

Post-Graduate Training in Renewable Energies at Kassel University

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~ Weiterbildender Studiengang Energie und Umwelt

Abstract: Three different post-graduate education programs on *Renewable Energy Technologies and Energy Savings* are offered at Kassel University:

- (A) a master course held in German language,
- (B) part of a European master course, and
- (C) part time courses for engineers, natural scientists, and technicians returning to the university for continuing education.

In the following an overview of the course structures, the prerequisites in terms of education for the students and scientific aims are given.

Introduction

In 1997 the EU Whitepaper "Energy for the Future – Renewable Energy" demanded to double the share of renewable energies on the primary energy consumption of the EU to 12% in 2010, compared to 1995. This ambitious aim requires a lot of effort in political, economical and infrastructural respect. Highly skilled and well educated engineers and scientists, who are able to employ, develop and refine renewable energy and energy saving technologies, serve as a prerequisite to meet this aim. Nevertheless, the lack of engineers and project developers has so far been one of the main limiting factors even in highly industrialized countries, for example for the growth of the German wind technology industry during the recent years. To overcome these problems the number of education programs need to be increased significantly, both, on national and international level, in order to meet the local needs and to take into consideration global perspectives.

Whereas the number of researchers working on *single* renewable energy technologies increased during the recent years, only little effort has been taken to connect different fields of new and conventional energy technologies in a combined study program. To provide a broad knowledge regarding technological options and saving measures, an interdisciplinary staff of specialists in the fields of photovoltaics, wind energy, solar thermal, small hydro power, biomass production as well as conversion, building physics, domestic service facilities and global energy scenarios has gathered to provide a joint education program at Kassel University. This was possible due to the fact that a high number of university and other research institutes as well as industry working in the renewable energy field are located in the region of Kassel.

The sequence of the education programs at Kassel University on renewable energy technologies is shown in Figure 1. In Table 1, an overview of the education programs is given. Additionally to the courses mentioned, PhD studies are carried out in the research groups involved in the education program.

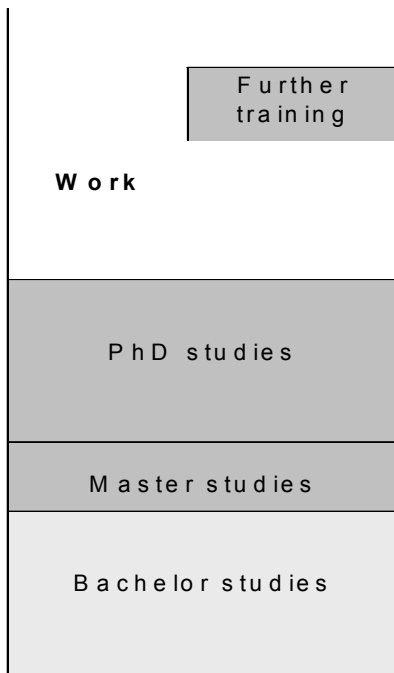


Fig. 1: Sequence of education programs. The dark fields mark study and training programs regarding renewable energy technology offered at Kassel University (Germany). A Bachelor course on "Renewable Energies" is offered at the Fachhochschule Nordhausen, located close to Kassel, cf. (Wesselak 2004).

Tab. 1: Survey over the possibilities of postgraduate studies in renewable energies at Kassel University.

	"German" Master	"European" Master	Extended Training
Language	German	English	German
Degree	MSc		Certificate
Focus	Science, application	Application, science	Application
Duration	18 months	12 months	6 to 12 months
Start	April and October	October	October
No. of participants	100/a (expected)	50/a (expected)	120/a
Fees	no	5.000 – 10.000 €/a	600 – 1150 €/Module
URL	www.uni-kassel.de/~solar	www.eurec.be	www.uni-kassel.de/e+u
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A) German Master Program on "Renewable Energies and Energy Efficiency".

Starting in spring 2005, this master program will be offered in German language in a cooperation of the departments of mechanical, electrical and civil engineering as well as architecture and agriculture. Prerequisite to take part in the course is a bachelor or comparable degree in technical or natural science or in agriculture. This broad range of start qualifications is taken into account in the didactic concept. However, strong basic knowledge in mathematics is mandatory.

Renewable Energy and Energy Efficiency

	Master Thesis																					30
Summer Term	Thermodynamics			Solar Engineering				Energy Efficiency				Environment								30		
	Thermo-dynamics	Heat Transfer		Solar Irradiation, Photovoltaic, Solar Thermal, Other Renewables				Building Physics, Domestic Services		Rational Use of Energy		Global Ressources, Environmental Impacts		Optional Technical Courses				Practical Work in a Laboratory				
Winter Term	Elektrical Engineering					Turbo Machines			Biomass				Economy								30	
	Electrical, Measurement and Control Technique			Systems Engineering		Fluid-dynamic	Wind- and Hydropower		Biomass Production		Biomass Conversion		Energy Economy, Project Planning		Optional Technical Courses				Non Technical Courses			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	90
Classroom hours per week																					Credits	

Fig. 2: Scheme of the curriculum of the German master course at Kassel University. The darkest marked courses are obligatory, depending on the previous degree of the students. The students may enter the study either in the winter and the summer term.

Special basic courses are offered in

- electrical, measurement and control technique,
- thermodynamics,
- heat transfer,
- fluid dynamic,
- agriculture,
- biology, and

building physics.

The technical knowledge base is taught as well as applications of the important renewable energy technologies and energy saving measures.

In addition, the curriculum contains courses regarding

- life cycle engineering,
- energy economy,
- project planning, and
- the global development regarding energy supply.

Besides the application-orientated education, special attention is laid on fundamental scientific skills, implemented into the education scheme with an extended master thesis. The interdisciplinary composition of teaching staff and students shall strongly stimulate discussions, exchange and cooperation beyond the single disciplines.

The course lasts 18 months and it is free of tuition fees. The students can enter the course each spring and fall. A scheme of the course structure is shown in Figure 2.

B) European Master Program: “Master in Renewable Energy”

The European Master Program “Master in Renewable Energy” has a total duration of 12 months. It is divided into three sections:

- a basic education about renewable energy technologies (*core phase*, lasting from September to December),
- a specialisation in a chosen field at a different university (*specialization phase*, January to April), and
- a research project (*project phase*, May to September).

During the program, the students are required to stay in at least two different European countries and to get in contact with a wide range of European research institutes and companies involved in the renewable energy field. The universities participating in the master program are all well established in training and education, and recognized at an international level for their work in the field of renewable energy technology.

The *core phase* of the master program provides a firm technical background in the key renewable energy technologies and an overview about energy production and use. Course languages are English, French or Spanish. The core providers (universities) follow a common syllabus containing solar, wind, biomass and water technologies. Additional non-examinable material and/or lectures on socio-economics may be provided. The student can choose one of the following universities:

- *Loughborough University*, UK for the core taught in *English*
- *Zaragoza University*, Spain for the core taught in *Spanish*
- *Ecole des Mines de Paris*, France for the core taught in *French*
- *Oldenburg University*, Germany for the core taught in *English*

During the *specialization phase* the students focus on a particular technology or implementation aspect (photovoltaics; wind power; solar energy in the built environment; biomass or hybrid systems). The classes are taught in English. The specialisation phase can be carried out at one of the following universities:

- *National Technical University of Athens*, Greece, for the specialisation in *Wind Energy*
- *University of Zaragoza*, Spain, for the specialisation in *Biomass*
- *Kassel University*, Germany, for the specialisation in *Hybrid Systems*
- *University of Northumbria*, UK, with input from the *New University of Lisbon*, Portugal for the specialisation in *Photovoltaics*
- *University of Athens*, Greece, for the specialisation in *Solar Energy in the Built Environment*

During the *project phase* the student gains practical or research experience through a research project undertaken in industry, a research laboratory or at the university. The project is normally related to the specialization taken, however it may also be carried out in a different field. The project must include sufficient technical content and must be directly related to renewable energy. Apart from that, there is no restriction in the type of the project. This allows a wide variety of projects to be proposed and gives flexibility to the student and the project provider to define the project. The students are welcome to propose his/her own project. During the project, the progress is monitored by a professor from the core and the specialization provider as well as a professional tutor from the project provider.

The project is presented at the end of September in the Renewable Energy House in Brussels where the students also have the chance to meet the staff of the different European renewable energy associations present in the House, the course directors and project tutors from the industry and research centres. The students are also obligated to write a project report.

The three course phases (core-specialisation-project) carry equal marks. After successfully passing exams and completing the project, students are awarded their respective degree by the university where the student studied in the first trimester, according to the respective national rules. The degree carries a label "EUREC Agency European Master in Renewable Energy".

The entire program is build up on a modular basis with credits awarded for passing each phase and the successful completion of the project. A total of 90 European credits (30 for each course phase) are required for the award of the European Master's degree.

C) Continuing Education "Energy and Environment"

(Weiterbildendes Studium Energie und Umwelt)

The continuing education "Energy and Environment" is offered at Kassel University since 1982. The target group are engineers, natural scientists and technicians who are on job and want to extend their knowledge on renewable energies for energy consultation. In 2000 a new modular concept has started with two specializations called "Energy Consultant for Buildings" and "Construction Planner Renewable Energies". Technical, economical, political and legal aspects are covered in the courses.

The lessons are given at weekends. Therefore, the program enables to combine a qualifying continuing education with a regular job.

In Table 2 the number of participants for different courses are listed. In 2003/04, 60 students participated in all of the courses about "Energy Consultant for Buildings". In 2004 the course was offered twice. Nevertheless, many applicants had to be refused.

The students come from all over Germany - and even other parts of Europe - to take part in the seminars.

Laboratories and computer-rooms of the University are used for supplementary practical trainings. These application orientated trainings are usually also oversubscribed.

The one year course is held in German and starts in fall each year. At the end of the courses the participants can receive a certificate. The fees amount from 600 Euro to 1150 €, depending on the chosen modules.

In Fig. 3 a time schedule of the courses is given.

month	10	11	12	1	2	3	4	5	6	7	8	9
Continuing education energy and environment	Special basic courses											
			Laboratory and computer seminars									
							Project work					
		Energy Consultant for Buildings										
						Construction Planner Renewable Energies						

Fig. 3: Scheme of the curricula of the further training "Energy and Environment" at Kassel University. The darker marked courses are modules offered for students with special interests.

Tab. 2: Number of participants of the continuing education in the field Energy and Environment

	2002/03	2003/04
Further education energy and environment	30	33
Module Energy Consultant for Buildings	120	60
Module Construction Planner Renewable Energies	35	17

References

Wesselak, V.: Renewable Energy Engineering, Proceedings of EuroSun 2004, Freiburg 20.-24.6.04