

# Energy Systems Master of Science

---

FACULTY 10  
ENERGY TECHNOLOGY



## Energy Systems

- 07 Career opportunities
- 10 Skills and expertise

## Before you start

- 13 Admission and Language requirements

## The practical degree programme

- 15 Contacts in industries
- 18 Curriculum
- 20 Compulsory modules
- 22 Elective modules

## General Information

- 25 Organisational Matters
- 27 Addresses

You will find all relevant information with respect to the course of studies Energy Systems in the internet. For that purpose, just photograph the QR code and use the adequate reader of your mobile phone\*.



\* Please note: Costs may arise upon initiating the web page.

# Introducing the degree programme

## **Introduction to the Master of Science in Energy Systems**

Both energy consumption and its impact on the environment are currently major issues in modern society and will be of great significance in the future. These topics raise many questions. If energy consumption increases over the next few decades, what effect will this have on global warming? How will we secure reliable energy sources if energy consumption continues to increase? How can renewable energy take over a larger share of the energy market in the future? Could nuclear energy be part of the solution? What is the best way of reducing CO<sub>2</sub> emissions?

One thing is certain: many more engineers will be needed in the future for the development of new energy conversion technologies, the improvement

of the efficiency of conversion processes, along with the development of biofuel technologies, solar and wind energy as well as hydrogen technology.

The FH Aachen, Jülich Campus, has long-standing experience in the field of energy technology. The Jülich Campus was founded in 1971 to train and educate mechanical and electrical engineering students in the field of energy technology, especially those with a nuclear background. The Campus is located near the Research Centre Jülich. With more than 1000 scientists and 4000 employees, the Research Centre Jülich is the largest of its kind in Europe. One of the major research fields conducted there concerns energy, in terms of the development of fuel cells, high temperature materials and energy efficiency.

The Master of Science in Energy Systems is conducted in cooperation with



the Research Centre Jülich. Many of the scientists from the Centre give lectures during the course. Two professors in this department are leading members of the Institute for Fuel Cell Development at the Research Centre Jülich.

The Solar Institute Jülich was founded in the early 1980's and has long been a major player in the field of renewable energies. Four professors of the supervisory board of the Solar Institute Jülich are also closely involved in the organization and teaching of the M.Sc. in Energy Systems.

The medium of instruction is English, the students are from many different countries, and the course is designed mainly for holders of a Bachelor's degree in mechanical, electrical or chemical engineering. The entire range of energy technology is covered and students have a large choice of elective courses in the

third semester. Both the mandatory project assignment and the Master's thesis can be conducted in research institutes, in industry or at the university.

Graduates of this program are very well-received in industry and research institutes as well as in the civil service.

The area of energy and environmental technology holds great perspectives for young, dynamic engineers, both male and female. Climate change is a much-discussed topic at present, and will remain so in years to come.





# Energy Systems

# Career opportunities worldwide successful

Career opportunities for graduates of the Master of Science in Energy Systems programme span many areas, ranging from fossil fuel production and renewable energy sources, through to nuclear power-related industries. However, not only energy companies are interested in the graduates of this Master's course; the topic of energy efficiency and CO<sub>2</sub> conversion is gaining importance for almost all industries and organisations.

What can be said about the new developments in the energy industry?

- > The petroleum industry is and will continue to be the dominant energy provider and is still a growing industry.
- > The natural gas and coal industries are growing much faster than the petroleum industry.
- > Renewable energy sources will play a significant role in the energy market only on a long-term basis.
- > Satisfying the global demand for energy remains a huge challenge.
- > Energy prices will rise to unknown levels in the future.

This means that the demand for experts working in these industries will rise dramatically. The energy industry will earn huge amounts of money, which must be re-invested in better, more efficient technologies and new development. This is true for all energy sectors, from crude oil production to hydrocarbon products, from coal mining to coal consumption in power plants and chemical industries, from biofuel production to the newly-developed combustion processes and from the development and industrial use of renewable energy plants such as solar power plants, wind generators, and geothermal energy.

---

**Find more information at:**  
[http://infobub.  
arbeitsagentur.de/berufe/](http://infobub.arbeitsagentur.de/berufe/)  
Suchbegriff: Ingenieur/in  
Maschinenbau -  
Regenerative  
Energietechnik

New, improved energy conversion technologies, energy efficiency and research in the field of renewable energies will become major issues over the next few decades. The utilisation of nuclear energy may also be of great significance in the future.

All these undertakings, from the improvement of the efficiency of existing plants, vehicles, HVAC systems, through to the implementation of new energy technology such as fuel cells, solar power plants, the production and use of biofuels or hydrogen technology, are all challenges which will create many new jobs for young, ambitious engineers.

Graduates of the Master of Science in Energy Systems at the FH Aachen are equipped to work on all the problems described above: the reduction of CO<sub>2</sub> emissions, the development of new energy technologies, and the reduction of environmental damage.

This is indeed an exciting perspective for young, dynamic graduates.

The Master of Science in Energy Systems programme has been part of the University's Master's Program since 2001 and from experience already gained, we know that our students usually are able to find places to complete their Master's thesis in relevant industries, in research institutes or partner universities, and occasionally in civil service. The same applies to our graduates.

Topics such as the efficient use of resources, the development of renewable energy systems, biofuel development, the influence of energy conversion technologies on the environment, and new energy transfer technologies are under discussion daily; such issues will be instrumental in determining our future. Due to the looming threat of energy shortages and increasing climate changes (carbon dioxide emissions), interesting areas of employment have arisen for young engineers, for example, in the modernisation of power stations in Germany and abroad. In Germany alone, around 20 billion euros will be invested in new power plants over the next few years. This means that a large number of new engineering positions will become available in this area. The type of knowledge and training required to take advantage of this corresponds to a large extent with the course profile offered here.

Over the last few years, the renewable energy sector has enjoyed a growth rate in double figures. Included here are solar technology, wind and biomass energy. Career opportunities in this area will multiply over the next few years.

Research in the area of combustible fuel cells is becoming ever more practically-oriented, opening up a wide area of possible employment to engineers. Energy-saving technology will





be introduced in all areas of industry, and engineers specialising in energy and the environment will be in demand. All large industrial plants, especially power plants, must now comply with strict planning and authorisation restrictions.

The authorisation processes are complicated and need appropriately qualified engineers to undertake this work. In all branches of industry, changes in the use of energy will take place and compliance with environmental regulations will be required. Similarly, in this area, energy and environmental engineers will find employment.

The construction of plants that produce electricity as well as heat (combined heat and power generation) is an area where German technology leads the world. This is also a typical area of employment for engineers educated in our programs. Mention here should also be made of the engineers who work to secure our daily energy supply.

Because of the strong tendency towards obsolescence in this field, many new positions are regularly created, giving young engineers ideal employment opportunities.

German technology is in great demand all over the world, which means that many young engineers are employed in the export sector, whether in planning, construction, maintenance and service, or in consultancy. Career opportunities here are good, in some cases excellent.

Graduates of the Master of Science in Energy Systems programmes can expect to enjoy a wide choice of career opportunities in their field once qualified. The areas of possible employment are extremely varied, and offer career advancement for engineers of differing aptitudes.

# Skills and Expertise

## energy and environment

The Master of Science in Energy Systems programme is designed in way that Bachelors with good basic engineering knowledge get the skills needed in the energy sector for positions as engineering manager, research and development engineer, engineer in higher administrative positions, and leading construction engineer.

The four semester course is divided into:

- > Bridging and basics semester,
- > Energy and economics semester,
- > Energy-related elective semester,
- > Master's thesis semester.

**Bridging and Basics Semester** | As students come from different majors they will receive training in those areas where they need broader knowledge to become an expert in energy systems. For example a Bachelor in electrical engineering will attend lectures in fluid dynamics and chemical engineering. The first semester includes also a lecture in mathematical tools and simulations to refresh and deepen the mathematical basis and a lecture in the basics of energy systems.

**Energy and economics semester** | The energy and economics semester includes the following modules:

- > Industrial Energy Technologies,
- > Modelling of systems and processes,
- > Energy economics and policy,
- > Business Administration.



Knowledge in industrial energy technologies is an essential part of the course, with the topics of power plant engineering, renewable energies and thermodynamic laboratory practices. Module modelling of systems and processes is an introduction to modern modelling techniques which will become very important in the near future. Our graduates shall have a sound knowledge in energy economics, business administration and energy policy; this is taught in separate modules.

**Energy-Related Elective Semester** | During the third semester, the student can select from a large list of electives in a wide range of energy- related specialisations. This is possible due to the fact that many of the elective modules and lectures are conducted by the scientists of the Research Centre Jülich (FZJ), the Solar Institute Jülich (SIJ) and experts from energy-related industries. One of the modules should be completed as assignment at a company, research institute or engineering office. The resulting scientific report will be defended in front of the supervisors from the university or industry.

**Master's Thesis Semester** | The fourth semester is reserved for the Master's thesis and the final colloquium which concludes the Master of Science in Energy Systems programme. The Master's thesis is normally the result of research activity and demonstrates the ability of the candidate. It should be related to the energy sector where the student plans to be employed.



Before you start

# Admission and language requirements

We are happy to receive your application and consider you for admission. However, spaces in the Master's programmes are limited, so unfortunately not all qualified applicants can be admitted.

Admission requirements are a Bachelor of Science, Bachelor of Engineering, Dipl.-Ing., Dipl.-Ing.(FH) degree or equivalent in mechanical engineering, electrical engineering or chemical engineering.

Students who have taken a national aptitude test in their country or GRE are requested to submit their score.

**English** | All courses in the Master's program are in English, therefore fluency in English is required. As proof of your English language ability, you must submit one of the following:

- > TOEFL score 520 on the paper-based test or 190 on the computer-based test, 68 on the paper-based test or 5.5 Overall band-score on the IELTS,
- > German Abitur "Englischleistungskurs" Minimum mark 2 (gut) or German Fachhochschulreife with other English language skills: Minimum mark 3.

The Program Coordinator reserves the right to determine if the student's academic background demonstrates sufficient English knowledge.

**German** | Knowledge of German with the proficiency of "Zertifikat Deutsch" (ZD) is an admission requirement. However, you can apply for a postponement of this qualification, but the Certificate shall be submitted before the exam period of the third semester latest.





The practical  
degree programme  
Energy Systems



# Contacts in industry

The excellent contacts with industry which exist in the field of Energy and the Environment are based, among other things, on:

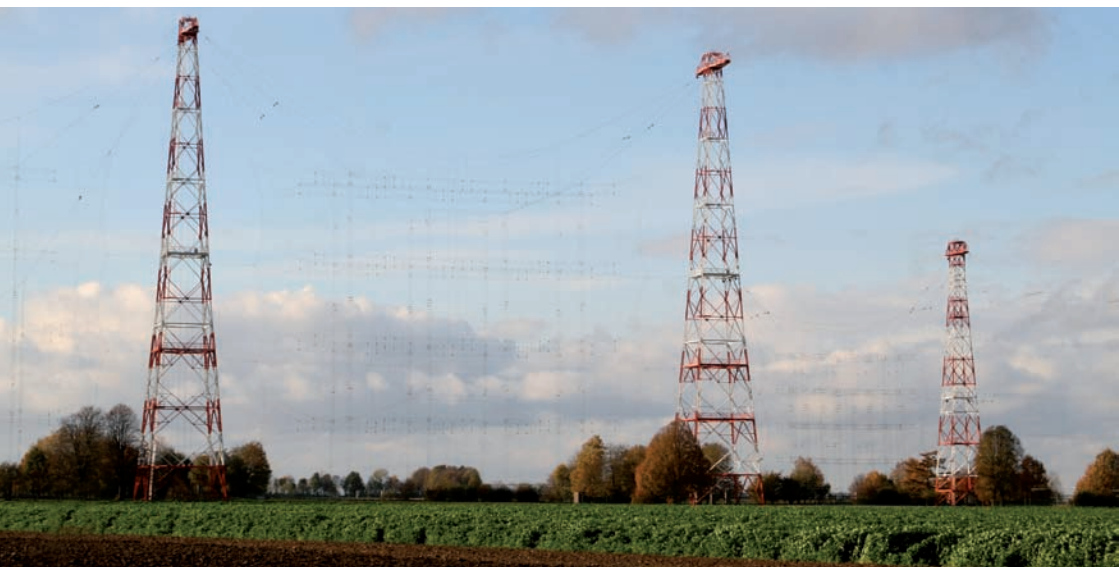
- > the competence platform “Energy and the Environment” comprising 13 professors and two scientific facilities,
- > the project “Education and Training” undertaken together with selected partners in industry, including the chemical industries with INEOS and the research center FZJ, in collaboration with the PowerTech Training Centre in Essen and their specialist training in Energy Studies.

All the important energy conversion processes – regenerative, fossil and nuclear – are represented in this project with industry.

These contacts are cultivated through the competence platform and offer students optimal conditions to work with partners from industry early in their academic careers (during their Bachelor's or Master's projects) as well as in corresponding seminars. It is, therefore, possible for our students to enjoy a seamless transfer from their studies to their chosen career. The following chart shows some of our partners from industry in North Rhine-Westphalia.

Thanks to the various research activities undertaken in the Mechanical Engineering programme, professors and staff working in the area of Energy and the Environment can report excellent relations with universities and research institutes at home and abroad. A selection of these is shown in the following chart.

Globalisation has meant that we have been able to develop good relations with universities and research institutes world-wide, and offer students the opportunity within their study program to spend a semester abroad. Moreover, internships and Bachelor's/Master's theses can also be completed abroad. These often take the form of specialised projects. A good knowledge of English, or, in the case of South America, Spanish, is required if students wish to participate in such programmes.





# Curriculum

No.	Name of module	C/E	Cr	SWS					Σ
				L	T	Lab	SU		
<b>1st semester</b>									
101310	Fundamentals of Engineering	C	10	5	2	2	0	<b>9</b>	
101320	Basics of Energy Systems	C	10	5	4	0	0	<b>9</b>	
101330	Mathematical Tools and Simulation	C	10	3	2	4	0	<b>9</b>	
<b>Total</b>			<b>30</b>	<b>13</b>	<b>8</b>	<b>6</b>	<b>0</b>	<b>27</b>	
<b>2nd semester</b>									
102340	Industrial Energy Technology	C	10	5	2	2	0	<b>9</b>	
102300	Modelling of Systems and Processes	C	10	4	3	2	0	<b>9</b>	
102310	Business Administration / Energy Economics and Policy	C	10	4	3	2	0	<b>9</b>	
<b>Total</b>			<b>30</b>	<b>13</b>	<b>8</b>	<b>6</b>	<b>0</b>	<b>27</b>	
<b>3rd semester</b>									
103xxx	Elective Module 1	E	10	-	-	-	-	-	
103xxx	Elective Module 2	E	10	-	-	-	-	-	
103xxx	Elective Module 3	E	10	-	-	-	-	-	
<b>Total</b>			<b>30</b>	-	-	-	-	-	
<b>4th semester</b>									
	Master's Thesis	C	25						
	Colloquium	C	5						
<b>Total</b>			<b>30</b>						
Cr: Credits L: Lecture									
C: Compulsory T: Tutorial									
E: Elective Lab: Laboratory									
SWS: Contact hours per week SU: Seminar									



		SWS						
No.	Name of module	C/E	Cr	L	T	Lab	SU	Σ
<b>Elective modules</b>								
103100	Energy Efficiency	E	10					
103370	Renewable Energy Systems	E	10					
103200	Fossil Energy Technology	E	10					
103360	Plant Engineering	E	10					
103300	Energy Applications	E	10					
103350	Advanced Modelling Techniques	E	10					
103400	Transformation of Energy	E	10					
103450	Sustainable Energy Systems and Energy Economics	E	10					
130500	Materials of Energy Techniques	E	10					
103550	Communication and Computer Skills	E	10					
103600	Management Skills	E	10					
<div>Cr: Credits L: Lecture</div> <div>C: Compulsory T: Tutorial</div> <div>E: Elective Lab: Laboratory</div> <div>SWS: Contact hours per week SU: Seminar</div>								

# Compulsory modules

---

101310

10 Credits

**Fundamentals of Engineering** | Prof. Dr.-Ing. Herbert Lauter

**Fluid Dynamics** | Prof. Dr.-Ing. Herbert Lauter

Application of hydrostatic, hydrodynamic, laminar and non-laminar flow principles to typical industrial problems including fundamentals of rheology.

**Fundamentals of Chemistry** | Prof. Dr. rer. nat. Ulrich Scherer

Understanding and application of chemical reactions and structural relationships.

**Electrical Engineering** | Prof. Neubauer

Application of the electro technical principles to power production and distribution facilities, load flow calculations, design of a three-phase - network, long distance AC transmission, application of power electronics.

---

101320

10 Credits

**Basics of Energy Systems** | Prof. Dr.-Ing. Christian Faber, Dr. W. J. Quadakkers

**Applied Thermodynamics** | Prof. Faber

Application of the 1st and 2nd law of thermodynamics for closed and open thermodynamic systems; assessment of thermodynamic cycles, knowledge of the 3 heat transfer principles: conduction, convection, radiation.

---

**Materials for Energy Systems** | Prof.

Dr. W. J. Quadakkers

Understanding of the section criteria for construction materials to be used for components in power generation systems.

Application of strengthening mechanisms used in different classes of metallic materials for low and high temperature applications will be discussed. methods for protecting the metallic components against the aggressive service environments at the high service temperature will be presented.

---

101330

10 Credits

**Mathematical Tools and Simulation** | Prof.

Dr. rer. nat. Werner Stulpe, Prof. Dr. rer. nat. Gerd Breitbach

Theoretical means for the investigation of technical processes are provided. Working with the software package MATLAB to compute even complicated nonlinear processes easily.

---

102340

10 Credits

**Industrial Energy Technology** | Prof. Dr.-Ing. Christian Faber

**Power Plant Techniques** | Prof. Neubauer

Knowledge of classical power plants and the design and operation of electric transmission and distribution networks and





the ability to analyse and compare the systems according to different principles  
**Renewable Energy Sources** | *Prof. Faber*  
 Knowledge and assessment of the use of renewable energy sources including their economical viability and their environmental impact.

102300

10 Credits

### **Modelling of Systems and Processes** |

*Prof. Dr.-Ing. Klaus Brüssermann*

### **Basics and Applications of Chemical Reactions** | *Prof. Dr.-Ing. Ralf Peters*

The student shall be able to apply the topics as shown in the contents description in practice.

### **Model-Based Control Systems** | *Dr. Simon*

The student shall develop the ability to improve industrial processes through appropriate control strategies. The first step is a survey of how the process reacts to external influences (process dynamics). Subsequently, the emphasis of the lecture is on the development of mathematical models. Finally, the students will learn how to develop an appropriate controller based upon these models and which „rules of thumb“ can be deduced for practical applications.

Modelling of Material Transport in the Environment - Prof. Brüssermann

The main topic is the mathematical solution of the below mentioned problems, i.e. advection/diffusion with differential equations in special geometries and the derivation of input parameters observed in the environment.

102310

10 Credits

### **Business Administration, Energy Economics and Policy** | *Prof. Dipl.-Math.*

*Jürgen-Fr. Hake, Prof. Dr. Ulrich Daldrup*

Understanding processes and trends in global, European and national economy and energy policy

- > learning basic facts about energy economy and energy policy
- > understanding the interactions between energy economy and energy policy
- > understanding the role of energy economy and energy policy in the context of sustainable development

### **Business Administration** | *Prof. Dr. Ulrich Daldrup*

Understand and be able to evaluate organisational structures and processes of enterprises and organizations Be able to realize business ideas leading to a business concept.

# Elective modules

---

**103100** **10 Credits**

**Energy Efficiency** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

Students learn to calculate the efficiency of technical equipment and plants, to distinguish between efficient and inefficient systems and propose processes with high efficiency. He/she shall also be able to conduct energy audits and/or technology assessments.

---

**103200** **10 Credits**

**Fossil Energy Technology** | Prof. Dr. rer. nat. Gerd Breitbach et al.

Fossil energy technology is still the main primary energy source, the efficient use of the fossil fuels, combustion technologies, advanced technologies such as fuel cell technology, advanced incinerator technologies, and power plant technology.

---

**103300** **10 Credits**

**Energy Applications** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

All kinds of Energy Applications: fuel cells, renewable energies, fossil energies, nuclear energy, modeling techniques.

---

**103350** **10 Credits**

**Advanced Modeling Techniques** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

The following choices are available: finite element methods, fuel cell technology, waste incinerator technologies, computer-aided design of electrical energy networks, technology assessment tools, CARNOT-simulation software for thermal solar systems.

---

**103360** **10 Credits**

**Plant Engineering** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

The following choices are available: fuel cell engineering, photo voltaic systems engineering, computer-aided design of electrical energy networks, waste incinerator technology, hydro power.

---

**103370** **10 Credits**

**Renewable Energies** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

New developments in the renewable energy sector, i.e. thermo solar systems, photovoltaic (physics and technology and systems engineering), hydro power, CARNOT-simulation software for thermal solar systems.



103400

10 Credits

**Transformation of Energy** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

All kinds of energy transformation technologies: renewable energies, solar, wind, biomass, hydro power, fossil energies, nuclear energy, modeling techniques, waste incinerators.

103450

10 Credits

**Sustainable Energy, Systems and Energy Economics** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

The following choices are available: CARNOT-simulation software for thermal solar systems, international management, total quality management, thermo solar system, photovoltaic (physics and technology and systems engineering), hydro power, technology assessment.

103500

10 Credits

**Materials in Energy Systems** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

The following choices are available: stationary applications of fuel cells, solar technology, waste incinerator technology, waste problems.

103550

10 Credits

**Communication and Computer Skills** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

The following choices are available: finite element method, CARNOT-Simulation software for thermal solar system planning, computer-aided design of electrical energy networks.

103600

10 Credits

**Management skills** | Prof. Dr. rer. nat. Gerd Breitbach (coordinator)

The following choices are available: Environmental Law (German and International Law), International Management, Technology Assessment, Energy Audits, Total Quality Management.

Note: One of three modules in the third semester shall be conducted as an assignment with one of the topics of the third semester modules. It should be a small research or development project with the workload of 10 credits. The results of the assignment shall be a paper of high scientific standard with the quality of a paper that could be published in a scientific journal, but must not necessarily be published. The assignment can be conducted at a company, a research institute, a cooperating university or in a laboratory of the Aachen University of Applied Sciences.



# General Information

# Organisational Matters

## **Programme duration, commencement of study and course structure**

| Programmes at the FH Aachen are offered in modules and ECTS-credit points are awarded. Including the Master's thesis, the standard length of the programme is two years (four semesters) or 120 ECTS-points. Lectures are held in English.

**Fees and the cost of the programme** | Every semester all students must pay a social contribution to the Studentenwerk (Student Services) and a student contribution, to the work of the ASTA (General Student's Committee). These include the semester ticket of the ASEAG (Aachen Public Transport Association). The amount is determined each semester. The listing of each of the current fees is at [www.fh-aachen.de/sozialbeitrag.html](http://www.fh-aachen.de/sozialbeitrag.html)

Starting in the winter semester of 2011 the Land Government North-Rhine Westphalia refrains from charging additional study fees.

**Application Documents** | All documents must be in English or German or must be accompanied by certified translations into English or German. The following documents must be attached to the application:

- > curriculum vitae/resume
- > all university transcripts and degrees
- > proof of English language requirement

**Important** | Applications will only be considered if all prerequisites are fulfilled and all documents are notarized by a notary or the German embassy. We cannot consider documents that have been stamped by a school, or faxes, emails or uncertified photocopies.

**Application Fee** | Starting in the winter semester of 2011 the Land Government North-Rhine Westphalia refrains from charging additional study fees.

**Confirmation of Receipt of Application and Admission** | We will send you an email with an application number when we receive your application. You must use your application number in all correspondence with us. In most cases you will receive a letter from us by the first week in January regarding your admission status.

**Application Deadline** | We take new students in the Masters' programmes in the summer semester and also in the winter semester. To start in summer semester the application deadline is 15 December for German citizens and European Union members, and 15 November for non-European Union members. To start in winter semester the application deadline is 15 June for German citizens and European Union members as well as for non-European Union members.

Send completed applications with all documents, including notarized copies of all certificates to  
FH Aachen | Jülich Campus  
Masters' Programmes  
Heinrich-Mußmann-Straße 1 | 52428 Jülich, Germany

**For further information** | [www.fh-aachen.de/master.html](http://www.fh-aachen.de/master.html)

**Course content and curriculum** | These are available online at [www.campus.fh-aachen.de](http://www.campus.fh-aachen.de)



# Addresses

## **Faculty of Energy Technology**

Heinrich-Mußmann-Straße 1  
52428 Jülich  
P +49.241.6009 50  
F +49.241.6009 53199  
[www.juelich.fh-aachen.de](http://www.juelich.fh-aachen.de)

## **Programme Coordinator Energy Systems**

Prof. Dr.-Ing. Josef Hodapp  
P +49.241.6009 53045  
[hodapp@fh-aachen.de](mailto:hodapp@fh-aachen.de)

## **Head of Examination Committee, ECTS Co-ordinator and Academic Counsellor**

Prof. Dr. rer. nat. Gerd Breitbach  
P +49.241.6009 53541  
[breitbach@fh-aachen.de](mailto:breitbach@fh-aachen.de)

## **Student Advisory Service**

Ms. Kattner, Mr. Braun  
Hohenstaufenallee 10  
52064 Aachen  
P +49.241.6009 51800  
[www.fh-aachen.de/studienberatung.html](http://www.fh-aachen.de/studienberatung.html)

## **Registrar's Office, Jülich Campus**

Ms. Burghardt, Ms. Gierkens  
P +49.241.6009 53117  
[www.fh-aachen.de/  
studentensekretariat.html](http://www.fh-aachen.de/studentensekretariat.html)

## **International Office, Jülich Camus**

Heinrich-Mußmann-Straße 1  
52428 Juelich, Germany  
P +49.241.6009 53270/53289/53290  
[www.fh-aachen.de/aaa.html](http://www.fh-aachen.de/aaa.html)  
[www.fh-aachen.de/master.html](http://www.fh-aachen.de/master.html)

---

## **Imprint**

**Publisher** | Rector of the FH Aachen  
Kalverbenden 6, 52066 Aachen, [www.fh-aachen.de](http://www.fh-aachen.de)  
**Information** | [studienberatung@fh-aachen.de](mailto:studienberatung@fh-aachen.de)

December 2010

**Editor** | Faculty of Energy Technology  
**Design Concept, Image Selection** | Ina Weiß, Jennifer  
Loettgen, Bert Peters, Ole Gehling | Seminar  
Prof. Ralf Weißmantel, Faculty of Design  
**Production** | Dipl.-Ing. Phillipp Hackl, M.A.,  
Susanne Hellebrand, Department of Public Relations  
and Marketing  
**Image Editing** | Dipl.-Ing. Phillipp Hackl, M.A.,  
Dipl.-Ing. Thilo Vogel, Simon Olk, M.A.  
**Picture Credit Cover** | FH-Aachen, [www.lichtographie.de](http://www.lichtographie.de)



**HAW**tech  
HochschulAllianz für  
Angewandte Wissenschaften