Project of co-operation of middle-european universities in Power Engineering

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Abstract *— Annualy the specialists and university teachers in a branch of Electrical Power Engineering are meeting on the conference – "Intensive Programmes" (IP) under supervision of european association SOCRATES – Education and Culture. Since 1999 till present it was realized always one meeting -conference per year. University of West Bohemia in Pilsen co - operate with University of Applied Sciences, Zwickau, Germany, Technical University Kosice, Slovakia, Technical University Chemnitz, Germany, Univ ersity of Technology, Graz, Austria, and industrial partners. Goal of IP project "Distributed Power Generation Systems" is introduction the latest trends in power generation, transmission and distribution into the study programmes of all the partner univer sities in order to train specialists who will be able to deal with the new situation in power generation in Europe, especially in Central Europe. Special emphasis is on the alternative sources of energy and distributed energy systems. Next is to harmonize the study programmes of the partner institutions with the help of the jointly designed and implemented IP and the subsequent inclusion of the course in the curricula of all IP partners, in groups. Students studying for a Master´s degree and also students i n Bachelor and doctoral programmes. Main activities are for example preparation, organization and evaluation of IP, dissemination of results - joint design and publishing of teaching materials, preparations for the integration of the course in the study pr ogrammes of all partner institutions. Expected outputs are design and implementation of the IP (later to be integrated in the curricula and study programmes of all the partner universities), teaching materials and proceedings of the IP, BSc., MSc., Ph.D. theses or semester projects dealing with the topics of the IP. Power engineering and technical ecology are an important part of the study programmes at all the five institutions. The problems to be dealt with in the IP are closely connected with these stud y programmes, the IP will, however, concentrate on possible solutions for the future. In this respect it is also in full agreement with one of the priorities of the European Union. The maximum use of alternative sources of energy. The project will prepare specialists for a wide and rational use of alternative sources and also for a reliable and safe operation of energy power networks in the new conditions.*

Index Terms *— co-operation among the european universities, education, harmonization of study prog rammes, Intensive Programmes.*

INTRODUCTION

The name of the co-operation project is Distributed Power Generation Systems. This is also main focus of this project. On the co-operation are included-integrated some middle-european universities. One of the most important issues facing humankind at present and especially in the next decades is an improvement in or at least preservation of the environment in the conditions of growing population and growing industrial production. The most serious damage to the environment is caused by power generation. That is also the reason why the European Union regulations require that approximately 10-15% of all energy should be produced from alternative sources by the 2010. This way of generating electric and thermal energy calls for a new approach to its generation, transmission, distribution, control and regulation. This problem does not concern one country only, it is a global issue whose importance is continuously growing. As our institutions of higher education are now training specialists who will be fully active in this field in 10 to 25 years, we have to provide them with the knowledge and skills they will need in order to be able to deal with the new situation.

It is expected that the plants generating power from renewable sources will be much smaller than the present megalomaniac power plants (both nuclear and thermal). They will, however, be evenly distributed in the country and will also have different characteristics from the point of view of energy supply, its regulation, storing and protection of sources, etc. The distributed power systems are understood not only as territorially distributed but also as distributed in time according to the possibilities of energy supplies available from different sources. At present all issues connected with up-to-date power generation and distribution are included in the curricula of the five universities participating in the project. The main trends for the future decades, i.e. distributed power systems, have so far been dealt with only by a few specialists or by PhD. students in their PhD. theses. There are specialists of this kind at all the partner universities and also outside higher education, i.e. in the

industrial enterprises with which these universities co-operate. Papers about the distributed power systems are published in journals and also at international conferences.

PARTNERSHIP COMPOSITION AND CONTRIBUTION

The co-ordinating institution is the University of West Bohemia, represented by the Department of Electric Power Engineering and Ecology at the Faculty of Electrical Engineering. While Electric Power Engineering is a well-established field of study at UWB (University of West Bohemia), Ecology is a relatively new, but dynamically developing discipline also taught by the same department. Its importance has grown considerably in the last ten years in connection with the new environmental policy defined by the Czech government. The University of West Bohemia has ample experience of co-ordinating international projects (e.g. 3 TEMPUS projects, 2 Leonardo da Vinci projects). In the years 1999-2001 it co-ordinated successfully the **IP** (Intensive Programme) "Use of measurement methods in solving environmental problems" (co-ordinator: Prof. Beran - UWB, partners: WSH Zwickau DE, TE Košice SK). There was also co-ordinated the IP "The Effecive use of Physical Theories of Conversion of Energy" (co-ordinator: Doc. Muhlbacher, Vice-Dean of the Faculty of Electrical Engineering and Head of the Department of Electric Power Engineering and Ecology, partners: WSH Zwickau DE, TU Košice SK, TU Ilmenau DE).
Thanks to the dissemination of the results of these projects and to an efficient public relations policy two other institutions have expressed their wish to join our team in this proposed project. Their participation will give the project a new dimension as these two institutions are noted for their excellent results in the teaching of and research into such fields as power engineering. They have already made valuable proposals concerning the continuation as well as extension of the teaching of power engineering with a special emphasis on alternative sources of energy.

The participating institutions are providing expertise in the following fields covered by the project:

- **Electric power engineering and ecology** (Czech Republic, University of West Bohemia, Faculty of Electrical Engineering)
- **Physics** (Germany, Westsächsische Hochschule Zwickau, Institute of Informatics and Physics)
- **Electric power engineering** (Slowak Republic, Technical university Košice, Faculty of Electrical Engineering and Informatics)
- **Electric power consumption** from the point of view of various sources of energy and the daily load diagram and their optimum exploitation in power generation (Germany, TU Chemnitz, Department of Power Engineering)
- **Distributed electric power generation** from the point of view of the territorial distribution of sources. **High voltage and electric equipment** (Austria, TU Graz, Department of High Voltage and Electrical Equipment)

Non-university partners involved in the project:

- **South Bohemia Power** (Czech Republic) Electric energy transmission, distribution and supply in the south Bohemia region, design of electrical networks, electrical networks protection in distributed power systems
- **Bomin Solar** (Germany) Use of photovoltaic and heat solar energy. Experience in co-operation: UWB partners in project EU INTERREG III
- **BIC Zentrum Zwickau** (Germany) Utilization of alternative sources of energy (from the German perspective). Experience in co-operation: UWB partners in IP "Use of measurements methods in solving enviromental problems"

Teaching staff from all the five institutions will participate in the programme and conduct lectures and seminars. **Co-ordinator** for organization of the IP, teaching, preparation and dissemination of teaching is **Doc. Ing. Jan Mühlbacher, CSc** and him helps 7 teachers from the same department UWB.

The other partner institution:

- Westsächsische Hochschule Zwickau (University of Applied Sciences, Faculty of Applied Physics and Computer Sciences) Germany: Organization study visit in Germany, laboratory measurement, teaching: 2 teachers
- Technical university Košice, Faculty of Electrical Engineering and Informatic) Slowak Republic: Preparation of teaching materials mainly for E - lerning and ODL, teaching: 2 teachers
- Universität Chemnitz (Technical University Chemnitz, Department of Power Engineering, Department of Electrical Machines) Germany: Dissemination of teaching materials, measurement, teaching: 2 teachers
- Universität Graz (Technical University Graz, Department of High Voltage and Electrical Equipment) Austria: Preparation study materials for technical measurement, teaching, organisation of study visit: 2 teachers

Non university partners institution, organisation:

- Environmental Centre Bozi Dar, Czech Republic (established in co-operation with UWB): Monitoring air and water pollution, testing of new and renewable energy sources, disposal of communal waste, heating with solar energy
- CEZ, a.s. (Czech Power Works Inc.) Czech Republic: Energy generation and transmission (desulphurization and storage of waste, measuring and examining the methods, effectiveness and operating costs of desulphurization, desulphurisation (special from power plant Tusimice))
- Ecotrend, Czech Republic: Design of non-traditional and renewable energy sources, waste recycling and waste use for energy generation (waste management in power generation industry)
- Ekowatt Praha, Czech Republic: Promotion of alternative sources of energy (use of small alternative sources of energy (from CZ perspective))
- Plzenska teplarenska a.s., (Pilsen heat company) Czech Republic: Thermic energy supply for Pilsen and vicinity (issues of supply heat and electrical energy)
- Zapadoceska energetika a.s., (West Bohemia Power) Czech Republic: Electric energy transmission, distribution and supply in the west Bohemia region (operation control and regulation electrical networks)

International and European co-operation has played an essential role in the innovation and development of both education and research at all the partner institutions. Thus, for example, UWB has benefited greatly from its participation in TEMPUS projects, Leonardo da Vinci projects and mobility schemes and, from student and staff exchanges under the ERASMUS programme.
Since 1999 till present there was realized always one meeting-conference per year. All the co-operated institutions and organizations were attending this meeting. The time duration for one IP is three years. Every year we must renew the approved IP for the next year and renew and prepare the actual program for the next period-decade.

PEDAGOGICAL AND DIDACTICAL APPROACHES

The distributed power systems are understood not only as territorially distributed but also as distributed in time according to the possibilities of energy supplies available from different sources. At present all issues connected with up-to-date power generation and distribution are included in the curricula of the five universities participating in the project. The main trends for the future decades, i.e. distributed power systems, have so far been dealt with only by a few specialists or by PhD. students in their PhD. theses. There are specialists of this kind at all the partner universities and also outside higher education, i.e. in the industrial enterprises with which these universities cooperate. Papers about the distributed power systems are published in journals and also at international conferences. These are very good prerequisites for a succesful implementation of the proposed IP and for sharing the new developments with a wider student population.
In the course of this 3-year IP the content and form of the teaching materials are developed and modified in accordance with the experience gained in those three years. Finally, after the completion of the 3-year IP, the teaching materials are ready for use in both full-time courses. Next the course will be integrated in the study programmes of all the partner universities and will become a regular part of their innovated curricula.
A wide variety of teaching methods are used - lectures, practical measurements, special excursions, computation seminars as well as modern electronic forms of processing the results and disseminating them both to the academic community and to other specialists in this field. In addition to lectures and seminars great emphasis is put on measurement in power plants.
The target participants in this proposed IP in the near future will be students studying for a Master´s degree. The programme will, however, be also open to those preparing for a Bachelor degree and to Ph.D. students if they show a well-founded interest. Students from all the three universities will apply for admission to the IP as they do for admission to an optional course in the framework of their university´s credit system. On completion of the IP and after passing the prescribed examination they will obtain the corresponding number of credits. If the interest exceeds the possibilities of the organizer, students at the individual institutions will be selected on the basis of their study results. The teaching staff from the three universities and experts from industry will be selected on the basis of their expertise in the given field.

OUTPUTS OF THE PROJECT

Envisaged outputs of the project – is IP syllabus and its implementation. The IP will take **place partly at the University of West Bohemia and partly at the training centre at Pernink**. 40 students and 8 staff members from the partner universities and 10 students and 8 staff members from UWB were taking part on the meeting at Pernink. Duration of the IP was one week, used languages was English and German. There was disscused problems about future situation in energy supply in

Central Europe. These problems include generation of power in relatively small, ecologically distributed sources as well as its transmission and distribution.
The teaching materials, whitch were and will be produced, will include both classical teaching materials (coursebooks, handouts) and multimedia teaching materials (CD Roms, websites, etc.). The volume and structure of the teaching materials will correspond roughly to three one - semester courses with 2 hours of lectures and 2 hours of seminars and laboratory courses per week. After the end of this 3 - year IP the teaching materials produced in its course will be used at all the partner institutions both in full-time courses. All materials will be produced in English and German, will contain the latest developments in the field and will be structured in a way that will enable students at different levels (BSc, MSc, Ph.D.) to find the information corresponding with their level of understanding the presented topic. At the end of the course proceedings of the IP will be published containing the best student projects carried out during this IP and also papers by some of the teaching staff. The assumed volume is 120 to140 pages and the languages to be used are English and German. Bachelor projects, Master and Ph.D. theses or semester projectsTopics for Bachelor projects, Master and Ph.D. theses or semester projects closely connected with the topics of the IP will be advertised by all the partner institutions.

CONCLUSION AND THE NEAR FUTURE

Students who have successfully completed the IP will receive credits that can be easily expressed in ECTS. The number of credits is relatively high (6-8 ECTS) depending on the number of points achieved in the final test. On completion of the IP students will also receive certificates. The fact that the participating students will receive credits is also very important for another reason, not just for academic recognition. The accounting systems of all the partner universities guarantee that the funding of the university by the state is calculated according to the number of credits each student has obtained. In this way, the IP will also be partly funded from the university budgets. After three years of improvements and modifications due to the experience gained in the course of the project, its results will become a regular part of the study programmes of the partner institutions and will be integrated in their curricula. The IP has been designed in a way that makes it possible to use its results at different levels of study and in full-time and evening courses and in continuous education.
The students will also improve their language skills enabling them to communicate with their European counterparts in areas covered by the topics of the programme.
It contributes to the internationalization of students in providing them with an opportunity to experience work and study with students from other European countries under the guidance of foreign staff. The staff also gains experience of teaching in an international millieu and co-operating with colleagues from other countries in the design of joint courses and teaching materials. An important part of the three institutions is the full recognition of study periods, an improvement in the language skills of both students and staff, and last, but not least modification and updating of curricula and syllabi leading to their Europeanization.

Some examples of outputs, photos from collective deals and conferencies are placed on the end of this article.

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FIGURE 1
Excursion on Environmental Centre Boží Dar - Czech Republic

FIGURE 2
Excursion on nuclear power reactor Vrabec - Prag - Czech Republic

FIGURE 3
Excursion on Sollar centrum Boží Dar - Czech Republic

FIGURE 4
Excursion on heat power station – Vřesová - Czech Republic

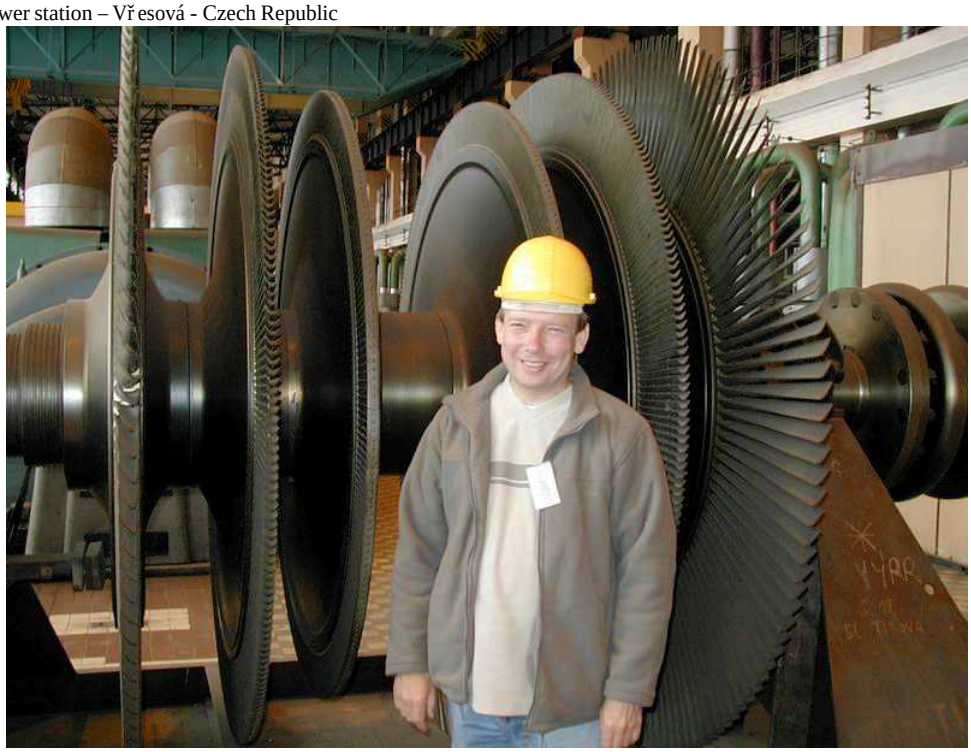

FIGURE 5
Excursion on watter power station Markersbach - Germany

FIGURE 6
Excursion on nuclear power reactor Vrabec - Prag - Czech Republic