

KIT
Karlsruhe Institute of Technology

26/09/2022

Overview Programme NUSAFE at KIT and Helmholtz Association

Th. Walter Tromm, Programme Nuclear Waste Management, Safety and Radiation Research

KIT - The Research University of the Helmholtz Association

KIT - Part of the Helmholtz Association

Helmholtz research centers

- KIT Karlsruhe Institute of Technology
- DLR German Aerospace Center
- FZJ Forschungszentrum Jülich
- DESY Deutscher Elektronen-Synchrotron
- GEMINI German Cancer Research Center
- IPF Max-Planck-Institut für Plasma Physik
- IMMMP Helmholtz Zentrum München
- GFZ Helmholtz Center for Heavy Ion Research
- HEB Helmholtz Zentrum Berlin für Materialien und Energie
- AWI Alfred Wegener Institute for Polar and Marine Research
- HZDR Helmholtz Center Dresden-Rossendorf
- UFZ Helmholtz Center for Environmental Research
- GFZ Helmholtz Zentrum Geoschichte - Center for Materials and Coastal Research
- GFZ Helmholtz Zentrum Potsdam - German Research Center for Geosciences
- MDC Max Delbrück Center for Molecular Medicine
- GEOMAR Helmholtz Center for Ocean Research Kiel
- IFU Helmholtz Center for Infection Research
- DFG German Center for Regenerative Diseases

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Nuclear Waste Management, Safety and Radiation Research

Participating Helmholtz - Centres

- Forschungszentrum Jülich GmbH (FZJ)
- Helmholtz - Zentrum Dresden - Rossendorf (HZDR)
- Karlsruher Institut für Technologie (KIT)

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The Research University in the Helmholtz Association

- University of Karlsruhe (1825)
- Research Center Karlsruhe (1956)

Research - Teaching - Innovation

→ merger to Karlsruhe Institute of Technology KIT (2009)

- = 9,760 employees, including
- = 385 professors
- > 3,100 doctoral researchers
- > 2,000 postdoctoral researchers and staff scientists
- = 22,500 students

1,090,7 Mio. € budget (2019/2020)

→ Institutional change as part of our DNA
→ an excellent staff-student ratio

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KIT stands for vision and tradition

- Ferdinand Braun: The first department for computer sciences in Germany
- Ferdinand Redtenbacher: Pioneer of the first e-mail in Germany
- Carl Benz: One of the largest energy research centers in Europe
- Heinrich Hertz: Robotics Artificial Intelligence





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KIT - Research, teaching and innovation at several locations

- Campus Nord
- Campus Süd
- Campus Ost
- Campus West
- Campus Alpine
- Helmholtz Institut Ulm


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Nuclear Energy in Germany

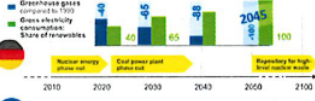





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Grand Challenges in Energy Research and Beyond




- Nuclear energy phase out in 2022
- Coal power plant phase out in 2038
- Reduction of greenhouse gases to zero in 2045
- Share of renewables up to 100% in 2050
- Feasibility of commercial nuclear fusion
- NEW: Independence from Russian fossil fuels and raw materials



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KIT Mission in Energy Research




KIT - The Research University in the Helmholtz Association


- We support the **transformation** of the energy system in Germany.
- We focus on **holistic and systemic approaches**, which include all relevant energy conversion paths.
- We are one of the **largest energy research centers in Europe**.
- We cross the lines between disciplines and combine **fundamental and applied research**.
- We develop **energy technology solutions** and provide advice to politics, business, and society.
- We operate **unique research infrastructure** and simulation tools to describe a multi-modal, multi-scale energy system.
- We educate and train the **next generation** to solve the global energy challenge.

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Strategic Scientific Goals at KIT





- Emphasizing the **systems perspective**: from technologies to integrated systems
- Provide energy storage technologies addressing **sector coupling**
- Risk and security research** (resilience) for dependable energy systems
- Efficient process chains for renewable energy sources and sustainable raw materials
- Final disposal of nuclear waste and reactor safety research** as a national responsibility
- Fusion energy** as a long-term option



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Research Field Energy

Programs in POF IV at KIT 2021 – 2027

Helmholtz Energy Transition Roadmap (HETR)

- Science driven
- Research-strategy tool
- Advice to politics and society

Energy System Design

- Energy System Transformation
- Digitization and System Technology

Fusion

- Stellarator Research
- Tokamak Physics
- Fusion Technologies and Materials
- Plasma-Wall Interactions

Materials and Technologies for the Energy Transition

- Photovoltaics and Wind Energy
- Electrochemical Energy Storage
- Chemical Energy Carriers
- High-Temperature Thermal Technologies
- Resource and Energy Efficiency


Nuclear Waste Management, Safety and Radiation Research

- Nuclear Waste Management
- Reactor Safety

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Nuclear Waste Management, Safety and Radiation Research

Topic 2 Reactor Safety



- Development of advanced safety analysis tools for Small Modular reactors (SMR)
 - Assessment of established Light Water Reactor tools for SMR conditions
 - Adaptation and validation of Helmholtz tools for the specifics of SMR
- Radiation tolerance of advanced structural materials
 - Application of ion irradiation to simulate neutron irradiation effects
 - Nanostructure-informed modelling of radiation hardening
- KALLA: Experimental liquid metal heat transfer investigations of rod bundles with blockages within the EU-project PATRICIA
- Helmholtz QUENCH Test Facility: Conduction of experiments on accident tolerant fuels (ATF) cladding materials as OECD/NEA Joint Undertaking
- Open source CFD code containmentFOAM: Implementation of advanced models for thermal radiation, fog and aerosol transport, sensitivity/uncertainty quantification

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