

The EUREC's Master in Renewable Energies – Educating Renewable Energy Engineers

Introduction

EUREC Agency is the initiator and the coordinating body of the graduate programme “European Master in Renewable Energy”. A network of eight European universities, members of EUREC agency, having a leading position in renewable energy RD&D, runs the course. The European Master in Renewable Energy is directed towards engineers that want to specialise in one of the renewable energy technologies, such as wind, biomass, photovoltaics, or in one application domain of these technologies, such as solar in buildings or hybrid systems.

From a survey¹ undertaken by EUREC Agency as part of an ALTENER project, a growing shortage of suitably trained technical staff for the RE sector and a distinct demand for postgraduate courses have been highlighted. The survey indicated a severe lack of high level teaching materials, due to inertia in higher education institutions and the slow rate of recognition of the renewable energy's increasingly important role in the energy mix.

Regardless the fact that the EU does not seem on track to meeting its targets², the European renewable energy industry is today one of the fastest growing industry sectors in the EU: it has reached a turnover of EUR 10 billion and employs some 200.000 people. The renewable energy industry, creates employment at much higher rates than many other energy technologies. New research, industrial and craft jobs appear directly in R&D, production, installation

and maintenance of renewable energy systems. Backward linkages to other sectors triggering demand for technical RE expertise exist for consultancies, insurance companies and even law firms performing technical due diligence. Predicting precisely the number of people to be trained is difficult. However, various projections for employment in the renewable energy industry have been made. Currently, around 85.000 jobs have been created in Europe in the field of wind energy alone. According to estimations of the European Renewable Energy Council³, by 2010, there will be 184.000 full time jobs in the wind sector, 338.000 in biomass, with 424.000 additional jobs for biofuels. Small hydro and geothermal power are expected to provide for 15.000 and 6.000 jobs respectively, while PV and solar thermal will employ another 30.000 and 70.000 people. This presents a total of over 1 million jobs for the RE sector by 2010, an impressive number that is to double for the new RE sector target of 20% by 2020! Even if it is only a small proportion of these employees who require education at graduate level, it is clear that the demand for technical RE expertise is growing.

A response to the demand for specialised engineers

Renewable energies cover a wide range of diversified technologies, and each domain requires specific skills and know-how a general engineer does not automatically get. How



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¹ Published in June 2000 “European Master Degree on Renewable Energy” in Proceedings EuroSun 2000

² EU Renewable Targets for 2010:

- RES-E Directive on the promotion of electricity produced from renewable energy sources (RES): 22.1% of gross electricity consumption from RES
- White Paper and Action Plan on Renewable Energy Sources (1997): 12% of energy consumption from RES
- Biofuels Directive on the promotion of the use of biofuels or other renewables fuels for transport (2003): 5.75% of sold gasoline and diesel

³ European Renewable Energy Council EREC: “Renewable Energy Target for Europe”, January 2004, Brussels. See www.erec-renewables.org for details

much does a biofuel expert have in common with a turbine developer? Even within one technology, such as PV, experts either focus on systems or on materials. Until recently, there was no university training to be found that went into sufficient depth to provide its graduates with the relevant expertise and specific training was left to the employer.

Most of the companies that make up the RE industry landscape are of small and medium size. Even if there are recent tendencies for consolidation of the sector like the takeover of MADE by Iberdrola or the expected merger of the Danish wind turbine manufacturers Vestas and NEG Micon, the majority of companies do not count as large enterprises. Given the fact that the launch of new products is a cost-intensive exercise involving heavy investment in research and development, the sector is certainly not making large enough profits for single companies to embark on expensive training programmes for new employees. However, new recruits, even if they might hold an engineering degree, are not *per se* fit for a company's daily job requirements and typically need a minimum of six months on-the-job training before being able to contribute tangible results.

Driven by the fact that there is not enough supply in the labour market that qualifies to meeting the specific demand of the different RE companies, EUREC Agency set up a graduate degree course to satisfy industry needs in human resources: the European Master in Renewable Energy. This full-time technical course provides its students with the state-of-the-art skills and expertise required for employment in the RE industry. By turning out experts in the respective RE technology, the course significantly reduces the time and financial burden of training new employees for the potential employers.

A European Master run by renewables-experienced universities

The European Master in Renewable Energy has been designed in cooperation with eight universities in five EU countries, with each

institution adding its specialised technological knowledge to the programme.

The core is taught by universities having a strong record in general renewable energy technology teaching. They are the following :

- Loughborough University, UK (language: English)
- Carl von Ossietzky University at Oldenburg University, Germany (language: English)
- Universidad de Zaragoza, Spain (language: Spanish)
- Ecole des Mines de Paris at Sophia Antipolis (Nice), France (language: French)

The core lasts from October to December and ends with a series of exams.

The specialisation providers propose a specific focus on one renewable technology or on one domain of application: Five specialisations, all taught in English, are available:

- Wind energy – at the National Technical University of Athens, Greece
- Biomass – at Universidad de Zaragoza, Spain
- Photovoltaics – at University of Northumbria at Newcastle, UK
- Hybrid systems – at Kassel University, Germany
- Solar in buildings – at University of Athens, Greece

Each specialisation lasts from January to April and ends with a series of theory and practical exams.

In the coming years, it is expected that the list of specialisations available will grow. A specialisation in water power (to include micro-hydro, wave and tidal power) would be especially welcome and relevant as this domain is expected to grow in a near future.

The twelve-months programme is divided in three parts, getting progressively more and more practical:

The "core" provides a firm comprehensive background in the key renewable energy technologies (wind, solar, biomass, water). It concentrates on energy production and use and addresses the socio-economic context. Mostly theoretical courses are completed with laboratory workshops. The "specialisation" focuses on the specific technology and implementation aspects of one renewable energy discipline of the student's choice: Wind energy,

biomass, photovoltaics, hybrid systems, or solar energy in the built environment. In-depth theory classes alternate with extensive practical work in laboratories and testing facilities, while study excursions illustrate real-life implementation.

The balanced mix of theoretical and practical courses optimally prepares graduating engineers for jobs in the growing renewable energy industry. An extensive 5-months company placement for hands-on project work is an integral part of the programme. It provides students with valuable working experience, while allowing companies to fill their short-term human resources needs and to “try out” potential future employees. During this period, a tutor from the host company supervises and guides the student during project work, while a second supervisor from the university at which the student will undertake his or her specialisation helps the student with his/her project work.

Different to the few other existing Master-level RE courses, the European RE Master plays the European card: students are required to study in at least two different European countries. This feature reflects the fact that there is at present a tendency to cross national borders and set up foreign representations or carry out project work abroad, even for small and medium RE companies. Clearly, intercultural awareness and foreign languages are assets that present a plus for any employer today.

Coordination and management

To guarantee the academic quality and level of the course and to delegate the academic programme management to the adequate body, a Scientific Committee exists, made up of the academic responsible persons for the project at the partner universities.

This Scientific Committee has final authority over any management decision affecting the European Master in Renewable Energy. Regular contact between the members of the Scientific Committee guarantee a smooth communication flow and successful implementation of the course.

Examination and assessment results are expressed in grades. There are many different grading systems in Europe. The ECTS (European Credit Transfer System) serves as tool for mutual recognition of student achievements.

ECTS credits are a value allocated to course units to describe the student workload required to complete them. They reflect the quantity of work each course requires in relation to the total quantity of work required to complete a full year of academic study at the institution, that is, lectures, practical work, seminars, private work – in the laboratory, library or at home – and examinations or other assessment activities.

ECTS credits are also allocated to practical placements and to thesis preparation when these activities form part of the regular programme of study at both the home and host institutions.

ECTS credits are allocated to courses and are awarded to students who successfully complete those courses by passing the examinations or other assessments.

ECTS grades are quoted alongside grades awarded according to the local grading system. Higher education institutions make their own decisions on how to apply the ECTS grading scale to their own system.

Conforming to the tendency towards EU-wide uniformity and comparability of university diplomas, the European Master in Renewable Energies leads to a final degree mutually recognised by the different countries' universities. The labelling is the equivalent of “European MSc in Renewable Energy” in the language of the core university (i.e. the University of Zaragoza issues a “Master Europeo en Energias Renovables”). The degree is issued by the core university according to its respective national standards. It has been decided that students only register with the core University, which then becomes responsible for awarding the degree. This is to ensure that the degree will be recognized universally as a Masters. The consequence of this is that the awarding institution must recognize the credits of the other participating Universities.

Table 1
2003 – 2004 Student
Overview Core / Spe-
cialisation

	biomass	wind	PV	hybrid systems	solar build		Total
Zaragoza	2	2	2	2		EU non-EU	8
Loughborough	3	3	3	2	0	EU non-EU	11
Ecole des Mines	0	2	0	6	0	EU non-EU	8
Total	6	8	6	12	0		32

EU students	27% EU students:	84,38%
Non-EU students	5% Non-EU students:	15,63%

Considerable co-ordination and management is required to organise such a course involving 12 different organizations in total. EUREC Agency plays a central co-ordination role and provides the initial point of contact for students. It is responsible for admissions, marketing, informing the Scientific Committee and implementing its decisions.

Companies are encouraged to contact EUREC Agency with a project proposal they would like to have a trainee for. EUREC Agency then finds trainees for them. All trainees already hold an engineering or other relevant degree and have followed the European Master in RE core and specialisation by the time they enter a company; they are already junior RE experts.

Target students

The course is of strictly technical nature and thus only applicants with an engineering, physics or relevant scientific university degree are admitted. Beyond this, applicants must have a very good command of English language in order to follow classes.

Typically, a student applies to EUREC Agency responsible for the admissions procedure. His application is reviewed by the academic partners of the core university and the specialisation university the student has chosen. The core university then registers the student for the whole course. Classes start in October for the core where the student learns about the different RET's in a general but technical manner. He does

laboratory work and passes a series of exams. During this period he also looks for a placement in the RE industry with the help of the core director. In January, the student moves on to the specialisation university. Here, he will only focus on his specialisation to get as deep an understanding as possible in the four months period. Guest lecturers add latest research findings or illustrate practical applications of the technology, and the student visits installations, and experiments with the technology in laboratories. Then he starts his internship period with a company. Leading to a report on his project work and the preparation of a presentation that he holds in September in Brussels in front of an academic panel composed of the course directors. His fellow students as well as interested industry or research representatives assist at this event. He gets graded on both project report and presentation.

EUREC Agency is creating an network of former students to keep track of their career development, to monitor which percentage of graduates find work in the RE sector as planned, which sectors are most likely to employ graduates and how long students have to look for a job upon graduation. The results of this monitoring are not available yet, as the first students have only received their final diplomas at the end of 2003. However, half of them is already working in their discipline of specialisation, an encouraging sign (see Table 1).

6. Outlook

The medium objective consists in establishing the European Master in RE as a reference in the field of Master-grade RE education on EU level, while taking into account the EU enlargement. In practical terms, this means promoting the course with the renewables industry, increasing the number of participating universities within the EU in order to cope with the growing number of students and extend the geographic scope to the East.

Given the high number of applications received from developing countries’ students, an adapted replication of the course is under consideration for Asia and later on for Latin America and Africa.

EUREC Agency, the European association of renewable energy research centres, makes sure the course curriculum fully and timely integrates all relevant new R&D results. EUREC members being R&D centres and universities as well, the network takes care of transferring knowledge from research laboratories into the classrooms. On the other side, the continuous dialogue with the RE industry guarantees that the teaching remains sector-relevant. After all, the course has ultimately been set up to serve the RE industry.

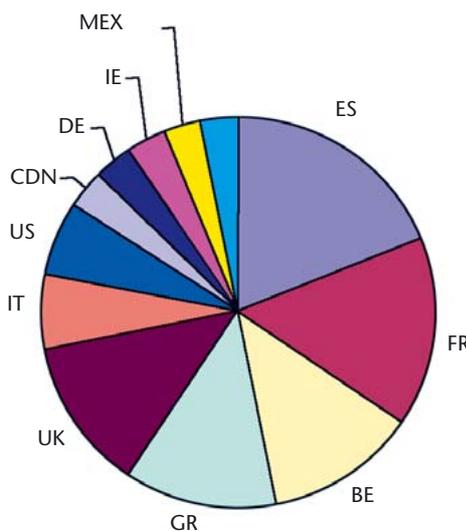


Figure 1
Nationality mix
of students in
2003–2004