR)

Undersecretary Dr. Ole Janssen
German Federal Ministry for Economic Affairs and Energy (BMWE)

Undersecretary Alexander Schott
German Federal Ministry of Defence (BMVg)

Undersecretary Rita Schutt
German Federal Ministry of Finance (BMF)

Representatives at federal state level

State Secretary Tobias Gotthardt
Bavarian Ministry of Economic Affairs, Regional Development and Energy (StMWi)

Deputy Director General Katharina Heil
Ministry of Science and Health of Rhineland-Palatinate

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer
Structure
Members, governing and advisory bodies
Locations in Germany

Publisher's information

State Secretary Guido Wendt
Ministry of General Education and Vocational Training, Science, Research and Culture of Schleswig-Holstein

Members delegated by the scientific and technical council (STC)
Prof. Dr. Elizabeth von Hauff
Director of the Fraunhofer Institute for Electron Beam and Plasma Technology FEP

Prof. Dr.-Ing. Peter Ohlhausen
Head of Research Coordination at the Fraunhofer Institute for Industrial Engineering IAO, Deputy Chair of the STC

Prof. Dr. Anita Schöbel
Director of the Fraunhofer Institute for Industrial Mathematics ITWM Chair of the STC

Honorary senator
Prof. Dr.-Ing. Dr.-Ing. E. h. Dr. h. c.
Ekkehard D. Schulz

Permanent guests
State Secretary Susanne Bowen
Ministry of Science, Culture, Federal and European Affairs of Mecklenburg-Vorpommern

State Secretary Tobias Dünow
Ministry of Science, Research and Culture of the State of Brandenburg

Minister Dr. Nicole Hoffmeister-Kraut
Ministry of Economic Affairs, Labour and Tourism of Baden-Württemberg

Dipl.-Phys. Doris Rösler
Chair of the Fraunhofer-Gesellschaft Central Works Council, Fraunhofer Institute for Building Physics IBP

Boards of trustees

In total, the boards of trustees of the institutes consist of 885 members, some of whom hold seats on several boards of trustees.

Scientific and technical council (STC)

The STC has 179 members, 104 of whom are delegated institute directors, while 75 are elected representatives of the scientific and technical staff.

Chair of the STC:
Prof. Dr. Anita Schöbel
Director of the Fraunhofer Institute for Industrial Mathematics ITWM

Presidential council

The presidential council of the Fraunhofer-Gesellschaft is made up of the members of the executive board and the chairs of the Fraunhofer groups, named below:

Prof. Dr. Andrea Büttner
Fraunhofer Group for Resource Technologies and Bioeconomy

Prof. Dr. Karsten Buse
Fraunhofer Group for Light & Surfaces

Prof. Dr. Jakob Edler
Fraunhofer Group for Innovation Research

Prof. Dr. Dr. Gerd Geisslinger
Fraunhofer Group for Health

Prof. Dr.-Ing. Christoph Herrmann
Fraunhofer Group for Production

Prof. Dr. Albert Heuberger
Fraunhofer Group for Microelectronics

Prof. Dr. Bernd Mayer
Fraunhofer Group for Materials and Components

Prof. Dr.-Ing. Boris Otto
Fraunhofer ICT Group

Prof. Dr.-Ing. Andreas Reuter
Fraunhofer Group for Energy Technologies and Climate Protection

Presidential council member acting in an advisory capacity
Prof. Dr.-Ing. Jürgen Beyerer
Fraunhofer Segment for Defense and Security VVS

Permanent guest
Prof. Dr. Anita Schöbel
Chair of the STC, Director of the Fraunhofer Institute for Industrial Mathematics ITWM

Executive board

Prof. Dr.-Ing. Holger Hanselka
(President and Chair of the Executive Board)

Elisabeth Ewen

Prof. Dr. rer. nat. Constantin Häfner

Dr. rer. pol. Sandra Krey

Prof. Dr. rer. nat. habil. Axel Müller-Groeling

Listed information valid as of December 31, 2025

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Structure

Members, governing and advisory bodies

Locations in Germany

Publisher's information

Locations in Germany

Fraunhofer worldwide

Foreword

Contents

Executive board's report

Senate's report

Review of Fraunhofer research

Finances

About Fraunhofer

Publisher's information

Publisher's information

Editorial team
Thomas Eck (editor in chief)
Tanja Schmutzer (managing editor)
Eva Bachmann
Mandy Bartel
Laura Rottensteiner-Wick

Editorial address
Fraunhofer-Gesellschaft
Hansastrasse 27 c, 80686 Munich, Germany
Monika Landgraf (person responsible for content)
Director of Corporate Communications and spokesperson for the president
Hansastrasse 27 c
80686 Munich, Germany
Phone +49 89 1205-1333
monika.landgraf@zv.fraunhofer.de

Design
Silke K. Schneider

Published by
Fraunhofer-Gesellschaft e. V.
Holger Hanselka
President and Chair of the Executive Board of the Fraunhofer-Gesellschaft

Reproduction of any material requires the consent of the editorial team.

© Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Munich 2026