

■ Launching the Open International Solar University (OPURE)

- The EUREC's Master in Renewable Energies – Educating Renewable Energy Engineers
- Renewable Energy Education Network:
The International Institute for Renewable Energies (IIRE)
- European Network on Education and Training in
Renewable Energy Sources (EURONETRES)
- Renewable Energy Research and Education Network

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.

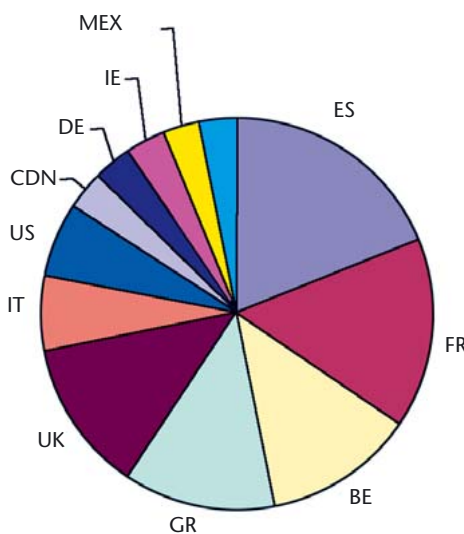


Figure 1
Nationality mix
of students in
2003–2004

Renewable Energy Education Network: The International Institute for Renewable Energy (IIRE)

Introduction

Naresuan University has entered an agreement for the establishment of the International Institute for Renewable Energy (IIRE) in cooperation with the following universities:

- Curtin University of Technology (Australia),
- University of New Brunswick (Canada),
- Yunnan Normal University (China),
- Claude Bernard Lyon University (France),
- Kassel University (German),
- Tokyo University of Agriculture (Japan), and
- Tribhuvan University (Nepal).

IIRE is located at the Research and Training Building, Energy Park, Solar Energy Research and Training Center, Naresuan University.

IIRE is a non-profit making, international institute that is concerned primarily with the promotion of research and development, testing and demonstration of renewable energy technologies and the diffusion of knowledge and information gained as widely as possible. IIRE will facilitate research cooperation among institutions, arrange training to enhance competence, and organize meetings to increase awareness, thus contributing to the development and promotion of renewable energy.

IIRE will continue to seek collaboration with international organizations and sponsors for joint activities, ranging from research and development through to the training of technicians and information dissemination.

The mission of IIRE is to be an effective center for the generation and sharing of information relating to renewable energy and for the development of the human resources required to successfully promote its use through the provision of training, the facilitation of international cooperation.

IIRE is organized into three departments; the Secretariat Office, International Cooperation Office, and Renewable Energy Information Center. Each department is sub-divided into sections according to their respective functions (Fig. 1).

The sections and functions of the Secretariat Office consist of Administration, Human Resource, Finance & Accounting, Public Relations, and Meeting & Seminar.



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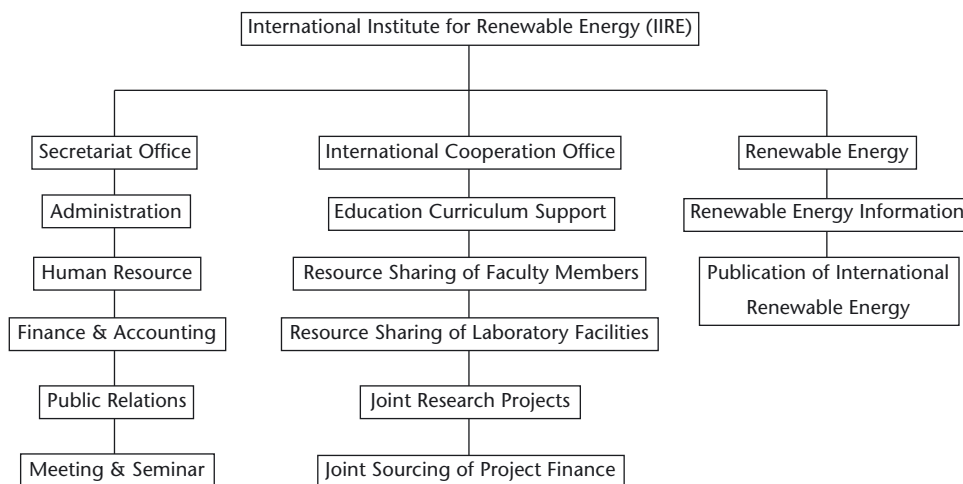


Figure 1
 Functions and Organization of IIRE

The sections and functions of the International Cooperation Office consist of Education Curriculum Support, Resource Sharing of Faculty Members, Sharing of Laboratory Facilities, Joint Research Projects, and Joint Sourcing of Project Finance.

The sections and functions of the Renewable Energy Information Center consist of the Renewable Energy Information Service and publication of the International Renewable Energy Journal.

Research, education and training for the global

IIRE aims to be an excellent institute for the research and development of renewable energy technology such as solar thermal, PV, solar hydrogen, biomass and energy economics. With high quality research, it aims to solve any potential energy crisis in the future in this country and the world.

To conduct the Doctor of Philosophy on Renewable Energy to enable the development of human resources in the field of renewable energy through study and research in order to advance knowledge for efficient utilization of renewable energy at the local, national and international level. Our goal is to develop professional personnel in the fields of renewable energy, energy conservation, energy management and environment conservation. Our program promotes research work in renewable energy in order to keep pace with current advances in technology and new innovations in the academic field.

Renewable Energy Training Program

The main renewable energy application areas are wide rural regions. Most people there are poor and have low education. They need to be trained to use the renewable energy. Our experiments let us know that the suitable knowledge and technology are important to the popularization of renewable energy application. Developed countries can support the expertise for Mekong Region to hold the different level

training classes in each developing country, various training programs as follows:

- Rural Energy Camp
- Solar Dryer System Use
- Renewable Energy Database Management
- Technology and Solar Energy Applications
- Biogas from Animal Dung
- Photovoltaic System for Remote Area
- Roof-top grid Connected

Standard Testing for Renewable System for the Mekong Region

The production of electricity from photovoltaic system needs a proper design for its efficient and continuous operation. The standard testing of photovoltaic module and balance of system (BOS) is very important for sustainable implementation of the photovoltaic system. Mekong countries do not have professional people who can do the standard testing of the photovoltaic system. We realized the importance of conducting a training course for standard testing of photovoltaic module and BOS to related government technical staff for meeting the standard of international standard testing. The training course is aimed for developing reliable photovoltaic system that will be suitable and beneficial for rural community in the region.

Strengths, expanded and financed

IIRE have to survive by financial support from the following sources

- University budget
- Government budget
- Benefit from business
- Donation budget
- Subsidy from other sources:

1) Domestic Fund

- NEPO: National Energy Policy Office
- NRCT: National Research Council of Thailand
- TRF: Thailand Research Fund
- NSTDA: Thailand's National Science and Technology Development Agency

2) International Fund

- ADB: Asian Development Bank
- ADEME: Agence de l'Environnement et de la Maîtrise de l'Energie
- AERECA: Asia Europe Renewable Energy Consortium Agency
- APEC: Asia Pacific Economic Cooperation
- AREDO: Asia Renewable Energy Development Organization
- ASEAN: Associate South East Asia Nation
- AusAID: Australian Agency for International Development
- CIDA: Canadian International Development Agency
- CORE: Council on Renewable Energy in the Mekong Region
- CRESTA: Center for Renewable Energy Systems Technology Australia
- DFG: Deutsche Forschungsgemeinschaft
- DLR: Germany Aerospace Center
- EC: European Commission
- ESCAP: Economic and Social Commission for Asia and the Pacific
- Fraunhofer ISE: Institut Solare Energiesysteme
- GEF: Global Environment Facility
- GTZ: Deutsche Gesellschaft für Technische Zusammenarbeit
- IEA: International Energy Agency
- InWEnt: Internationale Weiterbildung und Entwicklung gGmbH
- ISET: Institut für Solare Energieversorgungstechnik e.v.
- JICA: Japan International Cooperation Agency

- NEDO: New Energy and Industrial Technology Development Organization (Japan)
- NREL: National Renewable Energy Laboratory (USA)
- PSA: Plataforma Solar de Almeria
- RARC: Robotic Agriculture Research Center
- RBF: Rockefeller Brothers Fund
- UN: The United Nations Organization
- UNDP: United Nations Development Programme
- UNEP: United Nations Environment Programme
- UNESCO: United Nations Educational Scientific and Cultural Organization
- USAID: U.S. Agency for International Development
- WB: World Bank

The strength of the International Institute for Renewable Energy (IIRE) is the network which contains of various countries including developed and developing countries as well who have the same goal to protect and respect the natural resources and the environment. Capacity building for renewable energy will foster technology transfer and human resources development.

European Network on Education and Training in Renewable Energy Sources (EURONETRES)

The EURONETRES has been planned as a regional voluntary cooperative framework, uniting academic institutions of the European countries, interested in the capacity building on RES¹ at national and regional levels and in particular, in education and training of specialists in RES for the extended use of RES in Europe as well as in other regions of the World.

EURONETRES has been foreseen as an integral part of the Global Renewable Energy Education and Training (GREET) Programme of UNESCO, which is a priority area of the Organization’s actions in the field of engineering sciences and RES as approved by the 32nd Session of the UNESCO’s General Conference, which took place in September-October, 2003 in Paris, France. The Network will be sponsored by UNESCO through the UNESCO Office in Venice – Regional Bureau for Science in Europe (ROSTE).

- A member of the Working Group is nominated by the Steering Committee {or the Executive Committee} as coordinator of the Group, with the responsibility to coordinate and to operate the Working Group, in consultation with the Executive Committee
- The Working Groups can invite experts in RES from institutions which are not members of the EURONETRES



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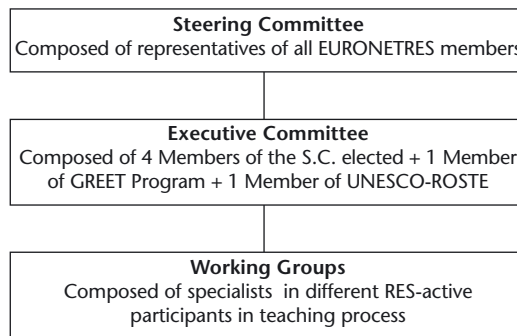


Figure 1 (above)
EURONETRES Structure

Members of the Network

The membership of the Network is open for educational-R&D institutions in Europe, which have a certain experience in RES education and training and have the intention to share this experience with partners, to contribute to the improvement of educational process on RES and to undertake new initiatives in this particular field. The membership of EURONETRES should be confirmed by the directorates of those institutions which also nominate their official representatives in the Network, one representative from each institution.

Working Groups Composition

- A Working Group is composed by specialists in the specific field, members of the EURONETRES Institutions

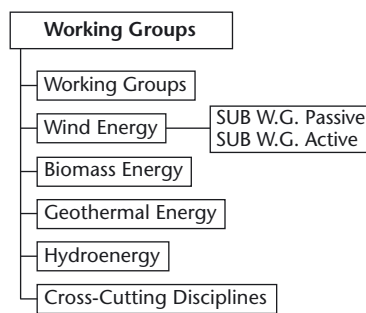


Figure 2
Structure of Working Groups

The Education Levels of EURONETRES

- A. University Level Education
 - A.1. Undergraduate Education
 - A.2. Postgraduate Education
- B. Retraining Education for Diploma Holders
- C. Technicians Education and Retraining (or Specialisation)

¹ RES = Renewable Energy Sources

- D. Students Education in Primary and Secondary Schools
- E. Mass Media for Initiation – Education of the Citizens on RES

EURONETRES will be activated progressively into the different levels of Education. The time to initiate the Education in the various levels will be decided by UNESCO. The modalities and the content of the Education in the various levels will be elaborated and decided by EURONETRES. The University level education will be the first to come in action, because the other levels need larger number of specialists to educate the educators.

A. University Level Education

A.1. Undergraduate courses on RES

Taking into account the differences in knowledges needed in the various University Departments (Department of Engineering, Department of Sciences, Department of Economics, Department of Social Sciences, etc), it is necessary to facilitate the responsible Departments to adopt the appropriate content of their courses to RES. The opportunity will be given by the elaboration of the program of studies followed by text books CDs, elaborated from the working groups (eg. basic knowledge, solar energy courses, biomass energy courses, the economics and social aspects of RES, the environmental aspects of RES, etc.). The responsible professors and other teaching staff in a Department have to adopt the EURONETRES material as a minimum for their students.

Advantages from the Adoption of the Undergraduate EURONETRES Education

- The students who have passed the examination in a specific course, prepared by the Working Groups, will obtain a specific Certificate of 2nd cycle by the Department. This Certificate will be valid for all the Universities participating in the EURONETRES. Thus, among other things, the students will be facilitated in their mobility within EURONETRES Universities (stimulation of cooperation and mobility).
- The Engineers or other scientists who obtained their diploma from their University and in parallel have earned a number of Certificates

on RES, will have the advantage to find more easily a job related to RES.

- Other advantages for the Universities to adopt the common rules for such Certificates, are coming from the fact that there are normally very few Universities that can offer courses for ALL THE RES, so, if they participate in EURONETRES, their students can collect Certificates in different disciplines (Solar, Wind, Geothermal, Hydro, Biomass Energy and also Economic, Social and Environmental aspects of RES) from other Faculties/Universities participating in EURONETRES (accredited Certificates).
- Another very important advantage is that the Diploma holders can participate in a specialization (retraining procedure) on RES, collecting Certificates from different EURONETRES Universities and so, they will create new opportunities to find jobs as specialists. That will be valid not only for EUROPE (the job creation is stemming from the targets adopted by the E.U. towards RES), but also worldwide.
- The EURONETRES Universities are expected to accept many engineers and other Diploma holders from other parts of the world, to be specialized on RES.
- Moreover, students who have obtained one or more Certificates and their normal Diploma and wish to continue their studies for a M.Sc degree will be more easily accepted in a EURONETRES University.

A.2. Postgraduate Education on RES

An assessment, made under the initiative of UNESCO/ROSTE, showed that there are only a few (2–3) cases in Europe, where there are pure Postgraduate studies, in the level of MASTER on RES. On the other hand there is a huge demand, already established, from private companies and research centers for highly specialized engineers and other scientists on different sectors of RES. This demand will become higher and higher in near future. A higher demand is expected also in the developing countries and in the International Organisations dealing with RES.

The wish of UNESCO, adopted from EURONETRES, is to elaborate and to adopt common rules and common content of

studies at a HIGH LEVEL. Only those Departments which are able to fulfill the rules and requirements and dispose the necessary facilities for one or more postgraduate studies in specific disciplines of RES (Solar, Wind, etc) will be accepted to the common effort in EURONETRES.

The Working Groups will elaborate dynamic curricula and the requirements needed for each discipline (Solar, wind, etc.).

The Postgraduate Diploma (Master) given from a Department under the common rules and conditions, will be equal for all the Universities of EURONETRES. The Departments wishing to participate in EURONETRES but do not fulfill all the requirements concerning the teaching staff, the Practice and Laboratory facilities, can elaborate and present a cooperation agreement with other Departments, by visiting professors and research laboratories in the same country or within other countries.

The Working Groups will evaluate the demands from the departments and will propose to the Executive Committee of EURONETRES for the final decision. The evaluation of the students and their final examination will be done under STRICT RULES, that the Working Groups will elaborate and the Steering Committee will adopt, in order to guarantee the objectivity about the merit of the Master of Science or Diploma. The Diploma of MSc will be awarded from the Universities concerned, but will be accompanied with a separate Certificate from the Executive Committee of the EURONETRES and so the MSc Diploma will be equivalent in all WORLDNETRES members.

Renewable Energy Research and Education Network

Introduction

Increasing global energy consumption and the use of fossil fuel to cover most of this demand as shown in Fig. 1 leads to an increasing concentration of CO₂ in the atmosphere with possibly dramatic consequences on our future climate. The correlation between the rising figures of consumption and the CO₂ content as given in Fig. 2 underlines this tendency clearly. But this is not the only risk of our current energy system: The scarcity of our resources comes immediately into our focus, if instead of a static estimation as normally done and as shown in Fig. 3 the future exponential growth of energy consumption is taken into account. Considering this assumption, the cumulative reserves including uranium, which are already explored today will be exhausted after 56 years as given in Fig. 4. But what is even more severe is the finding that, under the assumption of future growth, even ten time bigger reserves would be fully exhausted after another 70 years as shown in Fig. 5.

Due these circumstances, a radical change of our energy system is without any alternative, and today renewable energies are to become the only major source of energy in future. There have been developed many technologies in this field. To the end of a wider development, however, the lack of information exchange and the lack of education is seen as a big barrier today. It is the purpose of the initiative, which will be presented here, to overcome the problems mentioned above, the basis will be centred around the realisation of appropriate networks.



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Existing Networks in Renewable Energies Research and Education

To begin with a very successful network, the German Association on Solar Energy Research (FVS), will be presented. It consists of eight

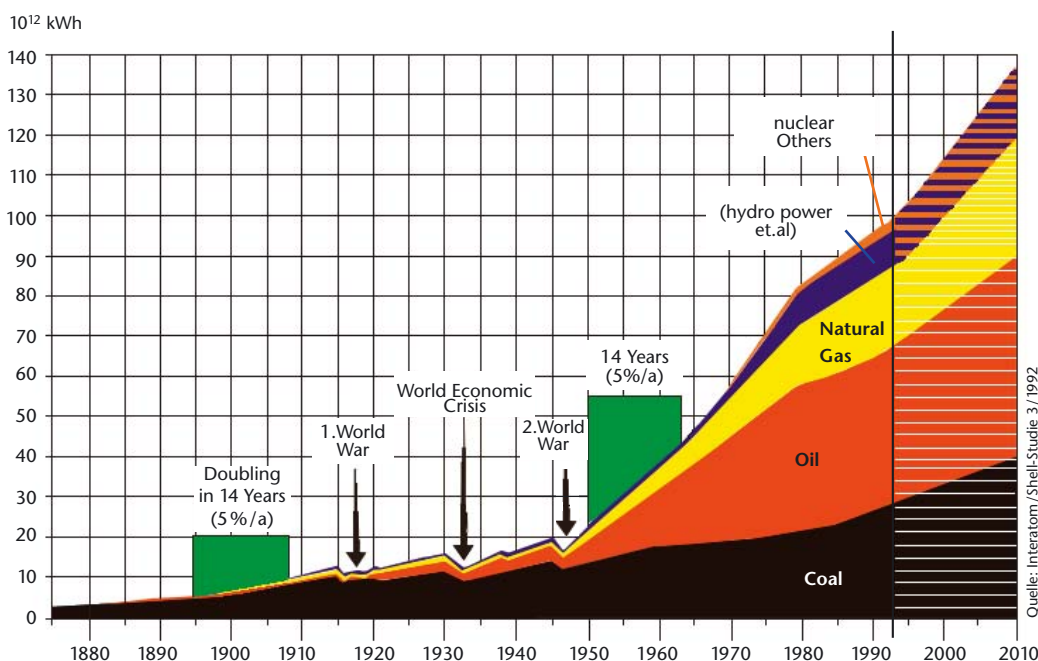


Figure 1
Global Energy
Situation and Trends

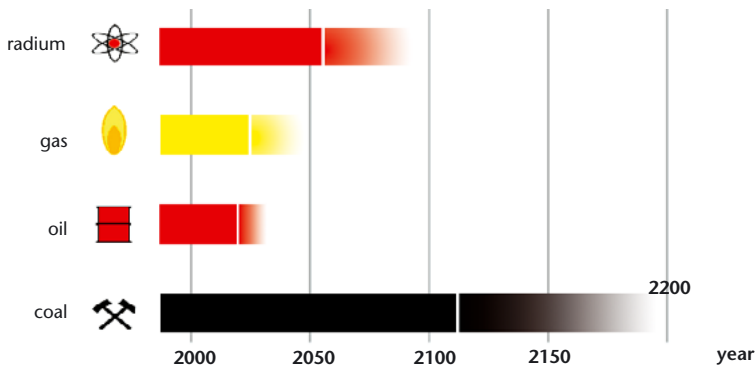
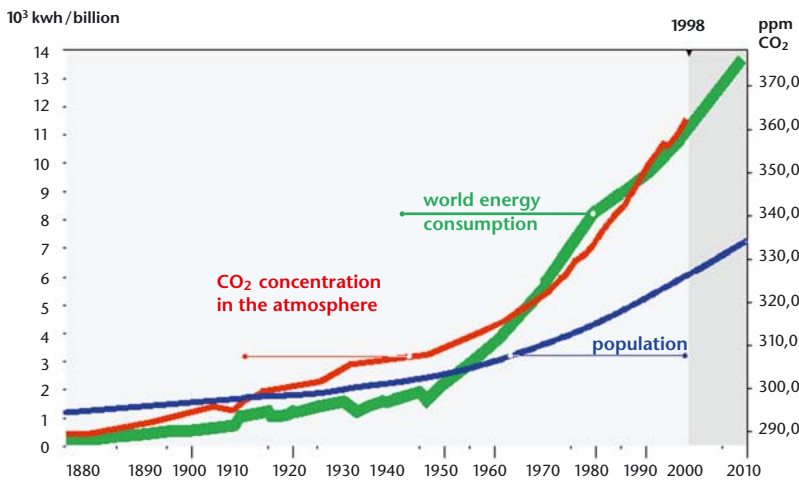


Figure 2 (above) Growth rates for population, energy consumption and CO₂ concentration in the atmosphere

Figure 3 Range of fossil energy resources; source: OECD

research institutes or centres which are shown in Fig. 6. This association covers research in nearly all fields of renewable energies and represents about 80 % of the German research capacity in this area. Besides cooperation, the FVS is organising annual conferences on selected research subjects.

In the European area, the EUREC Agency represents 20 research centres and ten universities. This network has already started a very successful initiative in the sector of education, namely a Master course in Renewable Energies provided by seven leading universities. Fig. 7 shows a description of the consortium. The students of this Master course, which have done their specialisation in hybrid systems in Kassel, are shown in Fig. 8 together with some teachers. As a second network, the European Academy of Wind Energy is shown in Fig. 9 and Fig. 10. This network consists of four European research centres and seven universities performing academy research and education equally.

On a global level, the International Institute for Renewable Energy (IIRE) has been created in 2002. It represents a network of universities and research centres from Australia, Canada, France, Germany and Thailand. The coordinating institute is the School for Renewable Energy at the Naresuan University in Pitsanulok, Thailand.

These networks can be seen as a sound basis for a wider and more systematic information exchange and educational activities on a global scheme. The proposal to establish a renewable energy information and education structure on a global scale can be seen as a result of the situation described above and will be presented in the following chapters.

Setup of a Renewable Energy Information and Education Network

Open University for Renewable Energies (OPURE)

There is a lack of information on actual research results, on the application potential, on economic figures etc. on all levels. This situation is true for Germany, but even more for Europe as well as for countries outside of Europe. In general this problem may be characterised as follows: There is very much information existing today but access to this information is difficult. For there is no systematic procedure of such access and the quality of such information is widely scattered. As a consequence effort and money is wasted by doing research on subjects, already performed by others, by delays in product development or its proper use, and by setting up wrong legal framework due to a lack of appropriate and up to date information.

On the other hand, new technologies in the ICT sector can provide a powerful tool to a fast, interactive exchange of information to an unlimited member of users. Such a platform could be realised with a small budget or even be integrated into the existing "Bildungs-Server" of the German BMBF (Federal Ministry for Education and Development). The remaining

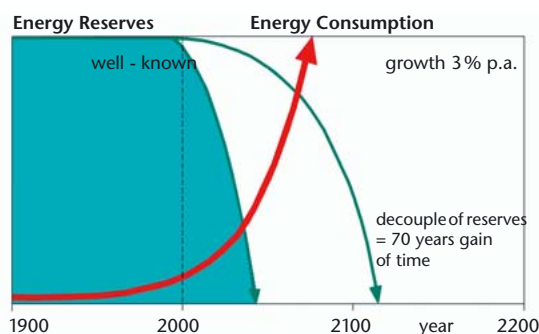
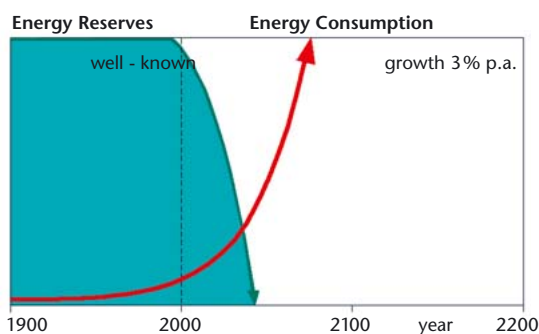


Figure 4
Range of the well-known energy reserves for a constant growth of the energy consumption of 3%

Figure 5
Range for a decouple of the well-known energy reserves for a constant growth of the energy consumption of 3%

problem is to organise the collection, the review, the grading or certification of the information and the provision of education material in a systematic way. Since it is expected that success of this initiative will heavily depend on its proper functioning in the initial phase, a multi-step process in the build-up is proposed:

- In a first step, which is the subject of the current proposal, this structure will be set-up in Germany. Languages of the material will be German and English.
- In a second step, the structure will be extended to Europe. For this step it is planned to seek for a support from the European Commission. Translation of information material into different languages will need to be provided in this phase.
- After successful implementation of the second phase, the system will be extended to global coverage with a special emphasis on developing countries. In addition to translation of languages, the transformation into different cultures will need careful adaptation of the information material and, as a consequence, the involvement of professionals from the anthropological, psychological and pedagogical sector.

in the same way as is traditionally done in high level, peer-reviewed scientific journals. As a consequence the process for scientific material is identical, which means a full text review including interaction with the author by at least three peers. Regarding education material, the level and quality of information, including ECTS-credits, will be classed by the review committees. As it is tradition in the scientific community, all committee members will act on a voluntary basis free of charge, but their names will be shown in the editorial sector.

Figure 6
Members of the German Solar Energy Research Association

Organisations of the Review Committees

For each subject and for each level (scientific, school-level or professional practitioners' skills) a committee will be organised, which will evaluate the information and education material

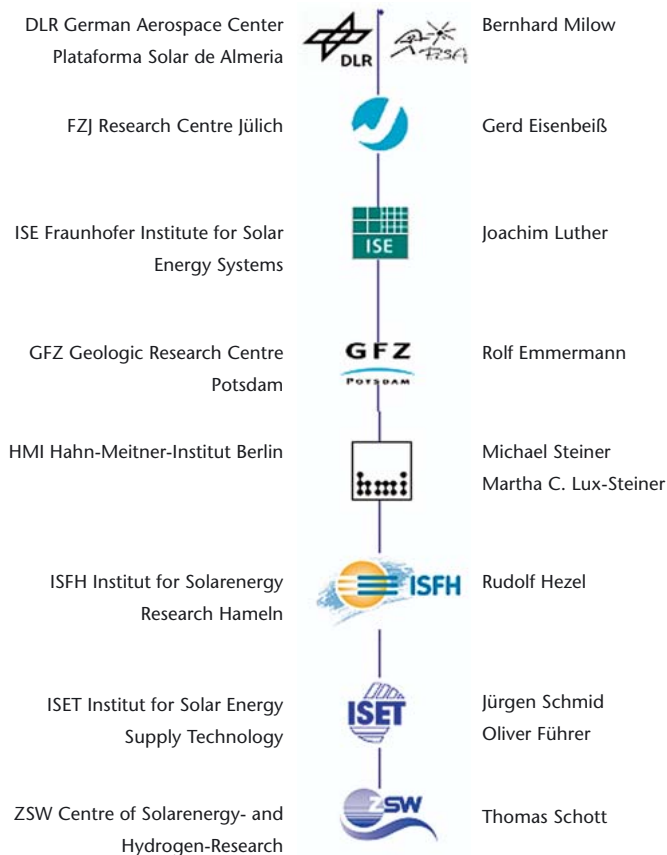


Figure 7 (left)
Research Centres and Universities of EUREC Agency



Figure 8 (right)
Participants of the EUREC Master Course 2004



Since the presentation and discussion of the basic structure of the proposal during the Science Forum on the Renewables 2004 Conference in Bonn, many stakeholders have expressed their interest to support or to participate in the proposed initiative.

Supporting Public Institutions in Germany

For Germany the following institutions have offered support:

1. BMWA – Dr. Knut Kübler
2. BMU – Dr. Wolfhart Dürschmidt
3. BMVEL – State Secretary Matthias Berninger (tbc)
4. dena – Stephan Kohler
5. DBU – Dr. Wulf Grimm
6. FVS – Dr. Gerd Stadermann and Dr. Gerd Eisenbeiß



Figure 9
European Academy of Wind Energy

Participating Institutions in Germany

7. ISET – Jürgen Schmid
8. Universities: Kassel, Magdeburg, Berlin, Oldenburg
9. Technical Colleges: FH Berlin, Aachen, Hamburg, Biberach, Internet-FH

European Institutions

- EUREC-Agency – Didier Mayer (10 Universities, 20 Research centres)
- European Academy of Wind Energy – Jürgen Schmid (7 Universities, 4 Research Centres)
- KFPE-Switzerland – A.-C. Clottu Vogel

Global Institutions

- International Institute for Renewable Energies Thailand (4 Universities, 3 Research Centres)
- UNESCO GREET-Programme, Paris

Organisation of the Programme

- General Coordinator: ISET, Kassel
- Coordination of scientific committees: FVS, Berlin
- Coordination of membership: University of Magdeburg
- Coordination of education for professional practitioners (vocational education) DBU, Osnabrück
- Coordination of schools
- Coordination of hardware infrastructure: ISET, Kassel
- Coordination of European actions: EUREC-Agency, Brussels
- Coordination of Global actions: UNESCO GREET-Programme, Paris

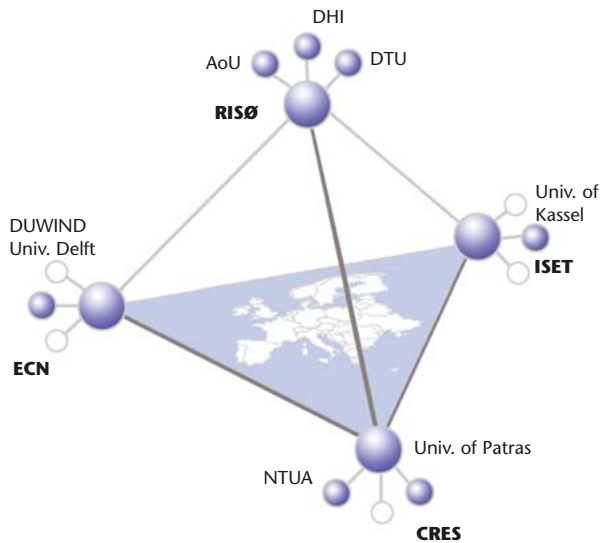


Figure 9
Member Institutes of
the European Academy
of Wind Energy

Work Programme

1. Building of a management team (one secretary, one scientist, one ICT technician)
2. Formation of the review panels
3. Set-up of a flyer and homepage explaining the target and content of the initiative
4. Hardware realisation
5. Organisation of annual meetings for all programme participants and supporters

Review Committees

1. Rational use of energy
2. Systems analysis and scenarios
3. Resource assessment for solar, wind, hydro, biomass, geothermal
4. Solar buildings
5. Thermal collectors and systems
6. Solar thermal electric power systems
7. Photovoltaics
8. Wind energy systems
9. Hydro power plants
10. Marine energy systems
11. Biomass energy systems
12. Geothermal systems
13. Storage devices and applications
14. Hybrid systems and minigrids
15. Social aspects
16. Grid design and grid management
17. Economics of renewable energies