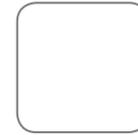




Research Centre
Energy and Environment





Foreword from the Vice Rector for Research

One of the integral elements of the 2010+ development plan for the Vienna University of Technology was the establishment of a research strategy based around five focal areas. As a result, the university's areas of expertise have been developed and amalgamated into research fields and assigned the different focal areas. The Vienna University of Technology research matrix set out in the 2013+ development plan aims to strengthen the university's profile, in particular by increasing its international presence through collaboration at all levels. Collaboration between our own faculties and with other research institutes, economic partners and the public is set to be further developed and expanded through a targeted strategy.

Energy and environmental research at the Vienna University of Technology follows a systematic, interdisciplinary approach. In order to build on this interdisciplinary collaboration, the Vienna University of Technology has set up the Research Centre Energy and Environment,

designed to bring together and establish connections between the ongoing scientific research activities in the six research fields assigned to this focal area across all eight TU Vienna faculties. Our exceptional expertise in the area of energy technology, which covers the entire value-added chain from fundamental research through to applications and product development, is enhanced by scientific expertise in the areas of climate, environment, resources and economy.

True to our mission statement "Technology for People", we are seeking to develop comprehensive solutions to future local and global problems in the areas of research, the economy and our society, as well as to complex interdisciplinary research challenges. This makes the Vienna University of Technology a reliable partner for tackling the energy and environmental challenges of the future.

Johannes Fröhlich

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Energy and Environment

Preserving the environment means developing new ideas

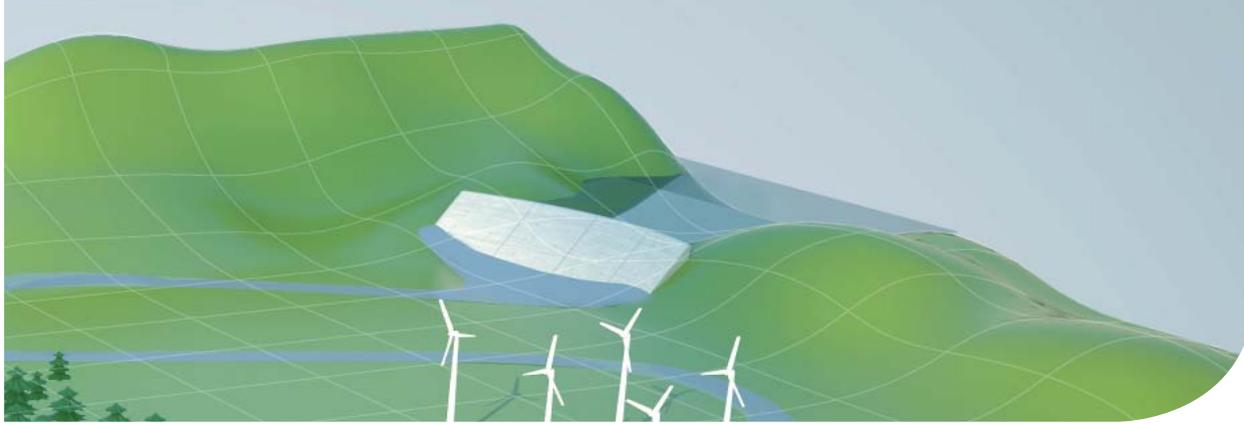
Population growth and worldwide industrialisation constantly increase the primary energy demand – new ideas are required. Alternative energy sources need to be developed, reliable solutions for climate problems are sought after and serious problems of pollution are still unresolved. Even if great successes could be seen in these fields in the recent years, many open questions still exist which can hardly be answered by traditional technological approaches.

The research themes in the area of energy and environment are at the intersection between people, nature and technology. In intersection that requires wide-ranging skills from the most diverse areas. Interdisciplinarity ensures lasting appreciation of research far beyond the limits of the individual specialist areas.

It is not seen as a status, but instead as a dynamic process.

Cooperation is particularly important in order to be able to find answers to the global challenges in the area of energy and environment. Answers to environmental problems can never be found in rejection and scepticism towards technology and industry. On the contrary: only with pioneering basic research and modern technology, real progress can be achieved.

Vienna University of Technology emphasises the relevance of this topic and has declared “Energy and Environment” as one of its five research focal areas.

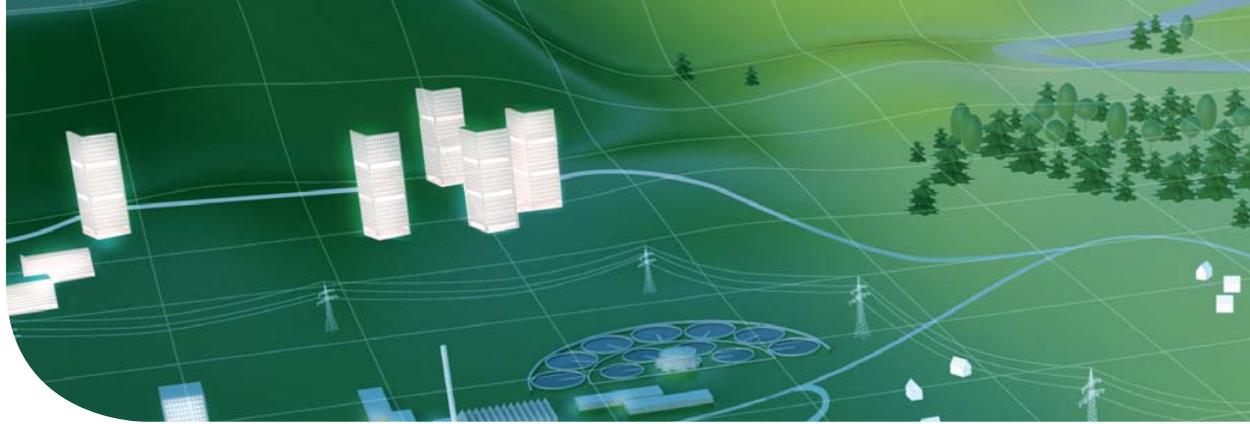


Broad range of competences

At the Vienna University of Technology a broad range of competences can be found in the areas of energy and environment. The research topics range from questions about energy generation and energy storage to ideas of energy-efficient architecture and regional planning. Additional topics include the design of intelligent electricity networks, and also energy saving measures and energy policy concepts. In the field of environmental research the main focuses are placed on environmental monitoring – reliable data on the state and change of our environment is essential for the development of new strategies. At the Vienna University of Technology research is furthermore concentrated on solutions for the efficient utilisation of resources, environment-friendly creation of products and production processes, as well as on concepts for low emission mobility.

Technology for People

Many of the research groups at the Vienna University of Technology are key competence experts in Austria and internationally renowned triggers for innovation. In order to establish excellent research, specific working groups which network internally, nationally and internationally are a self-evident necessity. Often, environmental problems can only be understood on a global scale and solved in an international context. However, at the same time, it is of particular importance for a country like Austria (with its ecologically sensitive Alpine- and river regions) not only to adapt knowledge in the environmental sector from other countries, but also to pursue future oriented energy and environmental research with emphasis on our own specific problems.



Facts and Figures

Strategic research focal areas

The strength of the five research focal areas of the Vienna University of Technology is reflected in their ability to acquire third party funding.

Figure 1 shows the share of the research focal points in the third party funds within the time frame 2010-2012. During this period nearly than 100 % of the incoming third party funds were invested in research themes related to the five research focal points. This is an important indication that a main goal of the profiling process – the promotion of areas with high scientific and economic potential – is continuously implemented.

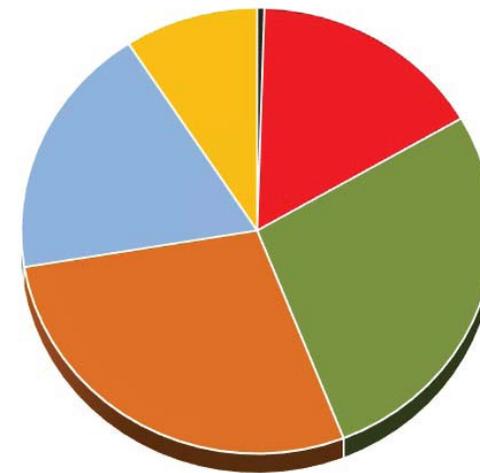


Figure 1





Energy and Environment

In this research focal point all eight faculties of the Vienna University of Technology are represented, approximately two-thirds of the 55 institutes.

More than 100 research groups are specifically doing research in different aspects of energy and environment.

The six energy and environment research fields

- E1: Energy active buildings, settlements and spatial infrastructures
- E2: Sustainable and low emission mobility
- E3: Climate neutral, renewable and conventional energy supply systems
- E4: Environmental monitoring and climate adaptation
- E5: Efficient utilisation of natural resources
- E6: Sustainable technologies, products and production

have been deliberately tuned and defined on urgent problems of our society. Basic and applied research work hand in hand and are a central part of a value chain to maintain and improve the quality of life.





Facts and Figures

In-kind contribution

The Vienna University of Technology invests own resources in the form of personnel and infrastructure for the development of the research focal point. In addition to the permanent staff, the TU subsidy tool “Innovative Projects” supports young scientist and invests in the technical equipment. Internal doctoral programmes educate the highly-qualified young academics and support the formation of the scientific focal area. Well endowed research promotion projects and awards are also supported using internal funds. In addition, in 2011 the TU’s internal science prize went to a researcher in the area of energy and environment.

The total budget invested in these activities amounted to approximately €2.6 million in 2010–2012.

Third party funds and publications

The volume of third-party funds attracted for the research focal area energy and environment in the same period was approximately €56 million.

The research output varies in the individual research fields - the project-financed personnel (Fig. 2) and the number of published journal contributions (Fig. 3) have been chosen out of the various figures used to quantify research activities.

Besides the varying accomplishments in the research fields the data also represents the different research and presentation cultures. Within the topics more related to the natural sciences (e. g. environmental monitoring and climate adaptation), scientific publishing has a different value than within more architectural related research fields (e.g. energy active buildings, settlements and spatial infrastructures).

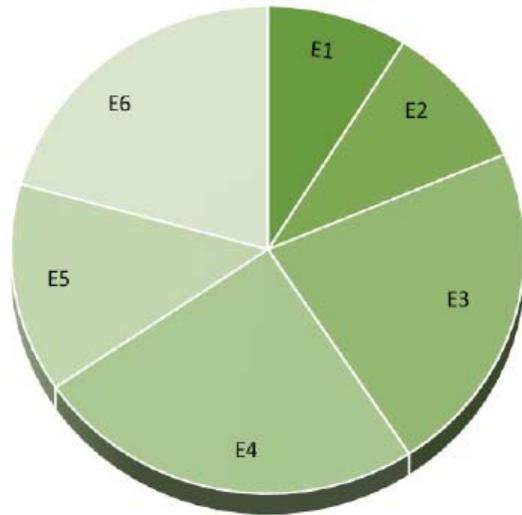
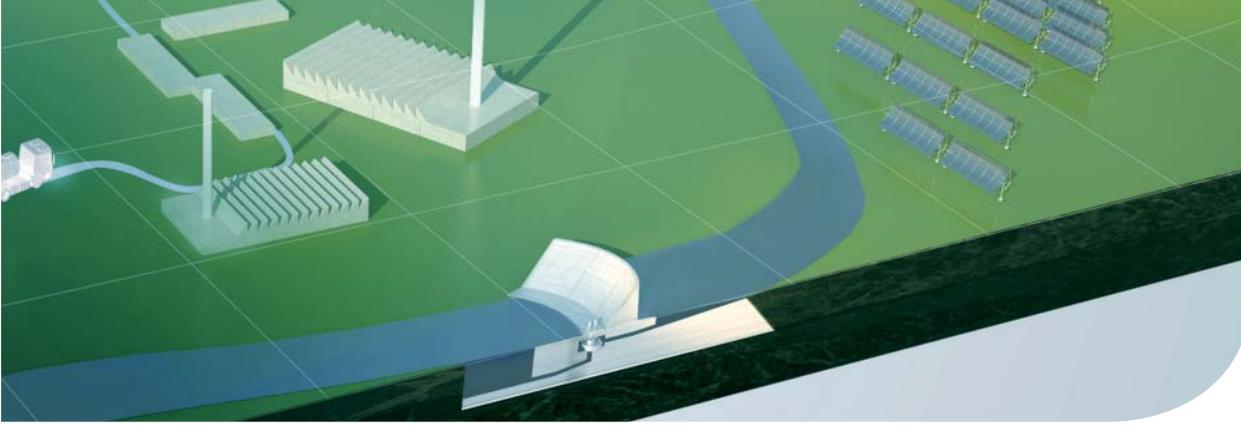


Figure 2

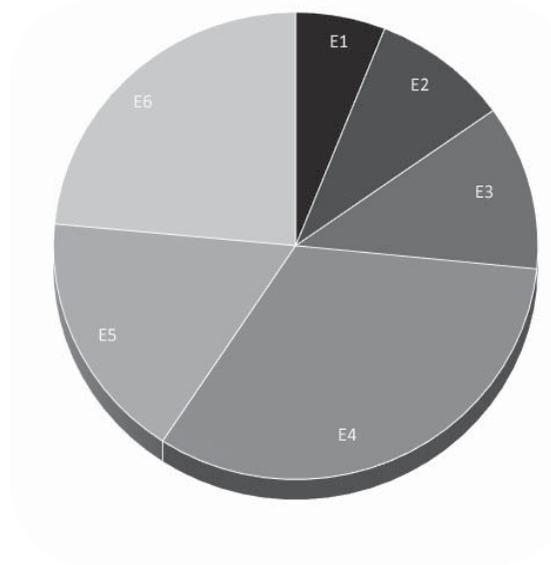


Figure 3

All data relates to the time frame 2010-2012.





Energy active buildings, settlements and spatial infrastructures

Research topics

Energy efficient buildings (active /passive house)

- Eco efficient building
- Application of renewable energy sources
- Building concepts/Resource optimisation
- Simulation/optimisation of entire system

Intelligent buildings and settlements

- Monitoring of buildings
- Smart systems
- Building automation
- Energy management (microgrid)

Sociological and Ecological aspects

- Building - and immovable performance
- User behavior
- Spatial comfort
- Building material
- Impact of climate change

Real estate and infrastructure

- Building stock
- Integrate energyefficient planning
- Lifecycle-analysis
- Analysis and models

Urban- and regional development

- Regional development
- Settlement- and buildingstructure
- Urban traffic and urban mobility
- Visualisation



Sustainable and low emission mobility

Research topics

Traffic concepts and mobility management

- Regional traffic concepts
- Analysis and scenarios
- Political frameworks
- User behaviour
- Logistics

Infrastructure

- Public and non-motorised transport
- Charging stations / petrol stations
- Roads
- Navigation
- Information and communication technology

Technology

- Alternative powertrains (electric / gas / hybrid)
- Development of components
- Modelling and measurement
- Optimisation of conventional drive technologies

Energy supply

- Production and usage of alternative fuels
- (Electrochemical) energy storage
- Battery management
- Grid integration of electric vehicles





Climate neutral, renewable and conventional energy supply systems

Research topics

Renewable energy systems

- Hydro power
- Solar energy
- Geothermal energy
- Biomass

Power plant optimisation

- Modelling
- Components / construction
- Processes
- Materials
- Nuclear fusion

Intelligent grids

- Operation management
- Grid integration of renewables
- Distributed control and regulation
- Supply Side Management / Demand Side Management (SSM/DSM)

Peripheral storage systems

- Thermal storage
- Chemical storage (fuel cells)
- Mechanical storage (magnetic bearing, pump reservoir storage, etc.)

Energy economics

- Climate change impact
- Environmental economy
- Business models
- Political strategies





Photo: NASA

Environmental monitoring and climate adaptation

Research topics

Natural disaster management

- Flood water
- Water management
- Hydraulic engineering
- Mass movements
- Tectonics / earth quakes
- Environmental law

Contaminant measurements, quality analysis

- Particulate matter / greenhouse gases
- Particles / heavy metals
- Dosimetry
- Drinking water analysis
- Organic elements
- Emissions
- Noise, etc.

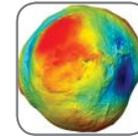
Environmental analysis and modelling

- Monitoring and forecast of geological / hydrological / atmospherical processes
- Development of intelligent measurement systems
- Bio-chemistry

Mathematical/geometrical data basis

- Satellite systems
- Environmental statistics

Environmental risk assessment





Efficient utilisation of natural resources

Research topics

Renewable raw materials

- Biomass
- Wood
- Ecological construction materials
- Starch/cellulose

Recycling/urban mining

- Metallic materials
- Composites
- Construction materials
- Minerals

Disposal/processing

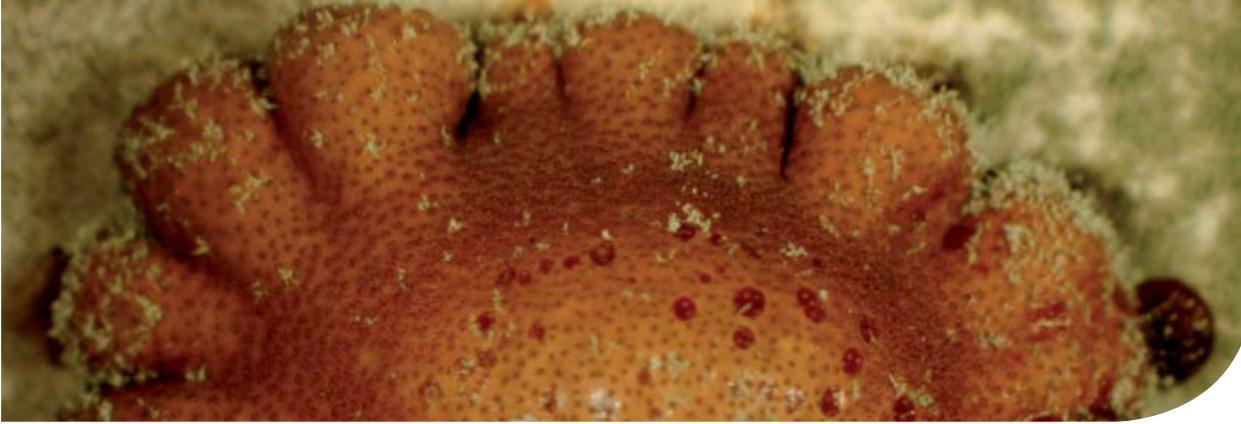
- Sewage water
- Chemicals, etc.

Mass flow analysis

- Metals/toxic substances
- Air pollutant
- Sewage water
- Solid waste management
- Resource economics

Water supply and distribution

- Water body ecology
- Watershed management
- Ground water economy
- Ground water usage



Sustainable technologies, products and production

Research topics

Efficient production and process optimisation

- Production and process management
- Modelling / simulation and optimisation
- Controlling / regulation and automation

Alternative sustainable methods

- Carbon Capture
- Hydrogen generation

Green Chemistry

- Bio fuels
- Materials
- Development of Omics-tools

New technologies

- Filter
- Sensors
- Laser
- Ultrasonic

Materials research and development

- Thermo electrics
- Light weight structures
- Extreme environments
- Fuel cells
- High temperature superconductors
- Nanomaterials





The “virtual” Research Centre

Interdisciplinary link between various subject areas

The “Energy and Environment” research centre follows the dynamic process of interdisciplinarity and acts as a communication and project platform in order to create synergies and added value for the actively participating research groups at TU Wien. It was established in 2008 as a coordination office and is structured free of organisational limits like institutes or faculties. It is organised as an open network and combined in a central management unit.

It is expected that this initiative will increase awareness of the expertise at TU Wien. It allows for new ideas and cooperation as part of innovative interdisciplinary projects and supports the development of holistic, cross-faculty solutions.



Research Centre
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