

ELECTROENERGY GENERATION AND ENVIRONMENTAL PROBLEMS IN TEACHING OF POWER ELECTRICAL ENGINEERING

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Abstract $\frac{3}{4}$ Students of the specialisation Power electrical engineering should have good knowledge not only in their field of study but in the related fields, too: for example they need to have an overview about influences of power electrical sources and equipments on environment. It is necessary to motivate students in these topical problems due to a suitable, interesting and engaging way. For this reason besides classical ways of teaching (lectures, seminars and laboratory training) is the special course organised by our faculty. In this way students have a chance to verify their theoretical knowledge and to extend it about practical experiences, particularly in interdisciplinary branches. The intensive course Problems of electrical sources in the relationship to the living environment which is organised by Department of Power electrical engineering at UWB Plzen is an example of this new approach to the training of students. It is arranged in the co-operation with the foreign universities.

Index Terms $\frac{3}{4}$ Electroenergy Generation and Environmental Problems, Teaching, Power Electrical Engineering.

INTRODUCTION

Project of this co-operation started in 1998, students and lecturers of the Faculty of electrical engineering UWB in Pilsen, University Zwickau, Technical University Košice, Technical University Illmenau and TH Regensburg take part in it. The study program is intended for the graduate and postgraduate students. Proceedings from each of these activities are printed with ISBN code

PROGRAM OF THE INTENSIVE COURSE

All the participating institutions contribute to the programme by their special expertise. The course is held in the vicinity of Boží Dar, where an ecological centre has been established by the Boží Dar municipal office. The role of the centre is to monitor air and water pollution, and to test new sources of energy. The University in Zwickau provides an expertise in the measurement of the physical parameters of the environment in untraditional energy sources.

Topics to be covered in the programme include:

- emission measurements inside fossil fuel plants,
- technical problems in the operation of power plants,

- emission loading measurements in open air,
- utilization of untraditional energy sources,
- waste management,
- restoration of natural environment.

THE GOALS OF THE INTENSIVE COURSE

The aim of this project is to provide training in the study and monitoring of emission loading in the North Bohemian region and the adjoining German border area. Both sides of the border are characterized by a great concentration of coal mines and fossil fuel power plants, which are the cause of long-term excessive emission loading. The disregard of these facts on both sides of the border has resulted in the devastation of the countryside, air and water pollution, and consequently, in the deterioration in the health of the inhabitants of these areas as well. Although based on the situation in the North Bohemian region and the adjoining German border area, the programme is very useful for students from other areas facing similar problems even though the scale may be smaller.

During the 14-day course the students are trained to be able to deal with these problems and to learn how to restore the natural environment in the above mentioned areas.

The complexity of the problem to be treated in the programme requires an interdisciplinary approach, which is ensured by the participation of students and staff engaged in different, even if closely related disciplines and of specialists outside higher education.

The proposed intensive programme forms an integral part of the postgraduate study programmes of all three institutions concerned. As all of them also have credit systems compatible with ECTS, they also award credits and certificates for the successful completion of the programmes. As no credits are awarded in the PhD study programme, the PhD students receive a certificate on completing the proposed programme; their participation is considered an integral part of their study.

THE FORMS OF THE TRAINING IN THE INTENSIVE COURSE

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The programme consists of lectures, seminars and work in small groups to solve partial problems which may be parts of the students' theses. Emphasis is put on measurements in both inside the power plants located nearby and in the ecological centre in Boží Dar. Measurements of this kind cannot be carried out at any of the partner institutions. An important part of the project is to create a mathematical model of the environment and to compare the results of this model with the results of the measurements. Teaching materials include handouts and lecture notes.

The specialists from power plants contribute to the programme by presenting problems which have to be coped with the operation of power plants, heating stations and incinerators, such as the reduction of emissions, desulphurization and waste management. They also cooperate with the WBU staff in the preparation of measurements.

This international education programme has been taking place for three years with name:

USE OF TECHNICAL MEASUREMENTS METHODS IN SOLVING ENVIRONMENTAL PROBLEMS

The next programme schedule is continuing for next three years with name:

THE EFFECTIVE USE OF PHYSICAL THEORIES OF CONVERSION OF ENERGY

Currently, only 1,5 % of the energy produced in the Czech Republic comes from renewable sources. The plan to produce 6% of energy from renewable sources by 2010 is closely linked with the accession of the Czech Republic to the EU. By this time, however, the production in the EU countries should reach 20% as agreed by the EU member states. Thus, the current need is to familiarize students with all the alternatives in energy production and enable them to analyse the pros and cons of individual alternative energy sources so that they can make the most effective practical use of them in the future.

The aim of the project is to familiarize students at all the partner universities with the complex issue of the production of energy from renewable and non-renewable sources, both the current possibilities as well as the forecasts for the future. Students will be exposed to a spectrum of both economic and ecological viewpoints on the acquisition, generation and effective use of energy. During 2 weeks, teachers and specialists from enterprises will also familiarize the students with the current situation and possibilities of combining different sources for the creation of energy, together with the future alternatives in their respective countries or regions. The students will examine the current possibilities of the effective use of physical processes of conversion of energy.

After participation in the learning programme, students will prepare their own theses on a selected type of alternative energy source based on the information acquired during the IP seminars and lectures. All types of energy

resources will be described and evaluated from the following points of view:

- Availability, influence on the environment, effectiveness (regarding both economic and energetic demands), methods of exploitation
- Current situation as well as alternatives for the future will be discussed
- Evaluation will also include the issue of disposal of equipment or waste connected with the use of alternative energy sources
- Teaching materials will include:
 - pre-IP notes and hand-outs prepared by lecturers, specialists and students based on the data collected during pre-IP activities and hand-outs (5 pp/each) prepared by lecturers that will be distributed to IP participants in the following sets:
 - traditional sources
 - nuclear energy
 - renewable sources of energy
- students' notes based on the lectures, seminars and analysis of data collected during the IP
- the result of the IP will be proceedings (approx. 100 pp) put together by students and staff from all participating universities. Student theses will contain the analysis of individual alternative sources of energy and their following features: methods of exploitation, effectiveness, operating costs, safety, issues connected with waste disposal, etc. The proceedings created under year 1 of the IP will be used as teaching material for the following two years, hence ensuring the IP data is updated. They will be distributed not only to project partners but also to other HE and non-HE institutions dealing with the issues of alternative sources of energy.

The target student audience will include graduate and postgraduate students from all the four partner institutions. The following fields of study will be represented:

- Electric Power Engineering and Ecology (University of West Bohemia, Faculty of Electrical Engineering)
- Physics (Westsächsische Hochschule Zwickau, Institute of Informatics and Physics)
- Electric Power Engineering (Technická univerzita v Košiciach, Faculty of Electrical Engineering and Informatics)
- Electric Power Energy Conversion and Automatisation (Technische Universität Ilmenau, Faculty of Electrical Engineering and Informatics)

Cooperation with public and/or private sector organisations will be expanded by the coordinator in the form of continuing education courses that offer upgrading and/or requalification of skills to professionals from the power engineering industry.

The IP will be structured as an supplementary module for students enrolled in the above described regular study

programmes, will take the form of additional credit, and the measures for academic recognition will include the award of 6 ECTS credits within the MSc. programme. In addition, all MSc. students will obtain certificates for the successful completion of the IP. Students from WHZ will receive certificates only, since WHZ is a "Fachhochschule" that does not have a complete credit system. For the UWB graduate students participation in the programme and the award of credits will also be counted as a part of the UWB Certificate Programme in Technical Ecology and Environment consisting of 6 subjects dealing with the issue of protection of the environment (one in particular is entitled Alternative Sources of Energy). Those who take all the subjects forming a Certificate Programme receive, on completion of their studies, a certificate in addition to their diploma. As no credits are awarded in the Ph.D. programme, the Ph.D. students will receive a certificate on completion of the proposed programme; their participation will form an integral part of their study and will allow them to conduct interdisciplinary research and integrate their acquired knowledge into their doctoral thesis or directly base their doctoral thesis on the IP results.

The pre-IP activities will include:

- two days measuring of laboratory samples of real practice processes such as the desulphurization of combustion products, features of types of solar cells, problems of the neutralization of industrial waste (laboratories at WHZ)
- measuring and examining the use of biogas for the drive of a generator and heating pump (at TUI)

During the IP, the pedagogical approach will include traditional didactics, i.e. lectures, interactive seminars, teamwork in small groups to solve partial problems which will become or are already parts of the students' theses. The methodology will place strong emphasis on on-site measurements, (i.e. directly at the sources of energy purchased with the help of the equipment planned to be purchased with IP funds) at the environmental centre at Boží dar where IP participants will benefit from special measuring conditions as measurements of this kind cannot be carried out at any of the three partner institutions concerned. After the data is collected, it will then be analyzed and evaluated during the IP seminars; the conclusions will become integral parts of the teaching material in the form of hand-outs and lecture notes.

In terms of post-IP activities, the result of all practical work during the IP will be proceedings put together by students and staff from all participating universities. The proceedings will consist of theses containing the analysis of individual alternative sources of energy and their following features: methods of exploitation, effectiveness, operating costs, safety, issues connected with waste disposal, etc

Although there is not any direct link between this proposed programme and ODL departments, use will be made of the results achieved and materials produced in

continuing education organized by all the three participating institutions in cooperation with industrial enterprises and power plants.

The IP will be monitored by the coordinating institution (UWB). The project manager Doc. Jan Mühlbacher will be responsible for the implementation of the project and the realisation of the activities to be undertaken by the contracting university and will ensure the project partners meet the responsibilities also described in section using the workplan as benchmarking. The workplan will be distributed to all partners so that they are able to monitor their activities and evaluate their own progress. External evaluation will be in the form of student/teacher questionnaires whose results will be included in the final IP report.

CONCLUSION

WBU and Zwickau University attract students from the devastated region of North Bohemia and the German border area respectively. Coming from a region where the quality of life is much poorer than in the other parts of the country can be regarded as a disadvantage due to the geographical location. A very positive factor is, however, the fact that most of the students return to these areas after finishing their studies and try to implement what they have learned in the course of their studies. The intensive programme with international participation proposed in this project will certainly contribute considerably to their training.

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