FACTS, FIGURES, PEOPLE

JÜLICH
Forschungszentrum
Shaping Change

Member of the Helmholtz Association



SHAPING CHANGE

With this mission, almost 7,120 people work hand in hand at Forschungszentrum Jülich, as do 934 visiting scientists from 65 countries. We are one of the major interdisciplinary research institutions in Europe and, being a member of the Helmholtz Association, we contribute to solving the major social challenges of our time.

CONTENT

RESEARCH

TRANSFER

NOTES

RESEARCH AT JÜLICH AT A GLANCE

11
Institutes

17
Branch offices in Germany and abroad

238
football fields
would fit into the 1.7 square kilometres of Forschungszentrum Jülich's campus

861
million euros
of revenue for Forschungszentrum Jülich in 2021

Supercomputer JUWELS, quantum computer JuPSI
Jülich Supercomputing Centre

Atmospheric simulation chamber SAPHIR
Institute of Energy and Climate Research

900 MHz NMR spectrometer
Institute of Biological Information Processing

EBRAINS
Institute of Neuroscience and Medicine

SELECTED RESEARCH INFRASTRUCTURES ON THE JÜLICH CAMPUS

3

Research focus areas

Information

Energy

Bioeconomy

84

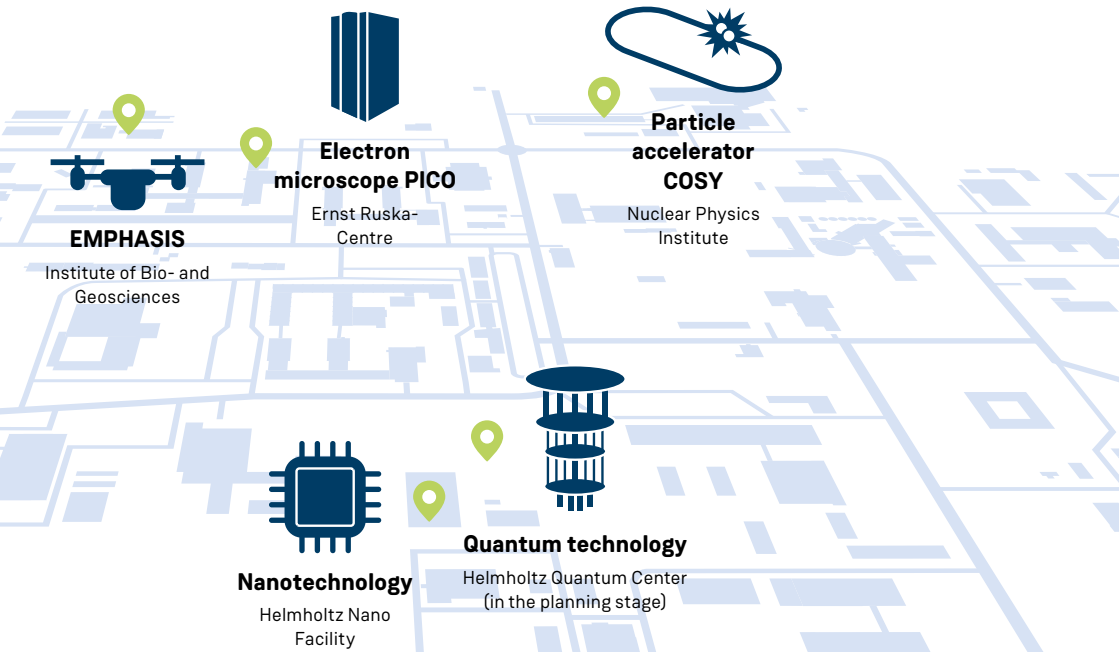
New patent applications

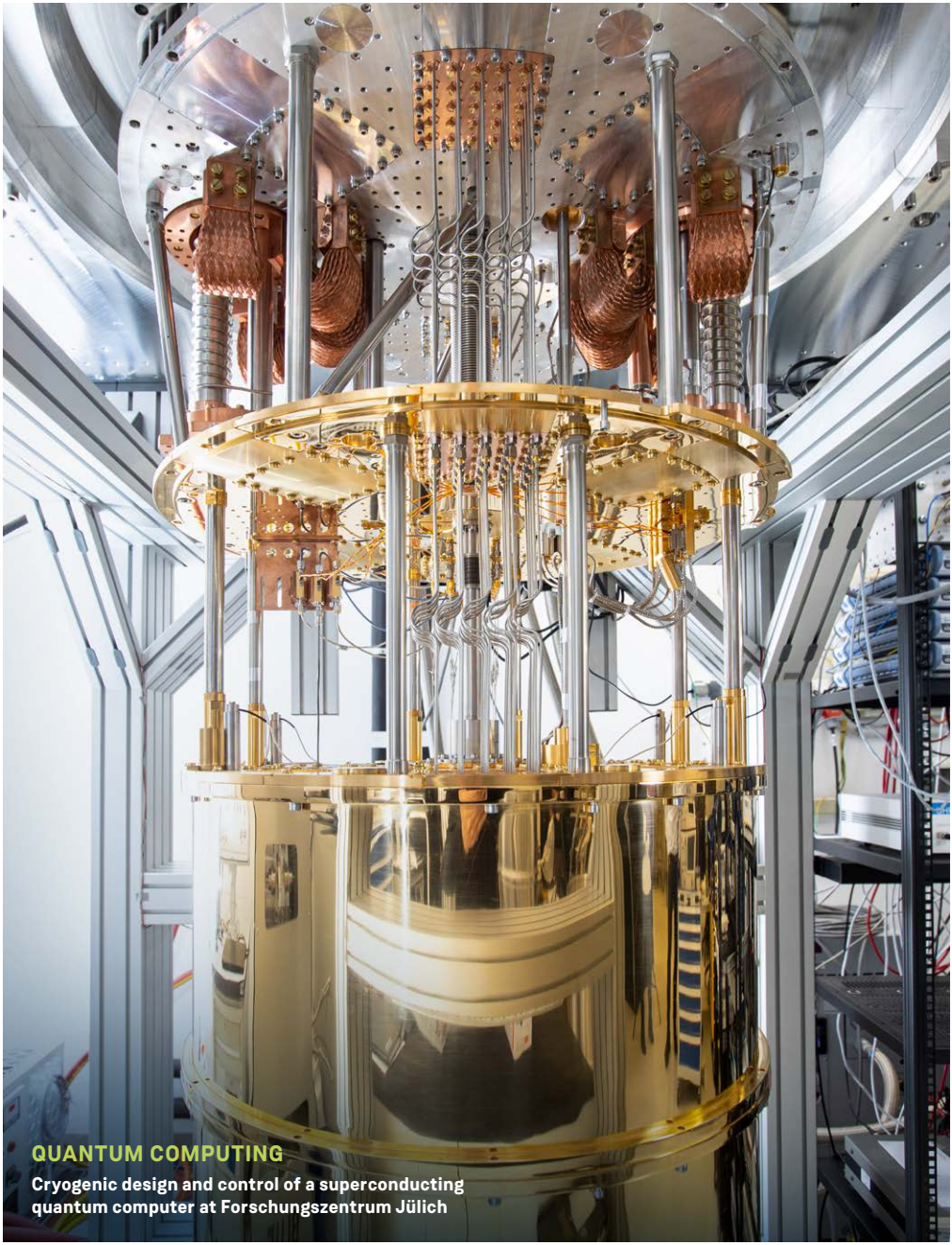
in 2021

3,081

Publications

in 2021





QUANTUM COMPUTING

Cryogenic design and control of a superconducting quantum computer at Forschungszentrum Jülich

FOCUS INFORMATION

Information dovetails the areas of simulation and data sciences of high-performance computing (HPC), quantum computing, brain research, neuromorphic computing and the research on bio-based and nanoelectronic-based information technologies of the future.

Jülich researchers use JUWELS and JURECA – two of the currently most powerful supercomputers in the world – to obtain, by means of simulations, answers to complex questions in climate research, neuroscience, materials research and other fields. They also develop modular hardware architectures for exascale computing. Many research results are based on large data volumes: Jülich scientists are therefore focusing not only on "big data" but also on certain types of artificial intelligence (AI) such as machine learning.

Quantum technology will change our world – in science, industry and business. Jülich scientists are researching this technology from the basics to application. In the joint project QSolid, which is coordinated by Forschungszentrum Jülich, a complete quantum computer based on cutting-edge, German technology will be created in the next few years.

Technology-based information processing is closely linked to research on biological systems. Learning from the brain – this is the basis of innovative computing concepts such as neuromorphic computing: the brain uses very little energy to process and store huge amounts of information. Jülich researchers develop components, architecture and software concepts needed for neuromorphic computers.

Decoding the human brain in all its complexity using digital methods is the vision of the EU-funded Human Brain Project. Artificial intelligence helps to develop a high-resolution atlas of the brain.

KRISTEL MICHIELSEN

Prof. Kristel Michielsen has set world records in simulating quantum computers on conventional supercomputers. She and her team have been exploring the possibilities of the first quantum annealer in Europe with more than 5,000 qubits since January 2022. Quantum annealers are not universally programmable like other computers.

Research headlines

Quantum technology

QUANTUM MICROSCOPE: “MADE IN JÜLICH”

Jülich scientists have advanced a scanning tunnelling microscope so that it works almost vibration-free at extremely low temperatures. It is therefore far more suitable than conventional devices for exploring the unusual properties of quantum materials near -273.15 degrees Celsius.

Simulations

OXYTOCIN AND AUTISM

Specialized receptors in the brain mediate the effect of the “cuddling and bonding hormone”, oxytocin. Jülich researchers carried out computer simulations that show how a mutation of these receptors affects the cellular response. The results help to understand why oxytocin nasal sprays are not always effective in people with autism.

Quantum computer

MATERIAL FOR TOPOLOGICAL QUANTUM BITS

Using a scanning tunnelling microscope with special measuring tips, Jülich physicists were able to measure the extraordinary electrical properties in ultra-thin topological insulators for the first time. These materials are considered promising components of quantum bits with a particularly low susceptibility to errors.

Neuromorphic computing

FASTER THAN THE ORIGINAL

Jülich researchers set a speed record in simulating a cerebral cortex network on the prototype of a neuromorphic IBM computer. The network works four times faster than its biological model.

Quantum computer

A QUANTUM OF NRW

North Rhine-Westphalia joins forces for the dawn of the quantum age by establishing a new network. Forschungszentrum Jülich is on board.

Brain research

JOINT PROGRESS

In the journal Science, brain researcher Prof. Katrin Amunts and supercomputer expert Prof. Thomas Lippert, both from Forschungszentrum Jülich, explain why advances in neuroscience are closely linked to developments in high-performance computing.

Quantum technology

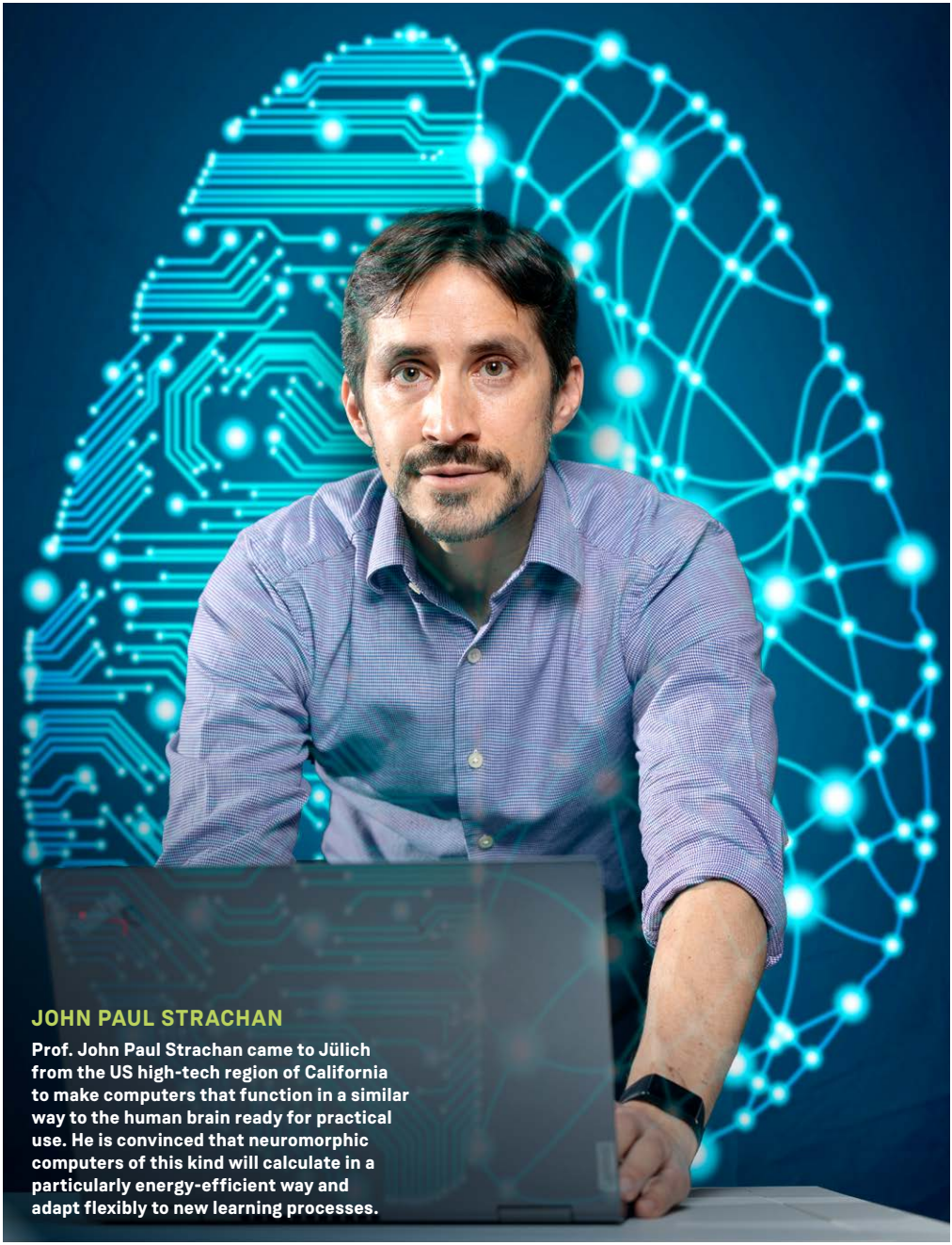
QUANTUM TRANSPORT SPEED LIMIT

Not even the special rules of the quantum world allow information to be transmitted arbitrarily fast. An international team with Jülich participation has now determined the highest speed at which this is possible.

Brain research

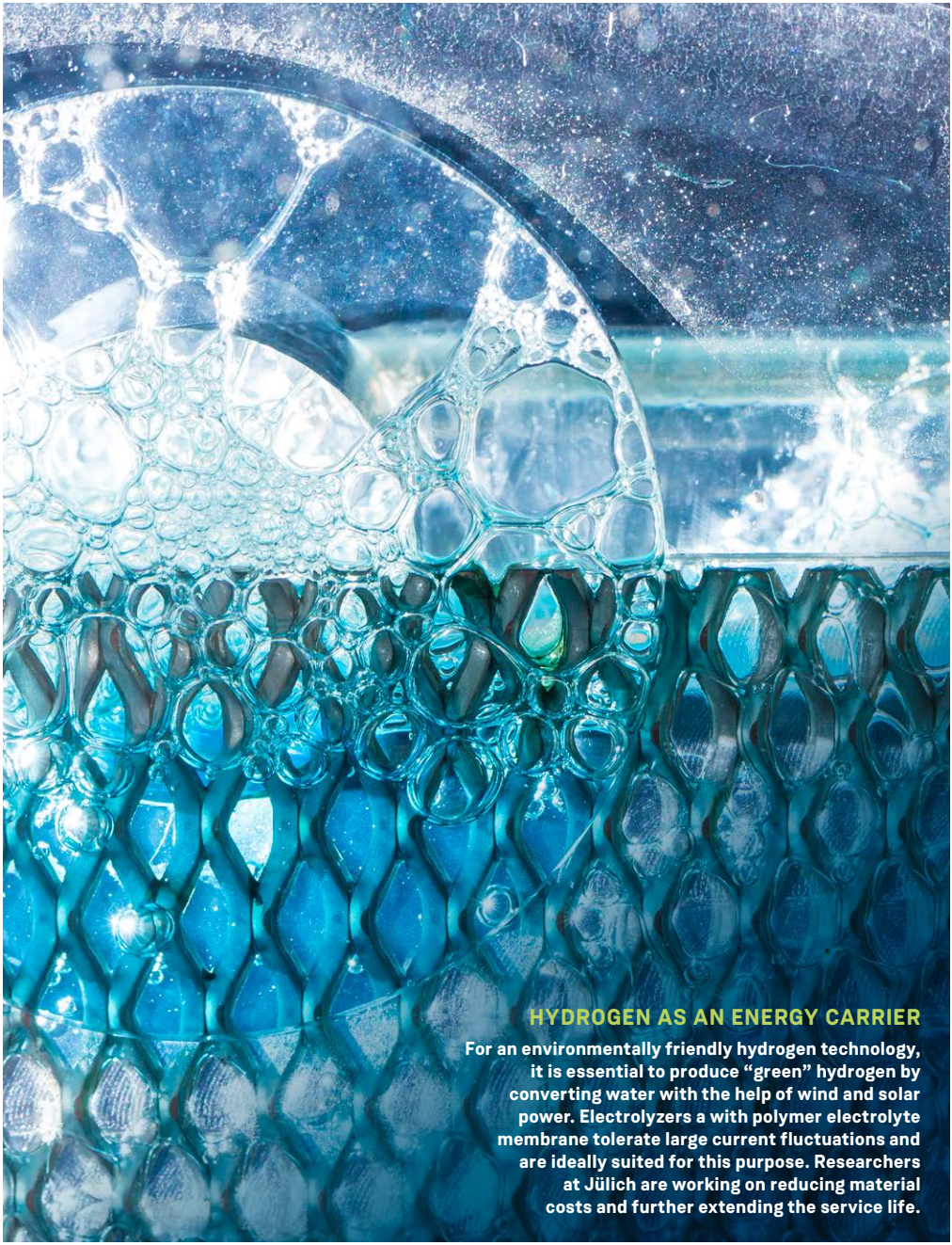
NEW FINDINGS ON ALZHEIMER'S DISEASE

Aβ oligomers are prime suspects in the search for the causes of Alzheimer's dementia. Researchers from Jülich, Düsseldorf and Cologne found out that these protein clumps form 8,000 times faster in a weakly acidic environment than at neutral pH.



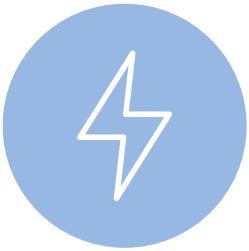
JOHN PAUL STRACHAN

Prof. John Paul Strachan came to Jülich from the US high-tech region of California to make computers that function in a similar way to the human brain ready for practical use. He is convinced that neuromorphic computers of this kind will calculate in a particularly energy-efficient way and adapt flexibly to new learning processes.



HYDROGEN AS AN ENERGY CARRIER

For an environmentally friendly hydrogen technology, it is essential to produce "green" hydrogen by converting water with the help of wind and solar power. Electrolyzers a with polymer electrolyte membrane tolerate large current fluctuations and are ideally suited for this purpose. Researchers at Jülich are working on reducing material costs and further extending the service life.



FOCUS ENERGY

The EU wants to be climate neutral by 2050. To achieve this goal, CO_2 emissions are to be reduced by 55 per cent compared to 1990 by 2030. At the same time, it is vital to secure the electricity supply and keep industry competitive. Jülich scientists have been modelling scenarios to find out how these goals can be achieved. They make recommendations for a future energy system based on renewable energies and develop technologies for it.

Hydrogen plays a key role: it is intended to replace fossil fuels, store energy, enable mobility and serve as a basic material for the chemical industry, both efficiently and cost-effectively. It is also to be "green", that is, produced with the help of renewable energies. Jülich research on this topic is diverse: from material development for electrolysis plants and fuel cells or solar modules to the analysis of electrochemical processes and the transport, storage and use of hydrogen.

Batteries are indispensable as energy storage devices. Jülich researchers optimize established systems and develop new battery types. Jülich is also pursuing a value chain in the research into technologies for storing excess electricity in high-energy chemicals ("Power-to-X"), for example for use as fuel.

The energy system is one of the most important human influences on the climate and the atmosphere, both regionally and globally. Jülich scientists investigate the exact effects of these influences by studying physical and chemical processes in the atmosphere. They use experimental findings and computer simulations to advance existing climate models, act as experts and advise politicians and the public on necessary measures.

JESUS GONZALEZ-JULIAN

Prof. Jesus Gonzalez-Julian develops particularly heat-resistant materials, such as for solar power plants or aircraft turbines. These so-called MAX phases are break-proof like metal, but withstand high temperatures like ceramics.

Research headlines

Electrolysis

SERIES PRODUCTION OF ELECTROLYZERS

The Federal Ministry of Education and Research has initiated the lead project H_2-Giga to advance the series production of electrolysis plants. These plants are needed to meet Germany's future demand for sustainably produced hydrogen. Forschungszentrum Jülich has received funding totalling €96 million for its contributions to the project.

Electrochemical processes

MORE EFFICIENT PRODUCTION OF H_2

On the surface of a catalytically active model electrode, an atomically thin layer doubles the amount of water split in an electrolysis plant. This also doubles the amount of hydrogen produced, without increasing the energy requirement, as reported by researchers from Jülich, Aachen, Stanford and Berkeley.

Hydrogen

OPPORTUNITY FOR WEST AFRICA

The H_2 Atlas-Africa project, coordinated by Jülich scientist Dr. Solomon Agbo, presents encouraging interim results: chances are good that the 15 states of the Economic Community of West African States, ECOWAS will establish themselves as producers and exporters of sustainably produced hydrogen in the long run.

Atmospheric research

FORMIC ACID IN THE ATMOSPHERE

Researchers at Jülich have unlocked the chemical processes that produce most of the formic acid present in the atmosphere. Thanks to this knowledge, it will be possible to further refine atmospheric and climate models.

Solar modules

NANOLAYERS IMPROVE CELLS

A nanostructured transparent material and a new cell design pave the way for the production of silicon solar cells with an efficiency of more than 26 per cent.

Energy transition

WAYS TO NET ZERO

Jülich systems researchers analyzed what is needed for Germany to achieve its declared goal of becoming greenhouse gas neutral by 2045. The study shows that immediate measures must be taken in all sectors – in energy, transport, buildings, industry and services.

Power supply

VULNERABILITY ANALYSIS WITH AI

Researchers from Jülich, Cologne and Norway have successfully harnessed artificial intelligence to find out what causes the everyday frequency deviations in various electricity grids. Such fluctuations are associated with risks for operators and costs for consumers.

Battery

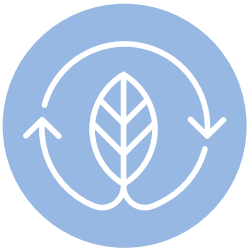
LITHIUM-ION BATTERIES NOT PUSHED TO THE LIMITS

Scientists from the Helmholtz Institute Münster, a branch of Forschungszentrum Jülich, showed in a study that the full potential of the conventional lithium-ion battery has not yet been tapped.

ASTRID KIENDLER-SCHARR

Jülich atmospheric researcher Prof. Astrid Kiendler-Scharr contributed to the current status report of the Intergovernmental Panel on Climate Change (IPCC). She is the lead author of the chapter on short-lived climate pollutants. Taken together, these pollutants have had a similar share in causing the observed warming of the global climate as the much-noticed CO_2.

PLANT RESEARCH
The octocopter is used to collect data on the vegetation covering the ground.



FUTURE FIELD BIOECONOMY

Sustainable bioeconomy is a bio-based circular economy that manages without fossil raw materials, instead relying on the efficient use of biological resources such as plants, animals or microorganisms. Scientists at Forschungszentrum Jülich have been developing new value creation processes, for example. They use customized microorganisms and biological catalysts to produce, from renewable raw materials or waste such as plant residues, valuable substances for medicines, bioplastics or even fuels. In biotechnology, automation, miniaturization and digitization play an important role in shortening development times and making them more predictable.

Agriculture and plant research are also part of the bioeconomy. Researchers use experimental data from trial fields and simulations of soil-plant interactions to help optimize yields, reduce fertilizer use and address changes caused by climate change. Digital monitoring supports tailored irrigation and can show stress in plants at an early stage.

It is to be demonstrated in the Rhineland region, which serves as a model region in this respect, how the switch to a fossil-free economy can succeed after coal-fired power generation has been phased out. One building block for this is the BioökonomieREVIER initiative. It is coordinated by Forschungszentrum Jülich and networks the local actors. For more than ten years now, scientific expertise and modern infrastructures in important fields of the bioeconomy have been pooled in the Bioeconomy Science Center, which is the competence centre of Forschungszentrum Jülich as well as the universities of Bonn and Düsseldorf and of RWTH Aachen University.

NICK WIERCKX

Prof. Nick Wierckx counts on the bacterium *Pseudomonas putida* to assist in a bio-based circular economy. It is very robust and tolerant to toxic chemicals. Wierckx wants to use genetic variants of the bacterium for different purposes: firstly to break down as many types of plastic waste as possible, and secondly to produce valuable aromatic chemicals such as benzene and styrene.

Research headlines

Plant research

NITROGEN STORAGE

Under Jülich leadership, an international research team discovered that micro-algae store vital nitrogen in the form of tiny guanine crystals. An efficient nitrogen balance makes CO_2-storing microalgae excellent nutrient suppliers for agriculture.

Plant research

BARLEY FOR TIMES OF DROUGHT

An international team with Jülich participation has identified a gene that makes the roots of some barley plants grow much more steeply downwards than average. This allows the roots to better access water and nutrients at much further depths in the soil in times of drought.

Soil

WATER MONITOR FOR GERMANY

The Jülich, wasser-monitor.de (in German) has been online since November 2021. The tool shows detailed simulation results of the water available to plants in Germany. It thus provides useful information in the face of extreme weather conditions, which are becoming more frequent in the course of climate change and which are significant for agriculture.

Simulations

MODELLING FOR CLEANER WATERS

There is too much phosphate in German bodies of water and lakes, which damages ecosystems. Germany hopes to meet the benchmarks in all bodies of water in the country by 2027. A simulation model from Jülich is helping to meet this goal.

Shaping Change WITH RESEARCH

The Rhineland region is a region in transition – away from the climate-damaging use of lignite and towards sustainable value chains. Structural change is one of the central social challenges not only for the Rhineland lignite region but for the whole of North Rhine-Westphalia.

Forschungszentrum Jülich is actively helping to shape this process. With scientific excellence, it contributes to developing innovations and products, attracting new cooperation partners to the region, maintaining high-quality jobs and creating new ones. The region is to become a model for new economic activity in this way.

Funded by an emergency programme of the Federal Government, and together with regional partners from industry, science and civil society, the focus is on projects from Forschungszentrum Jülich's three strategic areas of research – Bioeconomy, Energy and Information.

Forschungszentrum Jülich coordinates and networks the local actors. For more than ten years now, scientific expertise and modern infrastructures in important fields of the bioeconomy have been pooled in the Bioeconomy Science Center, which is the competence centre of Forschungszentrum Jülich as well as the universities of Bonn and Düsseldorf and of RWTH Aachen University.

PROJECTS INCLUDE:

- The BioökonomieREVIER initiative, which aims to establish a bio-based and sustainable economic system
- The iNEW innovation platform, which is intended to help establish a circular economy based on carbon dioxide (CO_2)
- The Helmholtz Cluster for a Sustainable and Infrastructure-Compatible Hydrogen Economy (HC-H2) with various demonstration projects in the region

PETER WASSERSCHEID

Prof. Peter Wasserscheid is the founding director of the new Jülich Institute for Sustainable Hydrogen Economy (INW), which is to become the innovative heart of the Helmholtz hydrogen cluster HC-H2. INW's research focuses on technologies for chemical hydrogen storage with liquid hydrogen carriers that can be handled similarly to conventional fuels.

RAINER WASER

Prof. Rainer Waser from Forschungszentrum Jülich and RWTH Aachen University coordinates the NEUROTEC project, in which scientists develop computers modelled on the human brain in order to create the basis for new added value in the Rhineland region. Demonstrators are to show the computational efficiency of neuro-inspired artificial intelligence (AI).

HC-H2

KICK-OFF FOR HYDROGEN MODEL REGION

The launch event for the Helmholtz Hydrogen Cluster (HC-H2) took place on 2 September 2021. The funding from the Federal Government and the North Rhine-Westphalian state government is an essential building block in developing the Rhineland region into a hydrogen model region with Europe-wide appeal.

BioökonomieREVIER

DOUBLED USE OF SPACE

Solar modules that are designed in such a way that plants for food and material use can grow on an area underneath: this is the concept of the Agri-/Horti-PV plant, which Forschungszentrum Jülich built together with partners in 2021. In this way, agricultural products and solar power can be generated on the same area.

BioökonomieREVIER

OPPORTUNITY FOR THE INDUSTRY

The study "Bioökonomie: Potenziale im Rheinischen Revier – Industrie und Verwertung" (Bioeconomy: its Potential in the Rhineland Region – Industry and Utilization) shows that the regional diversity of industries is conducive to establishing bio-based, cross-industry value chains in the future.

BioökonomieREVIER

GREEN TRANSFORMATION

The Federal Ministry of Education and Research is providing €38.5 million to further support the BioökonomieREVIER innovation labs. Forschungszentrum Jülich coordinates the innovation cluster, which is concerned with the topics of agriculture, integrated biotechnology and plastics technology.

iNEW

START OF THE SECOND PROJECT PHASE

With new funding, the iNEW project has been in its second phase since 2021. In this project, researchers at Jülich are working on replacing value chains based on natural gas to enable a chemical industry resilient to raw materials.

INSTITUTES AND SECTIONS

1 Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons

- Physics of Nanoscale Systems
- Materials Science and Technology
- Structural Biology

2 Institute for Advanced Simulation

- Jülich Supercomputing Centre
- Quantum Theory of Materials
- Theoretical Physics of Living Matter
- Theoretical Nanoelectronics
- Theory of Strong Interactions
- Computational Biomedicine
- Theoretical Neuroscience
- Civil Safety Research
- Data Analytics and Machine Learning
- Materials Data Science and Informatics

3 Institute of Bio- and Geosciences

- Biotechnology
- Plant Sciences
- Agrosphere
- Bioinformatics
- Computational Metagenomics

4 Institute of Biological Information Processing

- Molecular and Cellular Physiology
- Mechanobiology
- Bioelectronics
- Biomacromolecular Systems and Processes
- Theoretical Physics of Living Matter
- Cellular Structural Biology
- Structural Biochemistry
- Neutron Scattering and Biological Matter
- Technical and Administrative Infrastructure

5 Institute of Energy and Climate Research

- Materials Synthesis and Processing
- Microstructure and Properties
- Techno-economic Systems Analysis
- Plasma Physics
- Photovoltaics
- Nuclear Waste Management
- Stratosphere
- Troposphere
- Fundamental Electrochemistry
- Energy Systems Engineering
- Systems Analysis and Technology Evaluation
- Helmholtz Institute Erlangen-Nürnberg for Renewable Energy
- Helmholtz Institute Münster
- Theory and Computation of Energy Materials
- Electrochemical Process Engineering

6 Nuclear Physics Institute

- Experimental Hadron Structure
- Experimental Hadron Dynamics
- Theory of Strong Interactions
- Large Scale Nuclear Physics Equipment

7 Institute for Sustainable Hydrogen Economy

- Chemical Energy Storage – Interface Research Focus
- Chemical Energy Storage – Functional Materials Focus
- Chemical Energy Storage – Reactor Technology Focus
- Process and Systems Engineering for Chemical Hydrogen Storage

8 Institute of Neurosciences and Medicine

- Structural and Functional Organisation of the Brain
- Molecular Organization of the Brain
- Cognitive Neuroscience
- Medical Imaging Physics
- Nuclear Chemistry
- Computational and Systems Neuroscience
- Brain and Behaviour
- Computational Biomedicine
- JARA-Institute Brain structure-function relationships
- JARA-Institute Molecular neuroscience and neuroimaging

9 Jülich Centre for Neutron Science

- Neutron Scattering and Biological Matter
- Quantum Materials and Collective Phenomena
- Neutron Analytics for Energy Research
- Neutron Methods
- Technical Services and Administration

10 Peter Grünberg Institute

- Quantum Theory of Materials
- Theoretical Nanoelectronics
- Quantum Nanoscience
- Quantum Materials and Collective Phenomena
- Microstructure Research
- Electronic Properties
- Electronic Materials
- Quantum Control
- Semiconductor Nanoelectronics
- JARA-Institute Energy-efficient information technology
- JARA-Institute Quantum Information
- Institute for Quantum Computing Analytics
- Institute for Functional Quantum Systems
- Institute for Neuromorphic Compute Nodes
- Institute for Neuromorphic Software Ecosystems
- Topological Materials and Superconductivity
- Technical Services and Administration

11 Central Institute for Engineering, Electronics and Analytics

- Engineering and Technology
- Electronic Systems
- Analytics

As of July 2022

RESEARCH INFRASTRUCTURES

Scientists at Forschungszentrum Jülich have access to extensive, highly specialized research infrastructures. Facilities such as the Helmholtz Nano Facility (HNF), the Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons (ER-C) or the Jülich Centre for Neutron Science (JCNS) complement each other and, as world-class infrastructures, are also available to external researchers. In early 2022, with more than 5,000 qubits, Europe's first quantum annealer started operations as part of JUNIQ, the Jülich user infrastructure for quantum computers.

On the roadmap of the ESFRI (European Strategy Forum on Research Infrastructures) are research infrastructures that are of importance for Europe, strategically and as regards research policy. These include EMPHASIS, for plant phenotyping, PRACE, for the network of European supercomputers, and IAGOS, for research into the Earth's atmosphere – all of which are coordinated by Jülich. EBRAINS, the digital research infrastructure of the Human Brain Project (HBP), has also been on the ESFRI roadmap since 2021. The Ernst Ruska Centre 2.0 has been on the German roadmap for research infrastructures since 2019.

RESEARCH INSTRUMENTS AND FACILITIES

HELMHOLTZ NANO FACILITY (HNF)

The Helmholtz Nano Facility (HNF) provides scientists with instruments and knowledge for the production and research of nanostructures. Unique throughout Europe, the HNF is a research infrastructure for researching, producing and characterizing nanostructures and atomic structures for information technology. Work at the HNF focuses on quantum computing, the components of which are based on the laws of quantum mechanics and use qubits for computing.

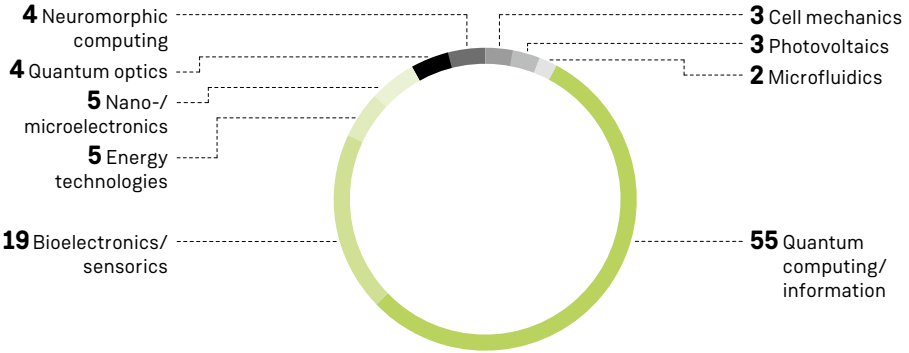
1,000

square metres of clean room of ISO classes 1-3 is provided by the HNF

As a state-of-the-art clean room facility with 1,000 m^2 of clean room of ISO classes 1-3, the HNF offers resources in production, synthesis, characterization and the integration of structures, devices and circuits.

Usage according to research area[1)]

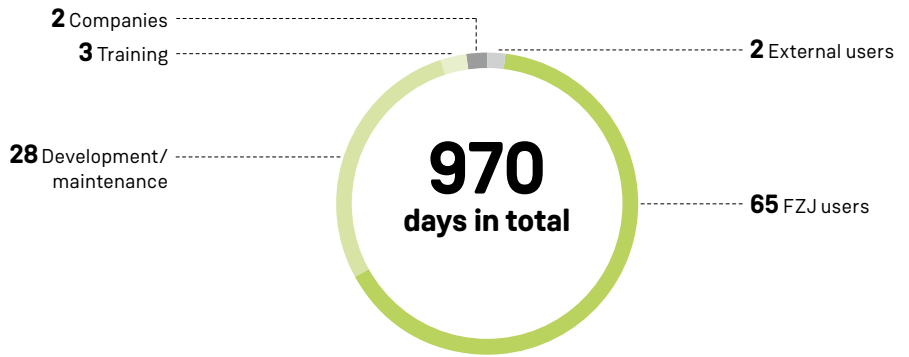
2021, in per cent



1) **Bioelectronics:** the combination of biological and electronic systems | **Cell mechanics:** behaviour of cells under different mechanical conditions | **Nano-/microelectronics:** electronic components with a very low energy requirement for processing or storing information | **Energy technology:** energy generation systems | **Photovoltaics:** converting light into energy/increasing the efficiency of solar cells | **Microfluidics:** behaviour of liquids in the smallest space | **Quantum optics**: systems for the interaction between light and matter | **Quantum computing:** circuits based on the laws of quantum mechanics | **Neuromorphic computing:** computers and circuits modelled on the brain

Allocated usage time[2)]

2021, in per cent



2) The usage of the HNF and the share of external users/companies was significantly lower in 2021 due to the corona-related access requirements applying to external users/companies.

EUROPEAN INFRASTRUCTURE FOR MULTI-SCALE PLANT PHENOMICS AND SIMULATION FOR FOOD SECURITY IN A CHANGING CLIMATE (EMPHASIS)

The European Infrastructure for Multi-Scale Plant Phenomics and Simulation for Food Security in a Changing Climate (EMPHASIS) is a plant phenotyping infrastructure distributed across Europe. It undertakes to analyze and measure the external appearance of plants, such as the architecture of roots or the number of leaves. The development of the European infrastructure is being coordinated at the Jülich Institute of Bio- and Geosciences as part of the EU-funded EMPHASIS-PREP project. EMPHASIS supports scientists in studying plants in different environments so as to enable more efficient crop production in a changing climate, ensure food security in the future and initiate a sustainable European agricultural economy. Information systems for data collection and a platform with mathematical models are linked by EMPHASIS at a European level, knowledge and new technologies are shared and scientific education is supported. Thus, researchers from Europe are given access, for instance, to the facilities of the “Jülich Plant Phenotyping Center” (JPPC).

EMPHASIS builds on the EU research infrastructure projects EPPN/EPPN2020 and will expand the portfolio of phenotyping infrastructures, integrate national infrastructures and ensure sustainable and long-term use of the infrastructures.

207

facilities across Europe for plant phenotyping in the EMPHASIS database

24

European countries are members of the EMPHASIS Support Group

144

transnational research projects in EPPN2020 with scientists from 37 countries

The D-Wave quantum annealer at its new location in the vibration-free JUNIQ building

JÜLICH UNIFIED INFRASTRUCTURE FOR QUANTUM COMPUTING (JUNIQ)

Quantum computing and quantum annealing are considered the computing methods of the future when it comes to solving extremely complex problems. While there is still a long way to go before these technologies will be fully developed, the first experimental systems, prototypes and commercial devices can already be used today. The Jülich UNified Infrastructure for Quantum computing(JUNIQ) provides users from Germany and Europe with access to various of these quantum machines. JUNIQ, which has been under construction since autumn 2019, thus permits science and industry early first steps into the practice of quantum computing.

Since the beginning of 2022, JUNIQ has included a quantum annealer with more than 5,000 qubits from the company D-Wave. It is housed in the UNIQ building, which was built specifically for this purpose. Additional systems are located at Jülich while others are in partner facilities. The Jülich supercomputers, which can be linked to quantum systems, are also part of this infrastructure. Moreover, JUNIQ supports users in the development of algorithms and applications for quantum computing.

JÜLICH SUPERCOMPUTING CENTRE (JSC)

The Jülich Supercomputing Centre (JSC) provides computing capacity of the highest performance class to scientists at Forschungszentrum Jülich, at universities and research institutions in Germany and Europe as well as to the industry. The Centre also supports them in their research projects. It responds at short notice to new user requirements such as the use of cloud services or artificial intelligence (AI), interactive supercomputing or the development of concepts and services for long-term data curation.[1)]

Jülich Supercomputing Centre in figures

- In 2021, the computers JUWELS and JURECA operated at the JSC were used by about **1,500** scientists in approximately **300** projects.
- In addition, more than **1,000** users were involved in smaller collaborative projects with the JSC in 2021.
- About **10** per cent of users consume about **90** per cent of the resources, since Jülich, as a national supercomputing centre, is primarily intended to support large-scale projects.

Users according to region

Computing time projects peer-reviewed by an independent panel of experts

Germany	1,200
Europe (without Germany)	250
Countries outside Europe	50

Since the introduction of the Top500 list of the world's fastest supercomputers, the systems operated at the JSC have always been among the 20 fastest on this list. Along with the JURECA system, JUWELS is a system that, together with a GPU-based booster module, currently provides a computing power of 85 quadrillion computing operations per second (85 petaflops[2)]). At the end of 2021, a research team was able to show that the JUWELS booster is the fastest AI supercomputer in Europe.

Energy efficiency (flops per watt) plays an increasingly important role in the operation of high-performance and supercomputers. The JUWELS booster available at Jülich is one of the most energy-efficient systems in the world. It is used for a wide range of applications, from basic research to climate and materials research to life and engineering sciences.

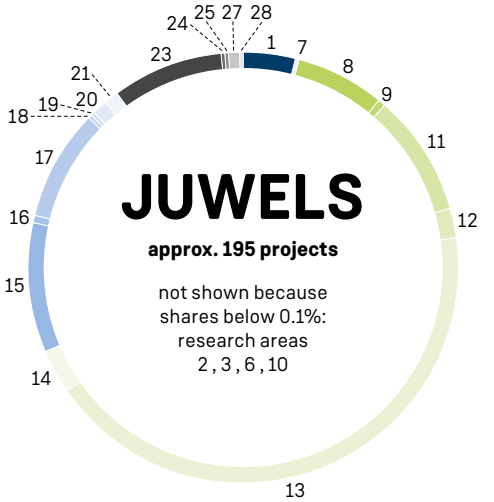
1) Activities required to maintain research data over the long term so that it remains available for reuse and retention.
2) The computing power of computer systems is expressed in floating point operations per second (FLOPS). This value indicates how many floating point number operations (additions or multiplications) can be performed by a system in one second.

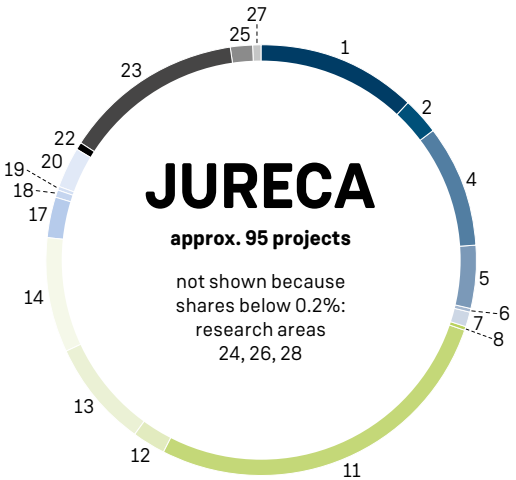
In June, Forschungszentrum Jülich – a partner in the German Gauss Centre for Supercomputing – was selected to be the site of the first European exascale computer. The supercomputer is expected to break the limit of 1 trillion computing operations per second, which is a one with 18 zeros. The system will be procured by the European supercomputing initiative EuroHPC JU (European High Performance Computing Joint Undertaking). The exascale computer will help solve major and pressing scientific questions concerning, for instance, climate change, pandemic response and sustainable energy production. It will also enable the intensive use of artificial intelligence and big data analysis.

Forschungszentrum Jülich will be the site of the first European exascale computer. It is to be operated by the JSC, whose supercomputers JUWELS (pictured) and JURECA are already among the most powerful supercomputers in the world.

Usage according to research area

Pro rata, as of November 2021





Research areas

- 1 Fundamentals of biology and medicine
- 2 Medicine
- 3 Social sciences (JUWELS only)
- 4 Neuroscience (JURECA only)
- 5 Plant Sciences (JURECA only)
- 6 Molecular chemistry
- 7 Chemical solid state and surface research
- 8 Physical and theoretical chemistry
- 9 Analytics/method development (chemistry) (JUWELS only)
- 10 Biological chemistry and food chemistry (JUWELS only)
- 11 Condensed matter physics
- 12 Optics, quantum optics and physics of atoms, molecules and plasmas
- 13 Particles, nuclei and fields
- 14 Statistical physics, soft matter, biological physics, nonlinear dynamics
- 15 Astrophysics and astronomy (JUWELS only)
- 16 Mathematics (JUWELS only)
- 17 Atmospheric, marine and climate research
- 18 Geophysics and geodesy
- 19 Geochemistry, mineralogy and crystallography
- 20 Water research
- 21 Mechanics and constructive mechanical engineering (JUWELS only)
- 22 Process engineering, technical chemistry (JURECA only)
- 23 Thermal energy technology, thermal machines, fluid mechanics
- 24 Materials technology
- 25 Materials science
- 26 Systems engineering (JURECA only)
- 27 Informatics
- 28 Construction and architecture

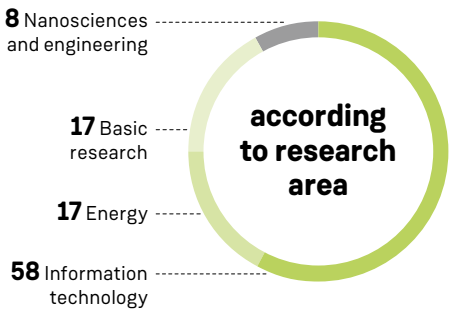
JÜLICH CENTRE FOR NEUTRON SCIENCE (JCNS)

The Jülich Centre for Neutron Science (JCNS) operates neutron scattering instruments at top sources in Germany, Europe and globally, offering them to a large user community. Neutrons serve as microscopic probes to conduct research in the fields of soft and condensed matter, biosciences and energy materials. Neutron research provides important contributions to meeting the major challenges that society is facing, for example with research into modern, high-performance materials for energy storage or in environmental analysis.

Together with its partners, the JCNS designs, builds and installs new instruments at neutron sources, such as for the European Spallation Neutron Source ESS in Lund, Sweden, or for a future high brilliance accelerator-based neutron source (HBS).

Useage of the neutron source of the Heinz Maier-Leibnitz Zentrum, Garching and ILL, Grenoble

2021, in per cent[1)]



2021, in per cent

1) The FRM II reactor at the MLZ was not in operation in 2021 due to the COVID-19 pandemic and a technical issue. The figures refer to the operation of the JCNS instruments at ILL, which do not cover all research areas.

Experiment duration at the Heinz Maier-Leibnitz Zentrum, Garching and ILL, Grenoble

2021, in days

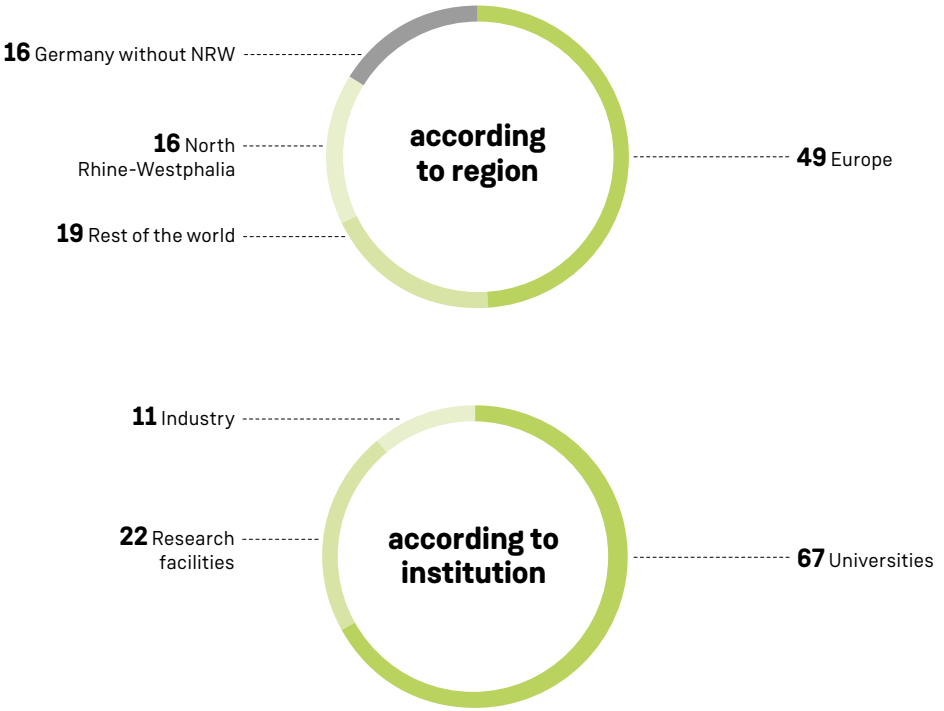
1–3 days	0%
4–7 days	92%
8–15 days	8%

ERNST RUSKA-CENTRE (ER-C)

The Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons (ER-C) is the national research infrastructure for ultra-high resolution electron microscopy. It is jointly operated by Forschungszentrum Jülich and RWTH Aachen University. The electron optical instruments provided and further developed by the ER-C can be used to investigate and describe structures at the atomic and molecular levels. The knowledge gained helps, for example, to develop innovative materials and to investigate medical substances. With PICO, the ER-C has one of only three electron microscopes in the world available for this purpose that, in addition to spherical aberration, can correct the second important lens error: chromatic aberration. In the ER-C 2.0 project, the Centre's infrastructure is being

External users

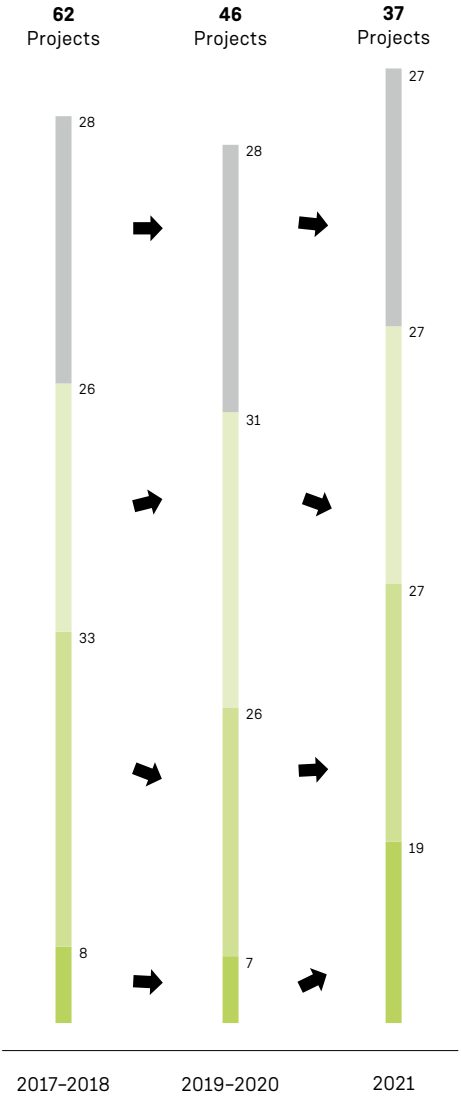
2021, in per cent



Usage according to research area

2021, in per cent

- **Energy research**
  - Catalytic nanoparticles
  - Fuel cells and batteries
  - Gas separation membranes
  - Photovoltaic materials
  - Thermoelectric materials
- **Fundamental solid state research**
  - Complex and novel materials
  - Heterogeneous interfaces
  - Lattice defects
- **Information technology**
  - Ferroelectric materials
  - Magnetic nanoparticles
  - Semiconductor nanostructures
  - Memristive memory for neuromorphic computers
- **Principles of electron optics**
  - Novel measurement techniques and analytical methods



specifically expanded as part of the national roadmap for research infrastructures.

The ER-C creates incentives for companies working with novel materials and technologies to settle in the Rhineland region and contribute to the development of a competence region for innovative materials technologies and, ultimately, to the success of structural change.

EBRAINS

EBRAINS is a new digital research infrastructure created as part of the EU-funded Human Brain Project (HBP). The aim is to promote brain research and the translation of scientific findings into innovations in brain-inspired computing, medicine and industry. To this end, multidisciplinary neuroscience works closely with the developers of state-of-the-art information technologies and uses powerful computers to assemble the ever-growing knowledge about the brain from different research fields.

Being the first research infrastructure of its kind in the world, EBRAINS offers access through a web portal to the most comprehensive database on the human brain to date as well as to powerful digital tools, for example for simulation or AI-based analytical methods. The "EBRAINS Computing Services", coordinated by the Jülich Supercomputing Centre, form the computationally powerful basis of EBRAINS and make it possible to integrate platforms and solutions from the various EBRAINS services into complex workflows. The offer also includes the extremely high-resolution 3D atlas of the human brain developed by the Jülich Institute of Neuroscience and Medicine, supercomputing methods specially developed for neuroscientists and "neuromorphic" computers inspired by the brain.

Nerve fibres of a brain section, visualized using Polarized Light Imaging

EBRAINS in figures

As of April 2022

- More than **500** scientists at over **130** European partner institutions from **19** countries are involved in the development of EBRAINS.
- EBRAINS contains more than **1,200** data sets; **108** models and **166** analysis programmes from **1,799** scientists.
- EBRAINS "Medical Informatics Platform" is installed in **30** European hospitals. It offers data protection compliant access to **20,000** data sets of patients with, e.g., dementia, epilepsy or traumatic injuries.
- **992** institutions in Europe and around the world use EBRAINS.

OTHER RESEARCH INSTRUMENTS AND FACILITIES

ESS Competence Centre
Coordinates the Jülich contributions to the European Spallation Source ESS (the world's most powerful neutron source)

Imaging Core Facility (ICF)
Pools the imaging methods of neurosciences and medicine

Jülich Centre for Structural Biology (JuStruct)
Combines infrastructure and expertise on atomic-resolution structural biology methods

Jülich Synchrotron Radiation Laboratory (JSRL)
Operates state-of-the-art photoemission spectroscopes and photoemission electron microscopes at the synchrotron sources DESY (Hamburg), ELETTRA (Trieste, Italy) and BESSY (Berlin)

Cooler Synchrotron COSY
Particle accelerator and storage ring (for generating proton and deuteron beams)

SAPHIR and SAPHIR-PLUS
For researching processes in the atmosphere

Biomolecular NMR Center
With ultra high-field spectroscopy for structural biology

Membrane Centre
For developing membrane systems for new energy-efficient technologies

Helmholtz Energy Materials Characterization Platform (HEMCP)
For materials research in energy technologies

The NMR high-field device with a field strength of 28 teslas helps to better understand proteins and enable new therapeutic approaches, for example to Alzheimer's disease.

ENVRI-FAIR
Makes data from all European Earth system research freely accessible worldwide via the European Open Science Cloud (EOSC)

Helmholtz Quantum Center (HQC)
Technology laboratory on the quantum computing research spectrum, from quantum materials to quantum computer systems

TRANSFER AT JÜLICH AT A GLANCE

7,120
Employees

2,817
Scientists
(education included)

1,589
Technical staff

1,509
Project management organizations

311
Trainees and placement students

894
Administration

As of 31.12.2021

STAFF ACCORDING TO NATIONALITY

72
America (North)

6,444
Europe

39
America (South)

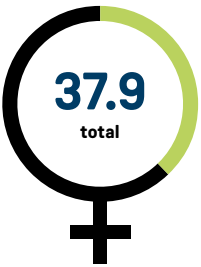
501
Asia

56
Africa

8
Australia

PROPORTION OF WOMEN

In per cent,
FTE (full-time equivalent)



NATIONAL RESEARCH PROJECTS

550
Project participations

54
Associations (coordinated by Forschungszentrum Jülich)

891
Doctoral researchers with employment contract and salary

312
Postdocs

New hires

87
Vocational training positions

15
Different professions

JUELICH_HORIZONS: PROMOTING YOUNG TALENT

We want to get young people excited about science. They will be the discoverers, idea generators and innovation drivers of the society of tomorrow: a society that is already changing today and one for which we are researching. Our goal is to promote excellence at all education, training and career levels and to attract the best minds in international competition. From events of the Schools Laboratory, future-oriented vocational training and dual study programmes to career support for young executives, we offer a wide range of opportunities for young talent under the "juelich_horizons" umbrella.

SPARKING THE RESEARCH INSTINCT IN CHILDREN AND YOUNG PEOPLE

The JuLab Schools Laboratory flexibly adapted its programme in 2021 to the changing corona regulations. In the second half of the year, select courses could again be offered in person for the cooperation schools.

Some 400 students took part in face-to-face events at JuLab and 257 in online events. In addition, 118 teachers attended further training courses.

In the first half of the year, the JuLab designed new online offers and optimized established ones. In cooperation with the Jülich scientists, new topics were developed for the online format "Mission Forschung" (Mission: research):

- **Mission: big data brain research.** In the form of live interviews, for example, researchers presented the topics of brain research, big data and ethics to senior school students. The students could participate interactively via an app. The offer was aimed at students from biology, philosophy or ethics classes.
- **Mission: energy.** The focus was on agricultural photovoltaic research in view of energy transition and structural change in the Rhineland region. During a live video tour, participants could get to know about sensors, such as for the temperature or the headcount in the room, as well as the smart control of energy consumption in the JuLab. The photovoltaic modules already installed and the wind turbine next to the JuLab building, both set up as part of the Living Lab Energy Campus, were also part of the presentation.

For the first time, the JuLab participated in the nationwide **Maus-Türöffner-Tag**. – an initiative by the popular German children's television programme "Sendung mit der Maus", internationally known as "Mouse TV" – with the format "Mission Gehirn" (Mission: brain) online. This gave many families even from outside the region an insight into brain research at Jülich.

Angela Ertz (left) and Anne Fuchs-Döll from JuLab and Prof. Peter Lang from the Institute of Biological Information Processing (IBI-4) present a brochure with student experiments on the topic of soft matter. The brochure was sent to schools in the region and is also available for download.

PROJECT COURSES

The JuLab coordinated three project courses for senior school students. For one year, together with their mentors from the Institute of Bio- and Geosciences (IBG-2), the students could work on their own research projects on the topics of “Algae in the Bioeconomy”, “Agricultural Photovoltaics” and “Education for a Sustainable Development”. The aim was to sensitize young people to socially important future issues and to get them excited about researching.

Brochure “Soft matter matters” with student experiments available for download (in German):

http://go.fzj.de/soft

VOCATIONAL TRAINING AND DUAL STUDY PROGRAMMES

As the largest training company in the region, Forschungszentrum Jülich assumes special social responsibility in vocational training. It offers up to 115 trainee positions in 26 different professions every year. More than 5,000 young people have received qualified vocational training here. Many of them are still employed at Forschungszentrum Jülich today.

In 2021, 95 trainees completed their training. 67 of them (70.5 per cent) passed the exam with the top grades of either “very good” or “good”.

Forschungszentrum Jülich is partnering with neighbouring universities in offering six dual study programmes in the natural sciences as well as in the commercial and technical fields. A dual study programme combines profound training at Jülich, for example as a mathematical-technical software developer (MATSE), with a bachelor’s degree at a university of applied sciences, such as a “Bachelor of Science in Scientific Programming”.

Vocational training positions

New trainees in 2021

Occupations	Total	including a dual study programme
Laboratory technicians	26	6
Electricians	14	–
Metal workers	12	1
Office staff	9	2
Mathematical-technical software developers	25	25
Other	1	–
Total	87	**34**

VOCATIONAL ORIENTATION AND INTERNSHIPS

Forschungszentrum Jülich offers a wide range of opportunities for career orientation. In 2021, 46 school students were accepted for their compulsory school internships, while 131 students were supervised in the context of compulsory internships and voluntary, study-related internships. Due to the Covid-19 pandemic, there were significantly fewer internships than are usually offered by Forschungszentrum Jülich.

YOUNG INVESTIGATORS GROUPS

Forschungszentrum Jülich offers superb starting conditions for a scientific leadership career to excellent postdocs with the opportunity to set up their own young investigators group. In 2021, two new groups were established at Forschungszentrum Jülich, which meant a cumulative total of 18 young investigators groups. Seven of the group heads held a junior professorship, two a W2 professorship and one a W3 professorship; four were funded by the EU through an ERC Starting Grant.

STUDIES AND DOCTORATE

Every year, students from all over the world come to Jülich to gain experience early on in a research-intensive environment. The mobility of young researchers fosters their personal and scientific development, propels the transfer of ideas and intensifies the international collaborations of Forschungszentrum Jülich.

20

publications were released by PGSB fellows

In 2021, in the RISE programme, the German Academic Exchange Service awarded eight scholarships to bachelor students for an internship at Jülich. Due to the corona pandemic, these internships had to be conducted virtually. Two Russian students came to Jülich as part of the DAAD's BARI programme.

Thanks to numerous committed fellows and alumni, the Palestinian-German Science Bridge (PGSB) was scientifically very successful in 2021 despite the pandemic. In 2021, four bachelor's and master's students, 35 doctoral researchers and two postdocs worked at Jülich as part of the PGSB. The PGSB fellows released a total of 20 publications. With a research cluster in the field of energy materials confirmed, there are now six research clusters with individual, sustainable concepts for cooperation between Forschungszentrum Jülich and Palestinian universities.

The China Scholarship Council (CSC) scholarship programme funded a total of 34 doctoral researchers and two postdocs in 2021. One master's scholarship was awarded under the Georgian-German Science Bridge.

TOPIC PORTAL FOR YOUNG RESEARCHERS

Since autumn 2021, Forschungszentrum Jülich has been offering a topic portal on the intranet for young researchers and their managers. It lists advice and support services, including contact persons, so that doctoral researchers, postdocs and young investigators group heads may quickly gain an overview. It provides information about the structured doctoral training offer at JuDocS as well as the Career Centre & Postdoc Office's offer of advice on career opportunities in and outside academia. A funding calendar provides an overview of those grants, scholarships and research awards for which Forschungszentrum Jülich offers individual advice. For young investigators group heads, the portal provides access to a range of services that support, advise and accompany them from the application process to offboarding.

JUDOCS – JÜLICH CENTER FOR DOCTORAL RESEARCHERS AND SUPERVISORS

The structured doctoral support of JuDocS forms the basis for the subject-specific offers in the institutes, research training groups and graduate schools, such as HITEC (Helmholtz Interdisciplinary Doctoral Training in Energy and Climate Research) or HDS-LEE (Helmholtz School for Data Science in Life, Earth and Energy).

In addition to a central point of contact for questions and problems, JuDocS supports Jülich doctoral researchers with a targeted onboarding process, an interdisciplinary qualification programme, a low-threshold counselling service in the event of supervisory conflicts, and independent monitoring of the progress of the respective doctoral project.

Dr. Markus Zimmermann and Dr. Florian Speck (from left) were awarded the Excellence Prize of Forschungszentrum Jülich in 2021 for their outstanding dissertations and achievements in the postdoctoral phase.

Since good supervision is crucial for a successful doctorate, Forschungszentrum Jülich has also increased its focus on the concerns of supervisors since early 2021: a new central email distribution list regularly provides all academic supervisors with relevant information and offers. Analogous to the contact person for doctoral researchers, a position already established in 2019, there is now a designated contact person for supervisors within JuDocS.

In the course of 2021, 1,227 supervised doctoral researchers[1)] worked at Forschungszentrum Jülich. Around 35 per cent of them were women and around 44 per cent came from abroad. They were supervised by the institutes, the doctoral supervisors and the academic supervisors at Jülich, adding up to around 460 people. As of 31 December 2021, there were 312 postdocs at Jülich, including 102 women. Some 48 per cent of all postdocs came from abroad.

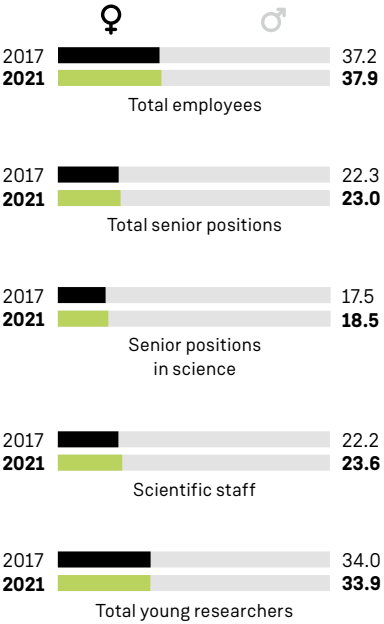
1) This figure also includes doctoral researchers who do not have a contract with Forschungszentrum Jülich, but are financed through scholarships, for example.

STAFF

Forschungszentrum Jülich offers a wide range of career opportunities in science, technical or administrative infrastructures and in research management. Our staff are committed to ensuring that our research meets the highest scientific standards and contributes to solving social problems. Their motivation, creativity and potential is the driving force behind the shaping of research for a changing society. Collegiality and diversity are the basis for us, as a multidisciplinary research centre with an international workforce, to make the most of our opportunities. In addition to excellent research infrastructures, we offer support in balancing work and family life. We want to make real equality of opportunity possible.

Proportion of women in Forschungszentrum Jülich's workforce

In per cent, FTE (full-time equivalent)



Staff overview

As of 31.12.2021

Area	Number[1]
Scientists and technical staff	4,406
of which scientists incl. individuals in scientific training	2,817
· of which doctoral researchers[2]	891
· of which scholarship holders	14
· of which student assistants	191
· of which joint appointments with universities[3]	163
· of which W3 professors	75
· of which W2 professors	81
· of which W1 professors	7
of which technical staff	1,589
Project management organizations	1,509
Administration	894
Trainees and placement students	311
Total	7,120

1) Only employees with a contract paid by Jülich are included
2) Including 129 employees covered by collective agreements with the intention of obtaining a doctorate
3) Not including members of the Board of Directors

APPOINTMENTS, PROFESSORIAL APPOINTMENTS

NEW TO THE BOARD OF DIRECTORS

Prof. Frauke Melchior and Prof. Astrid Lambrecht complete the five-member Jülich Board of Directors. Previously, the 54-year-old physicist Astrid Lambrecht headed the scientific physics division of the French National Centre for Scientific Research (CNRS) in Paris. She also brings a great deal of experience from numerous international science organizations. Her research on quantum fluctuations and the forces they excite extended from the basics to application. As a professor at the Centre for Molecular Biology (ZBMH) at Heidelberg University, the 59-year-old biochemist Frauke Melchior researched the control of cellular processes through the protein SUMO. As a member of the Senate of the German Research Foundation (DFG) and as Dean at Heidelberg University, she was also active in science management.

In April and June respectively, Prof. Frauke Melchior (left) and Prof. Astrid Lambrecht took up their positions on the Board of Directors of Forschungszentrum Jülich.

APPOINTMENTS

Jülich scientists were offered the following chairs in 2021[1]:

Dr. Sarah Genon
Institute of Neurosciences and Medicine

- Heinrich Heine University Düsseldorf, Chair of Cognitive Neuroinformatics

Dr. Timo Dickscheid
Institute of Neurosciences and Medicine

- Heinrich Heine University Düsseldorf, Chair in Computer Science

FORSCHUNGSZENTRUM JÜLICH

Prof. Jesus Gonzalez-Julian
Institute of Energy and Climate Research

- RWTH Aachen University, Chair of Ceramics

Dr. Moritz Wolf
Institute of Energy and Climate Research

- Karlsruhe Institute of Technology (KIT), Department of Chemical and Process Engineering

Dr. Anna Sieben
Institute for Advanced Simulation

- University of St. Gallen

Prof. Knut Müller-Caspary
Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons

- Ludwig-Maximilians-Universität München, Faculty of Chemistry and Pharmacy

1) Not including appointments to universities that resulted in a joint appointment with Forschungszentrum Jülich

JOINT PROFESSORIAL APPOINTMENTS WITH UNIVERSITIES

In the case of a joint appointment, the appointed person holds the office of a professor at a university and, at the same time, has a position at Forschungszentrum Jülich. In 2021, the following scientists were newly appointed to professorships:

New appointments in 2021

Name	Institute	University
Prof. Markus Axer	Institute of Neurosciences and Medicine	**University of Wuppertal**
Prof. Rami Barends	Peter Grünberg Institute	**RWTH Aachen University**
Prof. Hendrik Fuchs	Institute of Energy and Climate Research	**University of Cologne**
Prof. Norbert Galldicks	Institute of Neurosciences and Medicine	**University of Cologne**
Prof. Holger Gohlke	Institute of Bio- and Geosciences	**Heinrich Heine University Düsseldorf**
Prof. Anja Klotzsche	Institute of Bio- and Geosciences	**University of Cologne**
Prof. Stefan Krieg-Venghaus	Institute for Advanced Simulation	**University of Bonn**
Prof. Jochen-Franz Linßen	Institute of Energy and Climate Research	**FH Aachen University of Applied Sciences**
Prof. Emre Ozgur Neftci	Peter Grünberg Institute	**RWTH Aachen University**
Prof. Carsten Sachse	Ernst Ruska-Centre, Institute of Biological Information Processing	**Heinrich Heine University Düsseldorf**
Prof. John Paul Strachan	Peter Grünberg Institute	**RWTH Aachen University**
Prof. Simone Vossel	Institute of Neurosciences and Medicine	**University of Cologne**

Number of joint professorial appointments with universities

As of 31.12.2021

University	Number of professorial appointments[1]	of which new appointments 2021
RWTH Aachen University	69	3
FH Aachen University	5	1
Ruhr Universität Bochum	5	–
University of Bonn	14	1
HHU Düsseldorf	23	2
University of Duisburg-Essen	6	–
FAU Erlangen-Nürnberg	5	–
University of Cologne	19	4
KU Leuven	1	–
UCL Louvain	1	–
JGU Mainz	1	–
University of Münster	1	–
Goethe University, Frankfurt	2	–
Saarland University	1	–
University of Stuttgart	2	–
Aarhus University	1	–
University of Wuppertal	7	1
Total	**163**	**12**

1) Not including members of the Board of Directors

ACCOLADES

International

Name	Award
Prof. Tommaso Calarco Peter Grünberg Institute	**Business Excellence Prize in Quantum Technologies of the Spanish Association of Electronics, IT and Telecommunications Companies AMETIC**
Dr. Bo Persson Peter Grünberg Institute	**Award for Excellence from the Adhesion Society and Lifetime Achievement Award of the Tire Society**
Prof. Olivier Guillion Institute of Energy and Climate Research	**Appointed Fellow of the European Ceramic Society**
Prof. Ulf-G. Meißner Institute for Advanced Simulation, Nuclear Physics Institute	**ERC Advanced Grant**
Dr. Jenna Poonoosamy Institute of Energy and Climate Research	**ERC Starting Grant**
Prof. Michael Saliba Institute of Energy and Climate Research	**ERC Starting Grant**
Prof. Nick Wierckx Institute of Bio- and Geosciences	**ERC Consolidator Grant**
Prof. Martin Winter Institute of Energy and Climate Research, Helmholtz Institute Münster	**Corresponding Member of the Slovenian Academy of Engineering**

Helmholtz Association awards

Name	Award
Dr. Florian Speck Institute of Energy and Climate Research Helmholtz Institute Erlangen-Nürnberg	**Excellence Prize of Forschungszentrum Jülich**
Dr. Markus Zimmermann Institute of Neurosciences and Medicine	**Excellence Prize of Forschungszentrum Jülich**

National

Name	Award
Prof. Katrin Amunts Institute of Neurosciences and Medicine	**Cross of Merit, 1st Class of the Federal Republic of Germany** **and** **Hector Science Award of the Hector Foundation**
Prof. Tommaso Calarco Peter Grünberg Institute	**Election to the German Academy of Science and Engineering acatech**
Prof. Svenja Caspers Institute of Neurosciences and Medicine	**Election to the German National Academy of Sciences and Humanities Leopoldina**
Dr. Georgios Gkatzelis Institute of Energy and Climate Research	**Klaus Tschira Boost Fund of the Klaus Tschira Foundation**
Prof. Martina Krämer Institute of Energy and Climate Research	**Election as Secretary-Treasurer of the International Commission on Clouds and Precipitation**
Prof. Joachim Meyer Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons	**Harald Rose Lecture Award of the German Society for Electron Microscopy**
Dr. Miriam Menzel Institute of Neurosciences and Medicine	**Klaus Tschira Boost Fund of the Klaus Tschira Foundation**
Dr. Simon Rosanka Institute of Energy and Climate Research	**Bernd Rendel Prize of the German Research Foundation (DFG)**
Prof. Michael Saliba Institute of Energy and Climate Research	**Curious Mind Research Award in the category "Materials & Active Substances", awarded by the company Merck and by Manager Magazin**
Prof. Martin Winter Institute of Energy and Climate Research, Helmholtz Institute Münster	**Unity Ambassador of the State of North Rhine-Westphalia** **and** **Admission into the North Rhine-Westphalian Academy of Sciences and Humanities**

PUBLICATIONS

OPEN ACCESS TO SCIENTIFIC LITERATURE

The Central Library of Forschungszentrum Jülich develops and operates the Open Access Monitor (OAM) Germany, which records the publications of German academic institutions in scientific journals and monitors the shift towards open access publications. Open access will allow unrestricted and free reading of scientific articles and sustainably improve access to scientific literature for science. The conversion of scientific publishing to open access is the goal of all research funders and science organizations.

The OAM was previously based on the databases Dimensions (DigitalScience) and Web of Science (Clarivate). It can now also integrate the Scopus database, an abstract and citation database for peer-reviewed literature with content from over 27,000 journals by more than 7,000 publishers. This is possible because Elsevier, the scientific publisher owning Scopus, supports the OAM. The integration of the database expands the possibilities of the OAM as a central instrument for achieving progress in the open access transformation in Germany.

The ten journals with the most publications by Jülich researchers in 2021

Journal	Number of publications
Physical Review B	58
Atmospheric Chemistry and Physics	51
Scientific Reports	39
Nature Communications	33
Physical Review Letters	33
Advanced Engineering Materials	32
Nuclear Fusion	32
NeuroImage	25
International Journal of Molecular Sciences	23
Fusion Engeneering and Design	22

Jülich publications

Jülich publications in the last five years

Year	Total	in peer-reviewed journals	of which with researchers from other institutions	Books, other publications	Doctoral theses, habilitations
2017	**2,442**	1,861	1,499 | **80.5%**	460	121
2018	**2,319**	1,714	1,351 | **78.8%**	458	147
2019	**2,398**	1,891	1,443 | **76.3%**	400	107
2020	**2,473**	1,827	1,391 | **76.1%**	533	113
2021	**3,081**	2,447	1,811 | **74.0%**	507	127

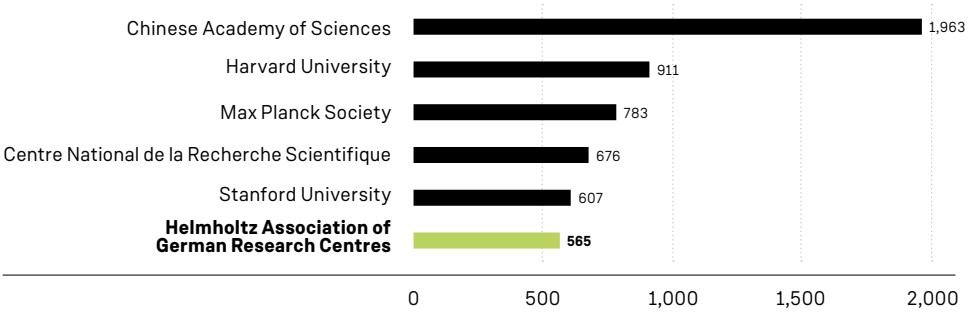
JÜLICH IN THE VANGUARD OF THE NATURE INDEX

Every year, the renowned journal "Nature" ranks the leading international research institutions in its "Nature Index". It is based on the number of an institution's publications in 82 scientific journals selected by an independent panel. It measures Count (summing up the number of publications with at least one authorship from the institution) and Share (indicating the relative share of authorship of an institution in each article).

In the "Nature Index" 2021, the Helmholtz Association, of which Forschungszentrum Jülich is a member, ranked second among the German institutions on this performance scale behind Max Planck Society and seventh in the international ranking. Among all 18 Helmholtz Centres, Jülich ranks third. Forschungszentrum Jülich has thus maintained its position as a top-class location in the national research landscape.

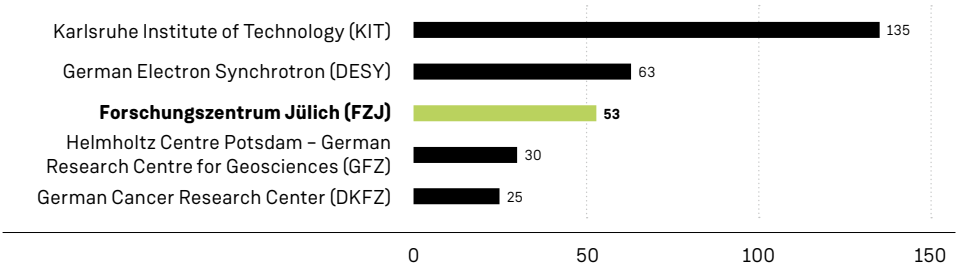
Top 6 globally (as of July 2022)

Institutions with Share[1] according to "Nature Index"



Top 5 in the Helmholtz Association

Institutions with Share[1] according to "Nature Index"



1) Proportion of authorship of an institution in each article

Prof. Wulf Amelung

Prof. Christoph J. Brabec

Prof. Simon Eickhoff

Dr. Hendrik Poorter

Prof. Michael Saliba

Prof. Björn Usadel

JÜLICH RESEARCHERS MUCH CITED

Among the most frequently cited researchers in the world are six Jülich scientists: Prof. Simon Eickhoff from the Institute of Neurosciences and Medicine, Prof. Björn Usadel from Bioinformatics, Dr. Hendrik Poorter from Plant Sciences, Prof. Michael Saliba from Photovoltaics, Prof. Wulf Amelung from Agrosphere and Prof. Christoph Brabec from the Helmholtz Institute Erlangen-Nürnberg for Renewable Energy. They were listed as “Highly Cited Researchers” by the Web of Science Group, which is part of Clarivate Analytics. This means that their publications are among the one per cent of the most cited papers in their field in the year of publication. Only those scientists who are involved in several of these particularly influential publications will be accepted as one of the “Highly Cited Researchers”.

6

Jülich researchers are among the “Highly Cited Researchers”

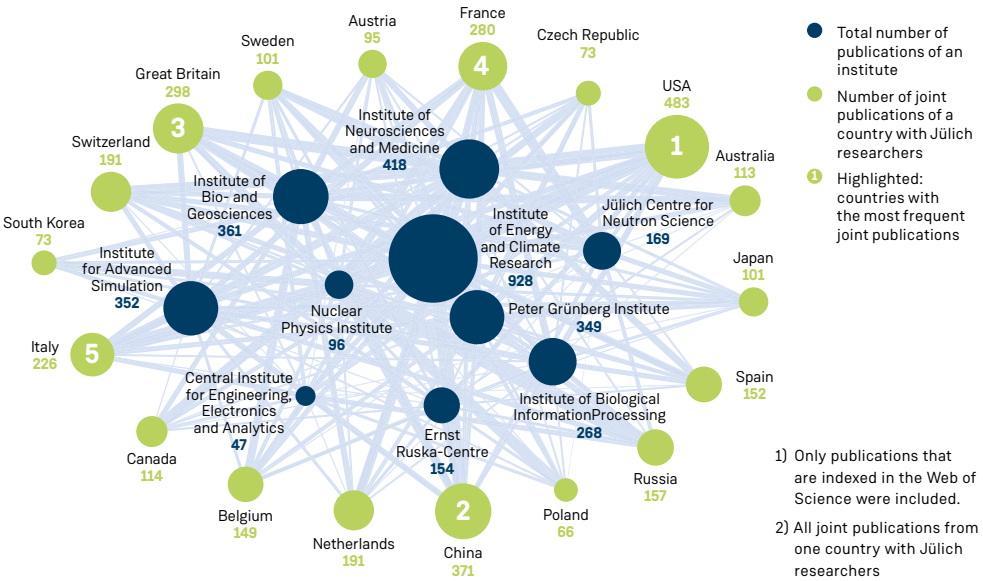
PUBLICATIONS WITH INTERNATIONAL PARTNERS

The international orientation of Jülich research is reflected in numerous joint publications with scientists all over the world. In 2021, there were 1,715 publications with international partners[1] involving scientists from 96 other countries. 18 countries had a share of 3 per cent or more in these joint publications, 23 countries had a share of at least 2 per cent. On average, each of the joint publications was cited about 5.3 times by other researchers (citation rate 5.26).

International network of Jülich institutes

In relation to the respective total number of publications, there was a particularly high proportion of joint publications of Jülich institutes with 18 countries. The width of the connection lines shows the scope of the collaboration between an institute and a country relative to the total output of the institute and the country[2] – "Salton's Collaboration Strength". It is calculated using the formula

$$\text{Salton's Collaboration Strength} = \frac{\text{Number of joint publications of institute with partner country}}{\sqrt{\text{Total number of institute publications} \times \text{Total number of publications of partner country with Jülich}}}$$



1) Only publications that are indexed in the Web of Science were included.

2) All joint publications from one country with Jülich researchers

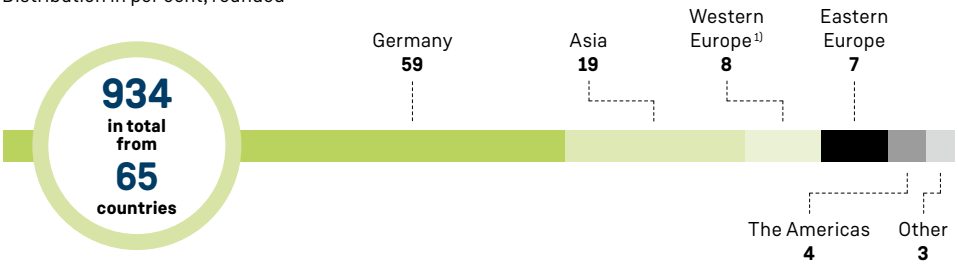
COOPERATIONS

Forschungszentrum Jülich works closely with numerous partners in Germany and abroad. In 2021, it was involved in 550 nationally funded research projects, 108 of which had a contract volume of €1 million or more. 242 projects were carried out together with several partners, and 54 research associations were coordinated by Jülich.

At the EU level, Forschungszentrum Jülich was involved in 171 projects from the Horizon 2020 and Horizon Europe framework programmes for research and innovation in 2021, including 42 for which the Jülich contract volume exceeded €1 million each. 33 of these projects were coordinated by Forschungszentrum Jülich, which coordinated a total of 46 EU projects.

Visiting scientists in 2021

Distribution in per cent, rounded



1) Excluding Germany

Participation in EU programmes in 2021

In the Horizon 2020 Framework Programme for Research and Innovation

Programme	Number of project grants	Coordinated by Forschungszentrum Jülich	Contract volume Jülich (in euros)
Joint Technology Initiatives	17	2	8,919,524
EURATOM	11	–	42,962,487
Excellent Science	76	24	100,323,026
Industrial Leadership	13	1	9,217,259
Societal Challenges	52	6	28,660,489
Spreading Excellence and Widening Participation	2	–	836,758
Horizon 2020 total	**171**	**33**	190,919,543

EU-funded projects involving Forschungszentrum Jülich in 2021

Funding grant exceeding €1 million

	Acronym	Project title	Jülich contract volume (in euros)
	EUROfusion[1]	European Consortium for the Development of Fusion Energy (Horizon 2020)	23,167,296
	EUROfusion	European Consortium for the Development of Fusion Energy (Horizon Europe)	16,542,962
	HBP SGA3	Human Brain Project Specific Grant Agreement 3	18,439,806
C	**PPI4HPC**	Public Procurement of Innovative Solutions for High-Performance Computing	8,451,195
C	**3D MAGiC**	Three-Dimensional Magnetization Textures: Discovery and Control on the Nanoscale	6,841,603
	ICEI	Interactive Computing E-Infrastructure for the Human Brain Project	5,203,968
	VirtualBrain Cloud	Personalized Recommendations for Neurodegenerative Disease	3,736,729
C	**ERA CoBioTech**	Cofund on Biotechnologies	3,621,683
C	**GNeuS**	Global Neutron Scientists	3,310,200
C	**DEEP-EST**	DEEP – Extreme Scale Technologies	3,183,961
	ACT	Accelerating CCS Technologies as a New Low-Carbon Energy Vector	3,015,036
C	**EUSMI**	European Infrastructure for Spectroscopy, Scattering and Imaging of Soft Matter	2,758,397
C	**IntelliAQ**	Artificial Intelligence for Air Quality	2,498,761
C	**HPCQS**	High Performance Computer and Quantum Simulator hybrid	2,348,167
C	**PRACE-6IP**	PRACE 6th Implementation Phase Project	2,076,741
	Solar Cofund 2	SOLAR-ERA.NET Cofund 2	2,016,413
C	**Dynasore**	Dynamical Magnetic Excitations with Spin-Orbit Interaction in Realistic Nanostructures	1,994,879
C	**ENVRI-FAIR**	ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research	1,914,475
C	**SARLEP**	Simulation and Understanding of the Atmospheric Radical Budget for Regions with Large Emissions from Plants	1,850,000

1) EUROfusion was approved as of 01.01.2021 under Horizon Europe, with the predecessor project EUROfusion under Horizon 2020 being simultaneously extended until the end of 2022.

	Acronym	Project title	Jülich contract volume (in euros)
	CSP ERANET	Joint Programming Actions to Foster Innovative CSP Solutions	**1,783,693**
	EoCoE-II	Energy Oriented Center of Excellence: Toward Exascale for Energy	**1,674,700**
C	**DEEP-SEA**	DEEP – Software for Exascale Architectures	**1,762,171**
C	**EMPHASIS-PREP**	European Multi-environment Plant pHenomics And Simulation InfraStructure – Preparatory Phase	**1,647,738**
C	**LightCas**	Light-Controlled Synthetic Enzyme Cascades	**1,498,125**
C	**QNets**	Open Quantum Neural Networks: from Fundamental Concepts to Implementations with Atoms and Photons	**1,486,439**
C	**PRO_PHAGE**	Impact and Interaction of Prophage Elements in Bacterial Host Strains of Biotechnological Relevance	**1,482,672**
C	**CUSTOM-SENSE**	Custom-Made Biosensors – Accelerating the Transition to a Bio-Based Economy	**1,482,220**
C	**CM3**	Controlled Mechanical Manipulation of Molecules	**1,465,944**
	GEOTHERMICA	GEOTHERMICA – ERA NET Cofund Geothermal	**1,463,494**
	EPPN2020	European Plant Phenotyping Network 2020	**1,449,689**
	EURAD	European Joint Programme on Radioactive Waste Management	**1,321,783**
	EPI SGA1	Specific Grant Agreement 1 of the European Processor Initiative	**1,296,750**
	SOLAR-ERA.NET Cofund	SOLAR-ERA.NET Cofund	**1,268,804**
	AISee	AI- and Simulation-Based Engineering at Exascale	**1,203,204**
	OpenSuperQ	An Open Superconducting Quantum Computer	**1,196,431**
	POP2	Performance Optimisation and Productivity 2	**1,193,710**
C	**VIRTUALTIMES**	Exploring and Modifying the Sense of Time in Virtual Environments	**1,161,574**
	BlueBio	ERA-NET Cofund on Blue Bioeconomy – Unlocking the Potential of Aquatic Bioresources	**1,096,938**
C	**srEDM**	Search for Electric Dipole Moments Using Storage Rings	**1,072,207**
	TELEGRAM	Toward Efficient Electrochemical Green Ammonia Cycle	**1,061,114**
	EMERGE	Emerging Printed Electronics Research Infrastructure	**1,009,793**
	SusCrop	ERA-NET Cofund on Sustainable Crop Production	**1,007,800**

C Forschungszentrum Jülich as coordinator

Industry cooperations and industry partners

Selection

Information

Airbus Germany GmbH
Exascale

Bayer AG
Medical informatics

D-Wave Systems
Quantum computers

Daimler AG, Robert Bosch GmbH, Volkswagen AG, BMW AG
Quantum technology in the automotive industry

Grünenthal GmbH
Tracers for brain research

Infineon Technologies AG, IQM Germany GmbH
Quantum computers

Partec Cluster Competence Center GmbH
Supercomputing/HPC

Philips Technology GmbH
Imaging techniques/ brain research

Priavoid
Alzheimer's research

Siemens AG, Bayer Technology Services, IBM Deutschland GmbH, Robert Bosch GmbH
Smart data/AI

Energy

BASF
Solid-state batteries

BASF, Shell Global Solutions International BV
Green chemistry

BMW AG
Lithium-ion batteries

Bosch GmbH
Fuel cells

Hydrogenius LOHC Technologies GmbH
Hydrogen research

RollsRoyce LTD
Materials research

Siemens AG
Materials research, electrocatalysts, hydrogen production

Siemens Gas and Power GmbH & Co. KG
Power2X

StreetScooter
Solar cells

Volkswagen AG
Solid-state batteries

Bioeconomy

Bayer AG
Plant research

CUREVAC AG
Vaccine development

Henkel
Production of new adhesives

Novozymes
Biodegradation of eco-polymers

RWE
Renewable energy

SenseUP
Development of microbial production strains

Covestro
Biorefinery

Pfeifer und Langen
Plant research and biorefinery

SUNfarming
Agro-photovoltaics

PATENTS AND LICENCES

PATENT PORTFOLIO

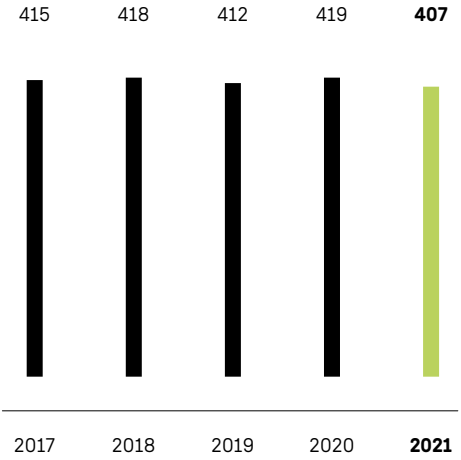
Jülich research generates innovations from which industry and society benefit and which result in property rights and licence agreements. Property rights include inventions for which patent applications have been filed as well as patents granted. An invention is patentable if it is novel, involves an inventive step and is commercially usable.

The patent portfolio is made up of the patent families and the total number of property rights. A patent family, in turn, consists of one or more patents in Germany or abroad that relate to one patentable technology. The total number also includes European patent applications and international applications under the Patent Cooperation Treaty (PCT), each of which comprises several individual property rights. The PCT is an international treaty that makes it possible to apply for a patent for all contracting states of the PCT by filing a single patent application.

A licence grants the licensee the use of an industrial property right, of know-how or software. For example, a company or research institution can use a patent of Forschungszentrum Jülich as a licensee.

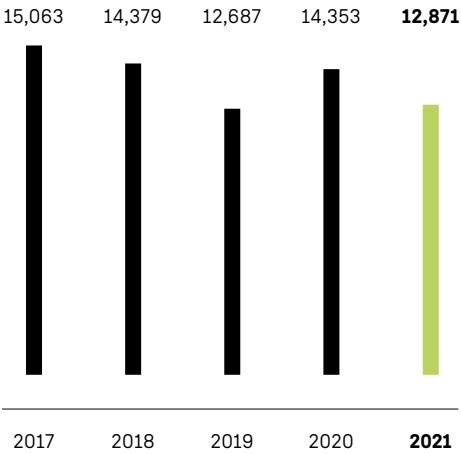
Patent families

2017–2021



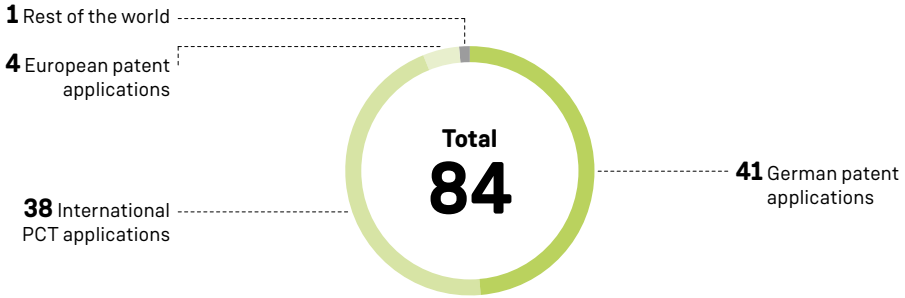
Total number of property rights

2017–2021

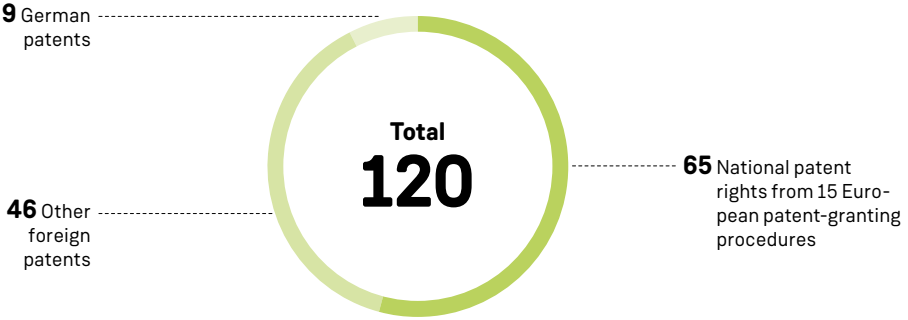


CURRENT PATENT ACTIVITIES

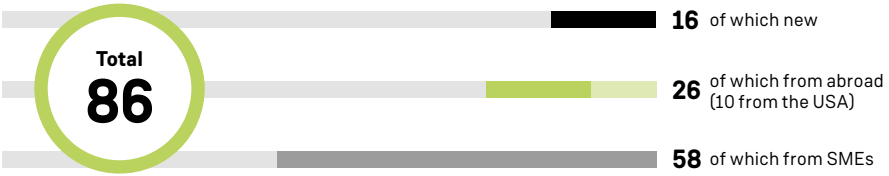
New patent applications in 2021



Patents granted in 2021



Total number of licences in 2021



JARA – JÜLICH AACHEN RESEARCH ALLIANCE

The RWTH Aachen University of Excellence and Forschungszentrum Jülich have been pooling their expertise in the Jülich Aachen Research Alliance (JARA) since 2007. Oriented towards the major challenges facing society, they carry out joint projects in the five research sections: brain research (JARA-BRAIN), sustainable energy (JARA-ENERGY), particle physics and antimatter (JARA-FAME), future information technologies (JARA-FIT) and soft matter research (JARA-SOFT) as well as in the JARA Center for Simulation and Data Science (JARA-CSD). JARA was one of the first cooperations between a university and a research institution in Germany. It contributes to developing the German scientific landscape further towards overcoming the juxtaposition of university and non-university teaching and research.

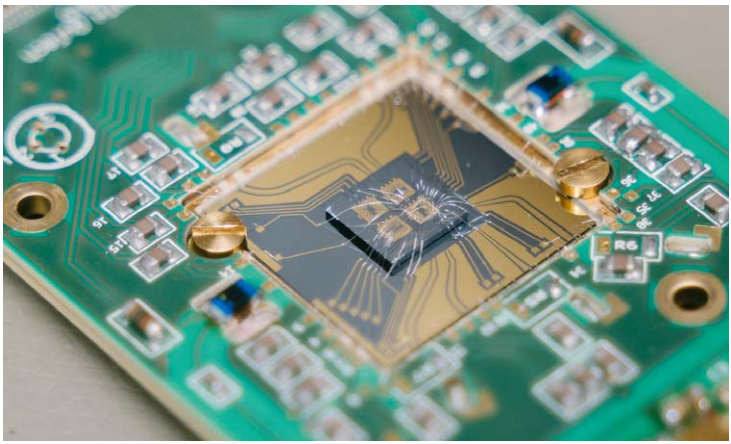
JARA in figures

As of 31.12.2021

Professorial appointments	
Joint professorial appointments	69[1)]

Publications	2021
All institutions involved in JARA[2)]	2,876
Joint publications	1,099

1) Not including members of the Board of Directors
2) Peer-reviewed publications



At the JARA Institute for Quantum Information, research is being conducted on a semiconductor quantum processor "made in Germany".

GIULIA ROSSETTI

Prof. Giulia Rossetti from JARA-CSD is using simulations and big data to search, among other things, for molecules that prevent severe lung diseases which may be triggered by the SARS-CoV-2 virus. These molecules are expected to inhibit the activity of a specific part of the viral protein nsP3. The Volkswagen Foundation is funding the research project.

JARA headlines

JARA-ENERGY

EXPERTISE FOR AFRICAN STUDENTS

With the International Master Program in Energy and Green Hydrogen, 60 students from 15 West African countries will be qualified for the future topic of “green hydrogen” under the JARA umbrella. West Africa has enormous potential to generate solar and wind energy and to produce hydrogen from it.

JARA-FIT

UNDERSTANDING QUANTUM ELEMENTS BETTER

JARA researchers have found a simple relationship between two equations that can be used to theoretically describe the behaviour of quantum devices. As a result, it is now better understood why quantum devices have a delayed reaction to control impulses.

JARA-BRAIN

GAIN THROUGH CHAOS

Chaos is generally considered undesirable. In the neural network of the brain, however, chaos actually promotes information processing in some cases, as researchers from the JARA BRAIN section have been able to show.

JARA-FIT

UNEXPECTEDLY STABLE

In a quantum system consisting of two coupled titanium atoms, the quantum information is retained even after a sudden current surge, as researchers from TU Delft and the JARA FIT section discovered. This is striking because normally, even the smallest interactions with the environment cause quantum effects to be lost.

PROJECT MANAGEMENT JÜLICH

As one of the leading project management organizations in Germany, Project Management Jülich (PtJ) supports its clients in the federal and state governments and the European Commission in realizing their funding policy goals. PtJ implements research and innovation funding programmes that are geared towards socio-political needs, integrating national and European funding. The funded projects cover the entire innovation chain, from basic research to market entry. One of the goals is the advancement of funding instruments to accelerate the innovation process. Through regional networking of science and industry, the aim here is to exploit, in particular, local innovation potential.

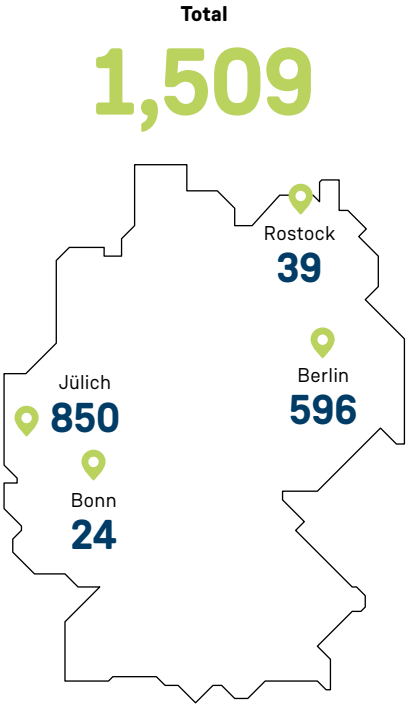
PtJ has pooled its experience and expertise into three business areas: Energy and Climate, Sustainable Development and Innovation, and Research and Society NRW. Expertise in central cross-cutting topics and tasks such as Digitalization, Circular Economy, Technical Communication or Monitoring and Evaluation are brought together by PtJ into areas of competency. These areas are managed by interdisciplinary teams and are closely interlinked with all PtJ business areas.

PROJECT MANAGEMENT JÜLICH IN FIGURES[1)]

The funding volume managed by PtJ rose to €2.525 billion in 2021. The number of ongoing projects increased to 35,029. Of these, 26,120 projects, with a funding volume of around €2.186 billion, were accounted for by federal programmes. For the programmes of

PtJ employees

According to location, 2021



1) As of 31.12.2018

federal states, PtJ managed a total of 8,909 projects with a funding volume of around €339.28 million.

With a share of 39.1 per cent of the managed funding volume, the Federal Ministry of Education and Research (BMBF) was PtJ's main client, followed by the Federal Ministry for Economic Affairs and Climate Action (BMWK) with 33.6 per cent, the Federal Ministry for Digital and Transport (BMDV) with 6.4 per cent and the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) with 5.5 per cent. Other federal authorities were accounted for at 2.0 per cent. The states had a share of 13.4 per cent in 2021.

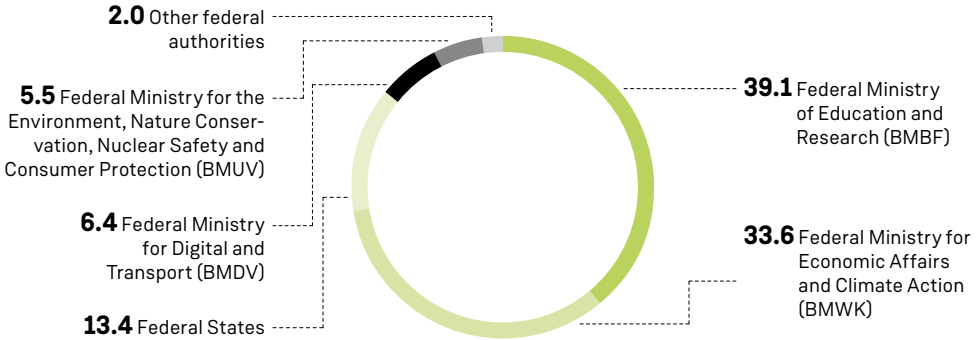
€1.28 billion of the funding volume went to the area of expertise Sustainable Development and Innovation, €968.85 million to the area of expertise Energy and Climate and €277.65 million to the area of expertise Research and Society NRW.

On 31 December 2021, PtJ had 1,509 employees at its four locations in Jülich, Berlin, Rostock and Bonn.

The PtJ management in discussion: Heads of Business Area Dr. Dirk Bessau and Michael Weber as well as Head of PtJ Dr. Stephanie Bauer and Head of Business Area Daniela Wirtz (from left).

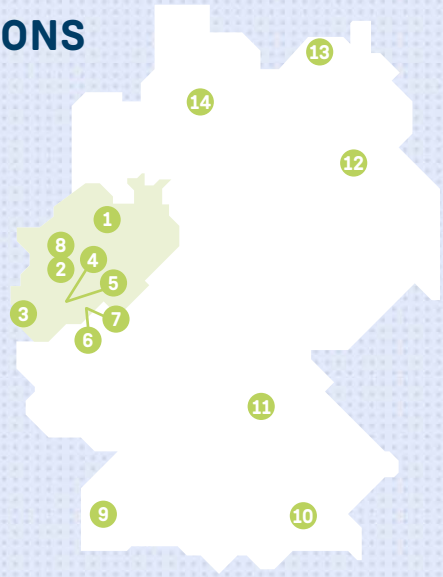
Funding sources

2021, in per cent



WORK AT OTHER LOCATIONS

Forschungszentrum Jülich operates branch offices in Germany and abroad with unique, large-scale facilities, including joint institutes with universities and the sites of the project managements.



1 **Münster**
Helmholtz-Institute Münster (HI MS): Ionics in Energy Storage in cooperation with RWTH Aachen University and the University of Münster (WWU Münster)

2 **Düsseldorf**
External Funding Management division runs the office of the **biotechnology cluster BIO.NRW**

3 **Aachen**
Peter Grünberg Institute (PGI-2, -11, -13, -14), Institute for Advanced Simulation (IAS-9) at RWTH Aachen University

4 **Cologne**
Institute of Neurosciences and Medicine (INM-2) at the German Aerospace Center (DLR)

5 **Cologne**
Institute of Neurosciences and Medicine (INM-5) at the University Hospital Cologne

6 **Bonn**
Project Management Jülich

7 **Bonn**
Institute of Bio- and Geosciences (IBG-2) at the agricultural experimental campus of the University of Bonn

8 **Duisburg**
Institute of Energy and Climate Research (IEK-5) at the NanoEnergieTechnikZentrum (NETZ) of the University of Duisburg-Essen

9 **Freiburg**
Institute of Neurosciences and Medicine operates the **Coordination Site of the Bernstein Network** at the University of Freiburg for the elucidation of neuronal processes

10 **Garching**
Jülich Centre for Neutron Science (JCNS) boperates the **Heinz Maier-Leibnitz Zentrum** at the research reactor in Garching along with the Technical University of Munich and the Helmholtz-Zentrum Geesthacht

11 **Erlangen/Nuremberg**
Helmholtz Institute Erlangen-Nürnberg for Renewable Energy (HI ERN) in cooperation with Friedrich-Alexander Universität Erlangen-Nürnberg (FAU) and the Helmholtz-Zentrum Berlin (HZB)

12 **Berlin**
Project Management Jülich

13 **Rostock**
Project Management Jülich

14 **Hamburg**
Institute of Biological Information Processing Centre for Structural Systems Biology (CSSB) with the European XFEL X-ray source for deciphering molecular mechanisms, operated together with nine partner institutions

15 **Oak Ridge (USA)**
Jülich Centre for Neutron Science (JCNS) operates a measuring instrument at the spallation neutron source SNS at Oak Ridge National Laboratory (ORNL)

16 **Grenoble (France)**
Jülich Centre for Neutron Science (JCNS) operates an instrument at the high-flux reactor of the Institut Laue-Langevin (ILL); shareholder along with the Commissariat à l'Energie Atomique (CEA, France), the Centre National de la Recherche Scientifique (CNRS, France) and the Science and Technology Facilities Council (STFC, UK)

17 **Bangkok (Thailand)**
Institute of Bio- and Geosciences (IBG-2) with the National Science and Technology Development Agency (NSTDA) on a sustainable bioeconomy

BODIES AND COMMITTEES

BODIES

PARTNERS' MEETING

The Partners' Meeting is the principal decision-making body of Forschungszentrum Jülich GmbH. It is composed of members representing the two partners: the Federal Republic of Germany and the federal state of North Rhine-Westphalia.

SUPERVISORY BOARD

MinDir Volker Rieke
Chair
Federal Ministry of Education and Research

The Supervisory Board supervises the lawfulness, expedience and economic efficiency of management. It makes decisions on important research-related and financial issues of the company.

BOARD OF DIRECTORS

Prof. Dr.-Ing. Wolfgang Marquardt
Chair

The Board of Directors conduct the business affairs of Forschungszentrum Jülich GmbH in accordance with the partnership agreement. They report to the Supervisory Board. The contact for all questions and concerns relating to the Board of Directors is the Office of the Board of Directors.

COMMITTEES

SCIENTIFIC AND TECHNICAL COUNCIL

Prof. Dr. Martin Riese
Chair
Institute of Energy and Climate Research

The Scientific and Technical Council (WTR) advises the Partners' Meeting, the Supervisory Board and the Board of Directors on all issues associated with the strategic orientation of Forschungszentrum Jülich and on all scientific and technical issues of general importance.

SCIENTIFIC ADVISORY COUNCIL

Dr. Heike Riel
Chair
IBM Research – Zurich, Switzerland

The Scientific Advisory Council advises Forschungszentrum Jülich on scientific and technical issues of general importance. This includes Jülich's strategy and planning of research and development activities, the promotion of the optimal usage of research facilities, and any questions relating to collaborations with universities and other research institutions.

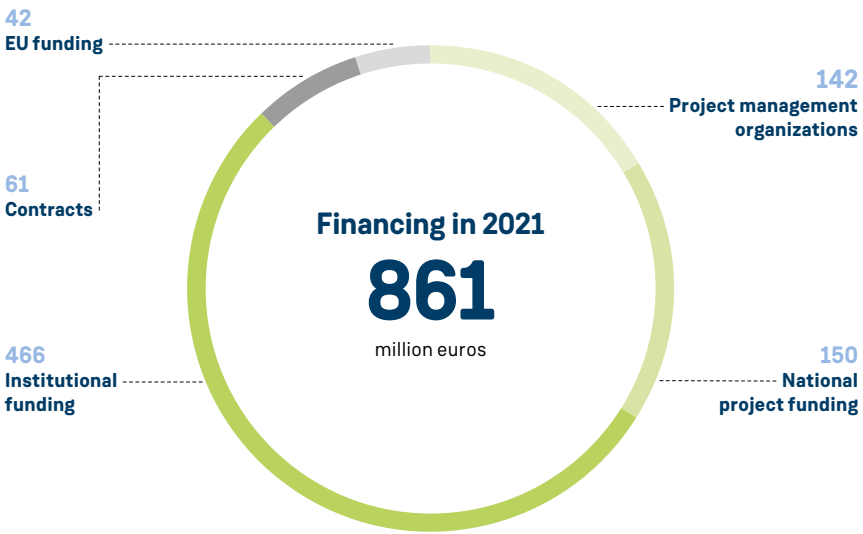
> **www.fz-juelich.de/en/about-us/organization/company-bodies-committees**

FINANCES

FINANCING IN 2021

In 2021, Forschungszentrum Jülich received institutional funding from the federal and state governments amounting to €466 million, which represented 54 per cent of total financing, to cover operating expenses to implement investment measures. In addition, Forschungszentrum Jülich's third-party funding totalled €395 million, representing 46 per cent of the total funding.

Third-party funding consists of the acquisition of international (EU funding) and national project funding, of R&D and infrastructure services (contracts), and of project management organizations on behalf of the Federal Republic of Germany and the federal state of North Rhine-Westphalia. National project funding includes funding from the federal government, the state government, the DFG and other domestic bodies.

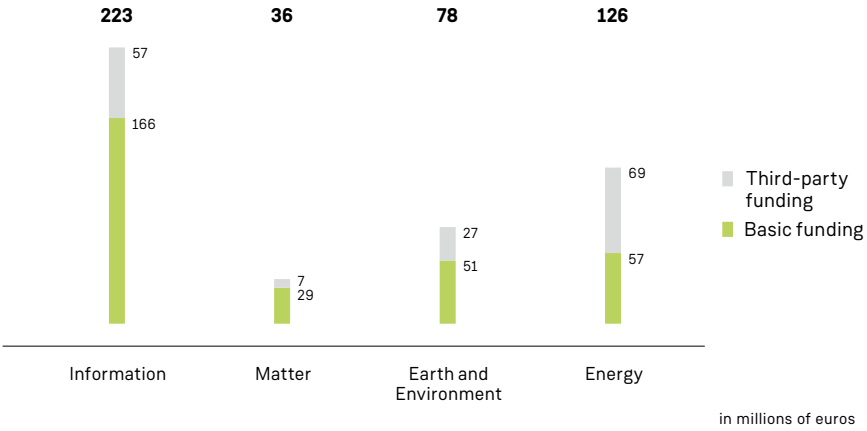


Financing in 2021 covered all research areas of Forschungszentrum Jülich as well as other statutory tasks. The majority of Forschungszentrum Jülich's financing (> 90 per cent) comes from public funds. The remainder originates from cooperations with industry partners.

BUDGET OF THE RESEARCH AREAS IN 2021

In 2021, all four research areas of Forschungszentrum Jülich – Energy, Earth and Environment, Matter, and Information – and their programmes were in the fourth round of the programme-oriented research (POF IV). The full costs of the four research areas amounted to €463 million in 2021 and are shown below in their percentage distribution.

Below is a breakdown of basic and third-party funding into individual research areas. Third-party funding per research area is between 19 and 55 per cent. Only third-party funds that are allocated programmatically were taken into account.



CONTACT

CORPORATE COMMUNICATIONS

Dr. Anne Rother Head

Forschungszentrum Jülich GmbH
52425 Jülich, Germany
Tel: +49 2461 61-4661
Fax: +49 2461 61-4666
info@fz-juelich.de
www.fz-juelich.de

There's more!
Our research magazine effzett

VISITOR SERVICE

We organize guided tours of Forschungszentrum Jülich for interested groups. Please contact our Visitor Service for more information.
Tel: +49 2461 61-4662/-9366
besucher_uk@fz-juelich.de

Use our campus app to find your way around the campus
https://go.fzj.de/siteplan

MEDIA

You can order our publications free of charge or read them as online magazines, browse through our Jülich blogs or see which social media channels we are active on:
https://www.fz-juelich.de/en/news/media

Would you like to be informed regularly about new happenings? Subscribe to our newsletter (in German):
https://go.fzj.de/newsl

PUBLICATION DETAILS

Facts and figures · Published by: Forschungszentrum Jülich GmbH · 52425 Jülich, Germany · Editorial team: Annette Stettien, Dr. Frank Frick, Anne Rother (responsible under German press law) · Authors: Dr. Frank Frick, Annette Stettien · Graphics and layout: SeitenPlan GmbH Corporate Publishing · Translation: ROTPUNKT·Texte & Bild · Picture credits: Forschungszentrum Jülich/Axer et al. (38), Forschungszentrum Jülich/Sascha Kreklau (6, 8, 11, 12, 14, 20, 23, 24, 31, 33, 57 top right, Forschungszentrum Jülich/Ralf-Uwe-Limbach (cover (all), 17, 18, 39, 43, 46, 48, 55, 57 bottom centre and bottom right, 66), Forschungszentrum Jülich/Central Library (58 (graphics)), Arjen Biere (57 bottom left), Jülich Aachen Research Alliance (JARA) (65), private (57 top centre), SeitenPlan (4-5, 40-41, 49, 70-71 (illustrations), (75 (montage)), Manuel Thomé (69), University of Bonn/PhenoRob (57 top left)

As of August 2022

Zertifikat seit 2010 audit berufundfamilie

In 2010, Forschungszentrum Jülich was certified as part of the “audit berufundfamilie” initiative. The fourth successful re-audit took place on 15 June 2020.