National Centre for Research and Application of Renewable Energy Sources

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Abstract
Slovak University of Technology in Bratislava acquired financial support from the European Fund for Regional Development for the establishment of the National Centre for Research and Application of Renewable Energy Sources in the framework of the “Operation Program Research and Development”. Slovak University of Technology in Bratislava (STU) is a research oriented university contributing to the development and spreading of scientific knowledge. Paper deals with the presentation of the activities of the National centre for research and development of renewable energy sources.

Key Words: biomass, hydro energy, laboratories, solar heat.

1. Introduction

The National Centre for Research and Application of Renewable Energy Sources is professionally guaranteed by four Faculties of STU:
- Faculty of Chemical and Food Technology
- Faculty of Electrical Engineering and Information Technology
- Faculty of Mechanical Engineering
- Faculty of Civil Engineering

According to the project proposal, the basic goal of centre will be focusing of research activities of research teams on new, ecological friendly renewable resources of energy, especially from biomass and solar energy. The Centre has three goals:
- establishment of centre of excellence as a network of research teams
- equipment of four laboratories at the faculties by special instruments
- equipment of centre of excellence by efficient computers.

The project implementation assumes configuration of equipment and research teams with variable use enabling very large application range for producers of energy from renewable resources. Variable instrumentation will enable of preparation of new projects in cooperation with business subjects among small and medium companies for production of new product or technologies.

2. Activities of the National Centre for Research and Application of Renewable Energy Sources

The topic of renewable energy sources has gained so much attention as the internet and information and communication technologies in the 1990s – it has become the hottest and most discussed topic among global leaders, investors and in mass media. The change to renewable energy sources has no analogy since the industrial revolution.

Also problems with fossil fuel - their depletion, the dependence of the many European countries on their import and their price fluctuation increase interest in renewables. Usage of renewable energy sources could decrease aforementioned influence, moreover they influence on environment is no as significant as influence of fossil fuels.

The National center develops research activities in the field of renewable sources also via investment to the new equipments (e.g. FTIR microscope, Laser doppler anemometer LDA and many others)

2.1. Goals of the National Centre for Research and Application of Renewable Energy Sources

National Centre for Research and Application of Renewable Energy Sources has been established by the Slovak University of Technology in Bratislava in cooperation with other centers of excellence for the development of fundamental and applied research and the transfer of knowledge to practice.

The aim of the Centre is to increase the research and innovation potential of STU, and the integration of research teams concentrated on new, ecologically acceptable renewable energy sources (RES). Essential subjects of the research are:
energy and materials from biomass,
solar heat and electricity,
hydro energy.
Activities of the Centre contribute to the competition ability and success of STU in international research cooperation. Realization of top research also provides for the transfer of newest knowledge into the university’s study programs educating young generation of specialists.

2.2. Research activities of the National Centre for Research and Application of Renewable Energy Sources

There are three main subjects of the National center: biomass, solar energy and hydro energy. The goal of the national center is to improving university research potential and integrating research teams focusing on new and eco-friendly RES.

National Centre offer cooperation in following research topics:
- utilization of biomass energy
- utilization of solar energy
- utilization of hydropower potential
- connecting of decentralised renewables into interconnected power system
- computer modelling and simulation of multiphysical tasks
- photovoltaic systems simulation

2.2.1. Energy and Materials from Biomass

Plant biomass is conserved solar energy bound by plant photosynthesis in organic matter. Plant raw materials can be utilized not only for energetic purposes (biofuel, biogas and ethanol production), but also for the production of valuable chemical compounds obtained mainly from crude oil at present. In biomass processing, these processes are employed, see tab. 1.

**Table 1. Biomass process and methods**

<table>
<thead>
<tr>
<th>Process</th>
<th>Typical methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>pressing, graining, mixing</td>
</tr>
<tr>
<td>Physical</td>
<td>distillation, extraction</td>
</tr>
<tr>
<td>Chemical</td>
<td>hydrolysis, pyrolysis, combustion</td>
</tr>
<tr>
<td>Biochemical</td>
<td>fermentation</td>
</tr>
</tbody>
</table>

In the field of biomass utilization, the Centre concentrates on the utilization of Slovakia’s unique renewable raw material – wood. Solution of this problem includes also a technological project of a specialized workplace concerned with processing of wood raw material (graining, drying, mixing) and design of processed raw material pelletization technology for the preparation of pellets suitable for the use in pyrolysis tanks.

2.2.2 Solar Heat and Electricity

Sun is the biggest energy source in the Solar system. Solar energy captured by Earth in a minute would suffice for the whole mankind for a whole year. In numbers it represents the power output of 10 000 kW per person.

In the field of solar energy utilization, the Centre concentrates on the research of new semiconducting materials allowing production employing available solar cells with good effectivity. Concerning energetics, the Centre investigates possibilities of solar power plant integration into the electricity supply system. The inconsistency of solar radiation intensity in Slovakia requires an inclusion of energy accumulation equipment in bigger systems.

2.2.3 Hydro Energy

Primary hydroenergetic potential is in the renewability of energy sources which belong to natural assets of every country. The technically exploitable part of the hydroenergetic potential is possible to be enlarged in two ways:

Considering existing water constructions with energy exploitation, it is mainly the optimization of the operating routine, when better manipulation with water is examined.

Another possibility is the design and realization of new waterworks on at present not exploited water courses. The choice of locations, especially on Hron and other smaller water courses has to respect not only the legislation specifications but also the protection of environment of the river and its surroundings.

The National Centre is engaged in the research of the primary hydroenergetic potential utilization increase considering Slovakia’s water traffic safety.

2.3 Others activities of the National Centre for Research and Application of Renewable Energy Sources

Except the research and development activities in above mentioned fields, the Center is active in the educational activities for primary and secondary schools and also for public.

One of the activities is presentation at the Researchers’ Night (fig. 1). It is a European-wide project supported by the European Commission aimed on presentation of scientists and popularization of science. It shows scientists as ordinary people that have their hopes, dreams and families and contribute to welfare of the whole society.
Among others activities belongs seminars at primary and secondary schools where the renewable energy sources are presented in an easy and suitable way for students. It is possible to present them just small models therefore we organized also presentations in our laboratories. We offer them e.g. pumping power plant (fig. 2), high voltage laboratory (fig. 3) and many other models from our laboratory of the renewable (heat pump, wind turbines).

3. Acknowledgement
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