

Energy Research Funding by the Federal Ministry of Education and Research (BMBF)

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Introduction

Energy research supports energy and climate policy. Sustainable energy supply is a strategic goal to the Federal Government of Germany. The objective is to ensure energy security at affordable prices, compatible with climate and environmental protection requirements. Therefore, the German Government established an **Integrated Energy and Climate Program** in 2007. This integrated Programme comprises:

- Realization of European climate protection goals by 2020
- Legislative initiatives and incentive programs
- **Energy research and innovation** is an important program element
- Energy research helps achieving energy and climate goals more efficiently, faster and less expensive
- Energy research supports competitiveness and export

In Germany five Federal Ministries fund energy research:

- Federal Ministry of Economics and Technology (BMWi)
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)
- Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)
- Federal Ministry of Transport, Building and Urban Affairs (BMVBS) and
- Federal Ministry of Education and Research (BMBF)

BMWi: General Principles of Energy Research Policy, Energy Research Program of Fed. Gov., International Energy Research Policy, Coordination Platform on Energy Research Policy; Institutional Funding: Efficient energy Conversion, Renewable Energy; Project funding: Applied research, development and demonstration ;

BMU and BMELV project funding applied research, development and demonstration renewable energy (BMU) respectively Bioenergy (BMELV)

BMVBS: project funding: efficient use of energy (building and transportation sector)

BMBF: funds energy research through institutional and project funding (basic energy research) in the areas of

- Efficient Energy Conversion,
- Renewable Energy,
- Nuclear Safety,
- Fusion

Energy research funding programmes by BMBF

BMBF funds energy research on various levels and with various instruments:

- **Institutional funding of German National Research Centres:** Helmholtz Association, Fraunhofer Society, Max Planck, Society, and Leibniz Association
- **Project funding** with priority on research alliances of research centres and universities and on **strategic alliances** of science and industry

- **Funding of young scientists** e.g. creating working groups led by post docs
- **Transfer of research results** via seminars, workshops, conferences, summer schools

BMBF funds fundamental, long-term research work: Basic Energy Research 2020+.

BMBF funding resources for energy research are

- 200 Mio. €/a institutional funding (Helmholtz association)
- 55 Mio. €/a for projects in basic energy research
- 70 Mio. €/a for energy relevant projects in other programs

Priorities of BMBF

Next generation solar technology

- **Electricity generation by thin-film solar cells based on inorganic materials**
 - new materials, cell structures and hybrid structures
 - Improvement of the understanding of the physical processes in the solar cell
 - New methods for structural and functional analysis and simulation
- **Hydrogen production by photocatalytic water splitting**
 - Further development of natural photosynthesis
 - Improvement of semi-artificial systems
 - Creation and optimization of artificial systems
- **Innovation alliance „Organic Photovoltaics“**
 - Development of new or improved solar cells based on organic materials
 - Combination of basic research, application-oriented materials research and process technology
 - Solar energy converters in the small power range with 10% efficiency and a life-time of 2 -3 years shall be available at low production costs on a medium-term basis
- **Regional cluster „SolarValley Mitteldeutschland“**
 - Cooperation between regional solar industry, research and educational institutions
 - Development of next generation solar cells based on very thin silicon wafers
 - Maintain competitiveness of German photovoltaic technology by reduction of production costs
 - Special regional initiatives for the education of young researchers and engineers

Bioenergy: biomass production and conversion

„BioEnergy 2021“ – a call for research on energetic use of biomass

- Use of specific energy plants as well as biological waste
- combined use of biomass for energetic and raw material purposes (bio-refinery)
- Improvement of efficiency of biomass conversion
- Goal: internationally competitive use of biomass in Germany

Efficient generation, transport, storage and consumption of energy

- Innovation alliance „Lithium-Ion-Battery“: Development of high-capacity and safe Lithium-based batteries
 - Stationary and mobile fields of application e.g. combination of regenerative electricity generation with local energy storage; cars with electric or hybrid drive
 - „National Development Plan for Mobility by Electric Cars“

Competition „Energy-efficient City“

- The city as a complex energy system
- Reduction of energy consumption and CO₂-emission by a certain percentage (The Federal Government's goal: 40% CO₂-emission reduction by 2020.
- Development of innovative strategies, technologies, instruments and new services
- Conversion of a „normal city“ into an „energy-efficient city“
- Networking in energy systems
- Development of new financing tools
- Overcoming barriers (financial, structural, legal etc.)
- Cost-benefit-consideration on municipal perspective

Various BMBF programs are relevant for energy efficiency

- Materials Research Program: Light weight materials; Components for fuel cell development; Heat insulation materials; High temperature-resistant materials (power generation)
- Electronics and electronic systems programs: Energy efficient drive systems; Energy saving chips and electronic systems (e.g. servers and personal computers); Electronics for application in automobiles
- Optical technologies: OLED R&D program
- Microsystems: R&D program on Micro FCs and energy independent microsystems
- Production systems and technologies: R&D program on energy and material efficient production technology
- Social sciences: Research program „New ways to sustainable consumption“

National Innovation Program on Hydrogen and Fuel Cell (FC) Technology

- Coordinated by BMVBS, cooperation with BMWI and BMBF
- Research, Development and Demonstration
- 500 Mio €, 10 years-program
- R&D to increase durability and reduce costs
- FC application in transportation, industry, home, special markets,
- H₂ production

Low CO₂-power stations and carbon capture and storage (CCS)

- BMWI: R&D on modern high efficiency power stations including carbon capture
- BMBF: R&D on carbon capture and storage (CCS) and usage of CO₂
 - Exploration, selection and evaluation of storage sites
 - Interaction of CO₂ with the reservoir medium and overlying rock
 - Acceptance by the public is essential!
 - CO₂ as a raw material for industry

Fundamental R&D on nuclear safety and waste

- Reactor safety, especially modelling and simulation
- Characterization and treatment of radioactive waste, partitioning and transmutation of long-lived radioactive waste
- radiation research: Radiation protection research, medical radiation biology, radiation and environment
- Participation in international committees and research platforms
- International integration of young scientists

International cooperation, Fusion research

- Cooperation in the large International Fusion Experiment ITER within EURATOM agreement (together with India and other international partner countries).

2nd German-Indian Conference on Research for Sustainability
United Nations University, Bonn, 27-28 April, 2009

- BMBF supports multilateral cooperation in projects of the International Energy Agency (IEA) and of the European Commission
- Basic energy research in the European Research Area in the framework of ERANET INNER (Innovative Energy Research)
- Individual cooperation contacts of the research institutions

Outlook:

The wide spectrum of German energy research topics offers many opportunities for an enhancement of bilateral Indo-German cooperation in the energy sector. Basic energy research as well as application oriented projects could be defined in the course of bilateral workshops and experts visits.