

Long-term Experience in University – Industry Cooperation in Power Engineering

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Abstract

One of the main problems of higher education these days is to prepare students for rapid changes in technology and the labour-market. In order for the preparation to be effective and as rapid as possible, it is necessary to closely cooperate with industry and power engineering, and also to ensure the rapidity and effectiveness of the mutual transfer of information.

The Faculty of Electrical Engineering and Computer Science of the Technical University of Ostrava and the Northern-Moravian Power Company in Ostrava have been co-operating closely since the foundation of the Faculty in 1991, both in the areas of education and scientific research. Long-term experience testifies to the mutual advantage of this type of co-operation. In this paper some aspects of this mutually advantageous and successful cooperation are shown.

1. Introduction

After 1989 the Czech Republic, a country in Central Europe, underwent a number of political and especially significant economic changes. The change of political system, now oriented towards western democratic systems, brought about fundamental changes in property rights – previously state owned socialist property has been gradually privatized by means of various methods.

Bigger problems appeared when big industrial companies were privatized, because together with the privatization it was necessary to ensure restructuring of industry. The Czech Republic, as a component of the Eastern Soviet block before the year 1989, was significantly oriented to the development of heavy engineering and metallurgy industries. This orientation was considerably developed in the Northern-Moravian region of the Czech Republic (Fig. 1) where the development of heavy industry was supported by quality black coal beds in

commonly called Silesia. However, the restructuring of industry proved to be a long-term and often painful matter. It is necessary to up-date out-dated technologies, to modernize and to automate a number of operations, and in many cases change the whole structure of the companies. This is related to the necessary change of the employees qualification system, and in the majority of companies, also to the significant reduction of the number of employees, which brings about considerable social tension in the region. For example, within the last decade the number of employees in the big metallurgical companies in the Northern-Moravian region was decreased to 43 thousand in the year 2000, which means nearly 50%. This is about 40 thousand employees who either have to undergo training or they are unemployed. It is expected that this trend will continue and in the next decade the number of employees in these companies will decrease by 18 thousand in the year 2005 and by 20 thousand in the year 2010. On the other hand, a new structure of companies is being gradually developed, especially specializing in new Information Technologies. Thanks to considerable investments of foreign firms in this sphere (Philips, Motorola), Czech companies are being modernized and the construction of new operations is being started, which will bring about new job opportunities for a few thousand employees.

These structural changes have considerably touched upon the operation of the Northern–Moravian Power Company. The structure of electrical energy consumption has changed. On one hand the consumption in heavy engineering and metallurgy industries considerably decreases due to production decrease, on the other hand new or modernized companies with the increase in consumption of electrical energy emerge. In these companies the energy demand from the point of view of effect of energy transformation mildly decreases, but the electrical energy consumption increases, e.g. for the production of 1 ton of steel due to new technologies of treatment.

New companies in the area of Information Technologies put higher demands on the reliability of supply and the quality of the supplied electrical energy and other services.

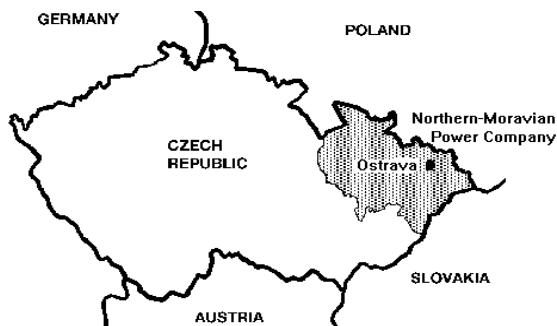


Fig. 1 Northern-Moravian Region, Czech Republic

All of these requirements then call for the need of management change of the Northern–Moravian Power Company and also for higher demands as far as the qualification of employees is concerned. These changes also reflect the need to prepare for the liberalization of the market with electrical energy, which will come into effect in the Czech Republic from 1st January 2002.

The management of the Technical University of Ostrava understood very quickly that it is necessary to react to the changing needs of industry and power engineering, and that is why immediately after the political changes in 1989 changes started to be gradually implemented. These alterations were reflected in the whole change of the University structure so that in 1991 the independent Faculty of Electrical Engineering and Computer Science was established, and then, in 1998, also the new Faculty of Civil Engineering. The Technical University of Ostrava thus significantly contributes to the necessary changes of qualifying structure in the Northern-Moravian region.

2. Faculty of Electrical Engineering and Computer Science - Technical University of Ostrava

The history of the **Technical University of Ostrava** goes back to the year 1717, when the first mining school was established in Jachymov by the Emperor’s decree. In 1849 it was moved to Příbram, and in 1865 it was given the right to use the name Mining Academy. In 1894 it was declared to have all the rights of a university. In 1904 its name was changed to the Mining University. After the end of the Second World War, in 1945, it was moved to Ostrava.

The teaching of electrical engineering at the University has been given significant meaning since the very beginning of its bold passage into the production processes in mining, metallurgy and mechanical engineering. The students have met with electricity and magnetism since the year 1890 within the framework of lectures in physics. In 1904 two independent electrotechnical courses were introduced. In 1945 the independent Department of Electrotechnics was established, and in 1970 the branch of Electrical Power Engineering was instituted at the Faculty of Mechanical Engineering. In the year 1977, the Faculty changed over to the Faculty of Mechanical and Electrical Engineering.

The Faculty of Electrical Engineering and Computer Science officially commenced on January 1, 1991, after the division of the original Faculty of Mechanical and Electrical Engineering into two independent faculties.

The Faculty of Electrical Engineering and Computer Science has been developing boldly as seen in Fig. 2. For example, the number of students accepted into the first year has increased from 102 in 1989 to more than 500 since 1996. In the year 2001, the Faculty has 1583 students and 112 teachers. Gradually, the offer of study branches has increased, and at present the Faculty ensures Master study in five branches (Electric Power Engineering, Electrical Machines and Drives, Measuring and Controlling Engineering, Electronics and Telecommunications, Computer Science).

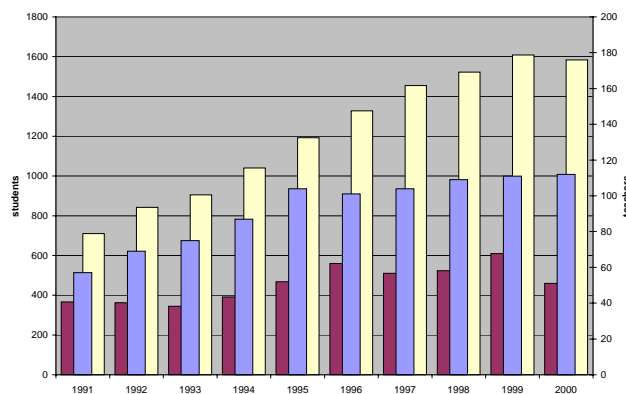


Fig. 2.

Also, the Bachelor study is being developed. The Faculty thus ensures study within the whole scope of Electrotechnics and Computer Science. At the same time the Faculty ensures postgraduate doctoral study (PhD).

In the area of scientific research the Faculty staff are involved in the grant projects of the Czech Republic and also international projects, and last but not least, collaborate with other workplaces in Europe and the USA.

3. Northern-Moravian Power Company in Ostrava

The Northern-Moravian Power Company is among the companies with the longest history in Northern Moravia. Its foundation date is considered to be the year 1919. The Northern-Moravian Power Company was established on January 1, 1994, after the transformation of the state company. It is owned (gradual privatization) by the state - 49%, the Czech Power Company - 2%, and three foreign companies - 49%. At present, the Government is preparing the final part of the privatization of power engineering. Its implementation will depend also on the political climate of the country.

The company operates in Northern Moravia and Silesia, in the area of 11 066 km² and almost two million inhabitants.

The Northern-Moravian Power Company is the biggest electrical energy distributor in the Czech Republic. It supplies energy to 985 thousand consumers, among those are 64% of large scale users (mines, metallurgical plants, heavy-machinery industries, railways), 12 % businessmen, and 24% inhabitants. These energy supplies are provided at different voltage levels. The company owns distribution networks 110, 22, and 6 kV, and low voltage distribution networks. The geographical location of the distribution area at the border of three states (Czech Republic, Slovakia, Poland) brings about the opportunity for advantageous purchase of electrical energy abroad, and the competition in its supply. In 1997 the Company supplied its consumers with 9.1 GWh of electricity, with the turnover of 0.414 bill. USD.

In January 2001 the new power law came into effect in the Czech Republic which will enable the liberalization of electrical energy market.

The Northern-Moravian Company has been preparing for this liberalization since 1996 when a re-engineering project was started. The goal is the transition towards action management and achievement of standards compatible with the best companies in the European Union (in order to stay ahead of competitors).

In the beginning, the project was closely connected to the implementation of new information technology for consumers. Already at the end of 1999 the consumers could meet their demands as for the electrical energy consumption in any the Northern-Moravian Power Company service centres, regardless of their consumption place in the region. Immediately, the new system was implemented by large-scale users and industrial companies.

One of the concrete results of re-engineering was the reduction of local offices from 48 to 19. They were replaced by Service Offices with a number of new authorities and tasks, in the areas of higher population density.

Together with the organisational changes, the changes in strategy and in the areas oriented towards services for customers were implemented. Since 1996 various activities have been taken out, and thus joint-ventures of the Northern-Moravian Power Company were established.

The basic strategy of the Northern-Moravian Power Company group is to be not only the distributor of electrical energy, but also a group which can offer a wide range of services.

In relation to gradual opening up of the market with electrical energy, the special Business Department was set up in the Northern-Moravian Power Company which is preparing a special offer of products and services to future potential customers.

The business strategy is aimed at variety and flexibility of the offer of new services for different categories of consumers. The Northern-Moravian Power Company was the first distributor of electrical energy in the Czech Republic which offered its consumers (big companies and businessmen) the possibility to gradually find the invoice information of measurement on the Internet. This service is offered to all the consumers who have the facility of a remote meter reading.

The Northern-Moravian Power Company was the first in the Czech Republic to install new types of static digital watt-hour meters, based on the cooperation with the Finnish company Enermet OY. By February 2001, 100 000 households were equipped with new meters. These meters are also provided to large-scale users.

The Northern-Moravian Power Company prefers, in harmony with the global trend, the telephone connection with their customers. The project – Implementation of the Telephone Information Centre was carried out as an alternative to personal contact with customers, and due to the reduction of a number of contact centres – Service Centres.

The construction and operation of the information network put higher demands on the experts in the area of Information Technology. These experts come and will come from the Faculty of Electrical Engineering and Computer Science -, Technical University of Ostrava.

4. Cooperation of Faculty of Electrical Engineering and Computer Science - Technical University of Ostrava with industry

The Faculty of Electrical Engineering and Computer Science has been developing in harmony with the needs for restructuring of industry in the Northern-Moravian region of the Czech Republic. The active mutual cooperation with big industrial companies, power engineering companies and private firms is essential for the Faculty not only in the area of education, but also in

the area of scientific research. We can summarize present **forms of co-operation:**

a) pedagogical area

- expert education according to the needs of industry and power engineering in Bachelor, Master and postgraduate Doctoral studies (lately, the extra studies in Computer Science, Telecommunication, Economics and Law have become an integral part of the syllabuses for the electro-technical students)
- cooperation towards a diploma work
- lectures of field specialists in engineering and postgraduate studies
- specialist lectures and courses organised by the Faculty for the purposes of industry and power engineering

b) scientific research area

- cooperation between the Faculty experts in solving technical problems of industry and power engineering when topical problems of practice are being solved. This cooperation brings about finances to the Faculty. The money is mainly being used for the modernisation and development of the Faculty laboratories.
- project evaluation by the experts
- cooperation in solving scientific tasks by means of a grant system, when a number of projects coordinated by the Faculty staff is being solved in close collaboration with other companies

A significant activity of the Faculty, in order to expand the links, are regular Faculty management meetings with the firms' representatives, which take place annually. Each year the representatives of 40-50 companies, mainly from the region but also from the whole Czech Republic, meet. On the agenda:

- The Faculty informs the representatives of the cooperating companies about the new study possibilities at the Faculty
- The firms' representatives inform the Faculty management about the need for education extension in particular areas

Along with the Faculty development, the cooperation with various firms has been expanding. Of course, the most fruitful is the cooperation with firms in the nearby surroundings of the University, that is in the Northern-Moravian region. From the development point of view of the FEI-TUO, the Northern-Moravian Power Company is the main partner. Their various forms of cooperation have existed for a number of years, since the beginning of the Electric Power Engineering studies at the University, that is in 1970.

Among those cooperating firms are also branches of leading international concerns such as Siemens, ABB, and for international cooperation then e.g. American firms Texas Instruments and National Instruments.

The Faculty management supports links with the firms, in most cases between individual departments and firms.

There are of course many other problems. They can be solved in cooperation with industry and the Northern-Moravian Power Company. For example, financial support for socially disadvantaged students, the offer of vacancies for graduates, cooperation in solving scientific, grant research projects, etc. The study support of physically disabled students at the University is also important (especially financial support for the necessary technical adaptation of the University campus and Halls of Residence).

5. Long-term cooperation between the Faculty of Electrical Engineering and Computer Science and the Northern-Moravian Power Company Ostrava

If we talk about mutual cooperation since the foundation of the Faculty, then it is necessary to make more accurate that the cooperation started at the beginning of the electrotechnical studies at the University, that is in 1970.

Every year, a number of electroengineers who have been educated at the Faculty for over 25 years start working in the Northern-Moravian Power Company. This significantly influences the forms of collaboration and their effectiveness.

In the **pedagogical area** the forms of cooperation are developing especially in the following ways:

- from the very beginning of electrotechnical studies at the Technical University of Ostrava the topics of the majority of diploma work have been assigned by experts from practice. In a number of cases, the results of completed diploma work are being used in the Northern-Moravian Power Company, and the successful graduates are employed by this company
- specialists from the Northern-Moravian Power Company not only supervise and evaluate diploma work, but they also assess doctoral dissertations
- for a number of years, the specialists from the Northern-Moravian Power Company come to give lectures in engineering and postgraduate studies. Thus the students are then acquainted with the topical problems of practice.
- new modern laboratories were established in the last couple of years thanks to understanding and financial support of the Northern-Moravian Power Company
- the changes in the Northern-Moravian Power Company management require deeper and more profound knowledge of the employees. That is why, in the last couple of years, the Faculty prepared several specialised courses in the area of power engineering and telecommunication
- the Faculty prepared the Bachelor study in the field of Power Engineering, especially on the basis of the

- requirement of the Northern–Moravian Power Company, which commenced in 1999

In the **scientific research** area the forms of cooperation can be summarised into these areas:

- from the very beginning, the dominant form of cooperation was the solution of technical problems of the Northern–Moravian Power Company by means of the scientific potential of the Faculty. As for the financial contribution to the Faculty, it is dominant and has a rising trend. Thus in 1998 the contracts for 3 mil. CZK (45% of the total number of contracts) were solved, and in 1999 for 6 mil. CZK (80% of the total number of contracts).
- the trend of gradual involvement of an increasing number of departments into the cooperation is seen as very positive
- especially the problems of reliability of power engineering networks operation and the power quality (EMC) are being solved for a long time. Recently, the Faculty specialists have tried to use knowledge of the latest development (e.g. the application of neuron networks), measuring methods and special measuring equipment (e.g. for monitoring the power quality or for localization of the faults in electrical networks) which is available at the Faculty.
- in the last couple of years, the interest of the Northern–Moravian Power Company in the solution of topical problems in the area of telecommunication considerably increased
- the Faculty specialists evaluate some of the Northern–Moravian Power Company technical projects, e.g. the optimization of control systems
- on the other hand, the Northern–Moravian Power Company specialists evaluate some of the grant projects of the Faculty

6. Cooperation Assessment

The Faculty of Electrical Engineering and Computer Science educates experts in all study branches of Electro-Engineering and Computer Science for the regional industrial companies and the Northern–Moravian Power Company. It also educates specialists with a view to a more complex orientation according to the needs and requirements of the firms in the region. For example, in Electric Power Engineering and according to the new requirements of power engineering, specialists educated in Computer Science, Telecommunication and Economics in power engineering.

We may state that at its present level, the cooperation between the Faculty and the Northern–Moravian Power Company is advantageous to both sides:

- graduates are prepared for the needs of the Northern–Moravian Power Company at the greatest level
- the flow of technical information is ensured to both sides
- the results of the solution of the Northern–Moravian Power Company technical problems by the Faculty specialists are used in practice, and in a number of cases the solution is less expensive than in other firms

Various forms of financial support, especially when renewing and building new laboratories, are also a significant contribution to the Faculty.

The official contract about cooperation, signed by the General Director of the Northern–Moravian Power Company and the Rector of Technical University Ostrava, specifies the points of mutually advantageous cooperation.