



**Workshop „Future skills needs for the green economy“**

# **Curriculum development for green jobs in the biomass production for energy purposes**

**Thessaloniki, Greece  
6 – 7 October 2008**

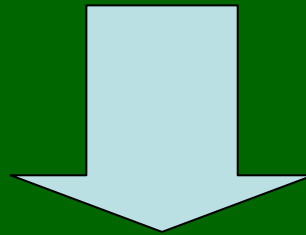
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Slovak Republic

The Faculty of Engineering of the Slovak University of Agriculture in Nitra was established in 1969



**Up to academic year 2007/2008  
more than 6000 graduates  
completed their studies**

**Study programme Agricultural engineering has been established at the Slovak University of Agriculture in Nitra in 1964.**



**The basic aim was to educate the specialists for the needs of the Slovak agriculture based on large - scale principles.**

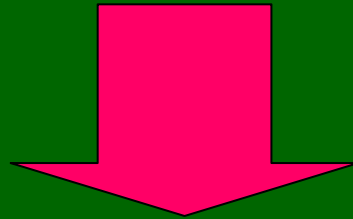
# At the Faculty of Agricultural Engineering in Nitra

each year graduated  
about 170-180 graduates  
of the study programme  
Agricultural engineering



85-92 % of graduates  
were able to find their job  
on agricultural farms, but now  
the situation has changed !!!

**63,3 % of graduates  
are founding their job  
in companies having  
NO RELATION  
to agriculture, bioenergy and food  
industry, but...**



**development of BIOENERGY industry  
can return our graduates  
to green jobs having relation to agriculture.**



**Since the year 2006  
the Department  
of Machines and Production Systems  
is involved in  
EU neighbourhood programme  
Hungary-Slovakia-Ukraine  
INTERREG HUSKUA III. A  
No. 14420100021**

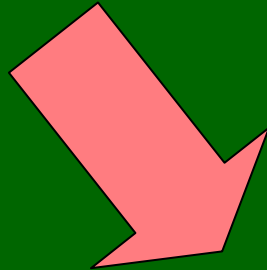




# Connecting European regions



**The title of our project:**



**„Cooperative model  
of the complex utilization of the biomass  
for the energy purposes  
in 1 hungarian region and  
3 slovakian districts“**

**.....and partners are:**



**Faculty of  
Engineering,  
Slovak University of  
Agriculture in Nitra,  
SLOVAK REPUBLIC**



**Office of Research  
and Development,  
Károly Róbert  
Főiskola in Gyöngyös,  
HUNGARY**



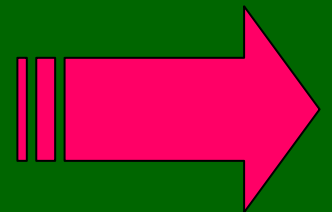
# The main aims of the project :

- 1. to specify the possibilities for mutual slovak – hungarian cooperation in the area of biomass utilization.**
- 2. to exchange of information and data.**

# The main aims of the project :

- 3. To establish the model of the cluster covering 6 districts on the both sides of the slovak-hungarian borders.**
- 4. By means of the synergy effects to achieve more intensive cooperation of both partners working in the area of research of the biomass utilization for energy purposes.**

**During the cooperation  
with our hungarian partner  
the following topics  
have been studied:**



# **1. Economical and legislative aspects of the using of biomass for energy purposes;**

- Analysis of the EU legislation
- Subsidies policy
- Legislative constraints and restrictions (biodiesel, bioethanol, biogas),

## **2. Investigation of the using of biomass for energy purposes and sustainable development**

- **Energy crops**
- **Wood and wood chips as a biomass**
- **Wastes from wood processing industry**
- **Wastes from agricultural crop production**
- **Materials for biodiesel, bioethanol, biogas,**

## **3. Green Energy cluster**

- **Specification of the cluster structure**
- **Participants in cluster**
- **Technical and organisational prerequisites**
- **Cluster and human resources**

## **4. Effect of using of biomass for energy purposes on life quality**

- **Green Energy social programme**
- **Protection of environment**
- **Environmental effects (soil, water, air)**



## **5. Micro and macroeconomical evaluation of the biomass used for energy purposes**

- Preparation of economical models**
- Economical calculations**
- Analysis of the results**

## **6. Horizontal and vertical model of the using of biomass for energy**

- **Machines for biomass cropping systems**
- **Technologies for biomass incineration (fytomass, dendromass)**
- **Biomass logistics and transport**
- **Green energy marketing**

**The project  
has allowed to define**



**the most important partners  
offerring the green jobs**

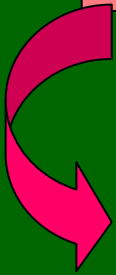
# **Participants in cluster of BIOENERGY industry offering the green jobs:**

- biomass growers and suppliers,**
- transport companies,**
- energy equipment manufacturers,**
- manufacturers of equipment**
- for biomass processing,**
- bioenergy plants.**

**....but also:**

- advisory companies,**
- financial institutions,**
- universities,**
- research institutes,**
- media,**
- trade companies,**
- educational agencies, etc..**

**Within the green job the manager should be know the structure of the BIOENERGY industry**

- 
- **legislative and economical conditions,**
  - **type and yield biomass,**
  - **biomass transport facilities,**
  - **technologies for biomass processing,**
  - **transport management,**
  - **capacity of the equipment for the biomass processing, (pelletizers, etc.),**
  - **design and installed energy plants power, etc.**

**The structure of the key  
study subjects of the bachelor  
study programme  
„BIOENERGY“**

# **1. SS „Introduction to the machinery and technologies for the biomass production and utilization”**

- Renewable energy sources and biomass.
- Energy and environmental problems.
- Potential of the energy received from biomass.
- Three E system: Energy, Economy, Environment.
- Ecological technologies for agriculture.



## 2. SS „Energy crops”:

- Energy crops. Justness of the energy crops growing and their yield potential – annual and perennial energy crops.
- Energy value of the energy crops, harvest and post harvest processing.
- Cropping of fast-growing woody plants.
- Type of fast-growing woody plants suitable for energy purposes, energy plantations;
- Site selection, establishment of woody plants plantations, planting patterns, plantation cultivation, harvest.

### **3. SS: „Machinery for establishment and cultivation of biomass plantations”:**

- Machines for tillage, seeding and planting;
- Machines and equipment for preparation of the seedling in greenhouses and forest tree nurseries;
- Machinery for crop protection and crop-stand cultivation.

## 4. SS „Evaluation of the biomass energy potential”

- Possibilities of the using of the biomass for energy purposes (Biomass boilers);
- Bioenergy technologies allowing to obtain the highest energy efficiency with regard to the ecological requirements.
- Environmental issues of the biomass using for energy purposes;
- General classification of biomass energy technologies: Direct combustion systems, Gasification systems, Biogas systems, Alcohol production

# 5. SS „Theoretical basics of technologies for biomass processing”

- Physical, chemical, dry and wet processes of the biomass transformation;
- Conditions for efficient biomass combustion and effects on the environment;
- Properties of the biomass as a fuel, its energy value;
- Biomass gasification; Gasification process and its phases;
- Liquid biofuels; Technologies for alcohol-type biofuels and their using in internal-combustion engines.

## 6. SS „Equipment and machinery for bioenergy industry”

- Production equipment for of liquid biofuels: ethanol, methanol, biodiesel, mixed fuels;
- Production of gas fuels made of biomass, wood gas, dump gas;
- Using of energy crops for production of energy;
- Biomass heating;
- Electricity from biomass;
- Methods of the implementation of equipments for using of renewable energy resources .

# 7. SS „Biomass harvest and processing”

- Machines and technologies for harvesting of the forages, grain, tubers and beets for energy purposes;
- Basics of the dendromass harvest;
- Theory and design of mechanisms for postharvest biomass processing (phytomass and dendromass);
- Machines and technologies for grinding, shredding, chopping, cutting, pressing of the biomass, with regard to the final process – biogas production, incineration, etc.

## 8. SS „Equipment and technologies for biofuels production”

- Production of the biodiesel and its energy balance;
- Comparison of the different fuels;
- Biogas from phytomass and zoomass;
- Aerobic and anaerobic decomposition – principles of biogas generation;
- Cogeneration and fuel cells;
- Biogas powered fuel cells as a technical solution;
- Combined production of the heat and electricity;  
Operation of the cogeneration units;
- Fuel cell technology.

## 9. SS „Biomass waste processing”

- Processing of the residual biomass by composting process;
- Composting of the biowastes;
- Machinery and materials for composting;
- Frequent mistakes in composting.



# 10. SS „Trade in machinery”

- Quantitative analysis of the machinery used in bioenergy industry.
- Technical requirements on the product and appraisal of quality.
- Machinery prices and price policy.
- Manufacturing, import and sale of machines.
- Commercial contractual relations, export and import operations. Communication policy in the area machinery trade.
- Operational parameters of machines (duration of the use), product life cycle, optimal time of machinery use.

# 11. SS „Modelling and simulation of the production processes”

- Computers-based methods for solving of the tasks related to the agricultural machines exploitation.
- Legislation framework of the utilization of the renewable energy sources.
- Energy self-sufficiency of the operational unit, company, region, etc.
- Logistics of the material flows related to the bioenergy industry.
- Biomass industry machinery: selection, investment and management.

## **12. SS „Basics of the BIOENERGY Cluster building”**

- Process of the cluster development.
- Activation of the initial interest to participate in the cluster);
- Participation in the cluster grows (selection of the action initiatives to solve the problems);
- Strategy making (new selection based on experience and new information).

# 13. SS „Project on the Bioenergy”

- Calculation of the needs of biomass for the given operational unit (workshop, machine line, division, company, region,).
- Proposal of the machines and equipment for the given unit and their numbers.
- Calculations of the indicators of the economical effectiveness.

# 14. SS „Biomass industry legislation”

- Basics of the state ecological and energy policy.
- Legislation for the area of biomass production and using for the energy purposes .
- State energy policy.
- Perspectives of biomass production and using for the energy purposes in EU.
- EU financial support for biomass energy.

# The graduates of the Bioenergy undergraduate programme should be able:

- to apply knowledge of math, science, engineering,
- to exploit the technical equipment and machinery used in different production and environmental systems,
- to design a system, component, or process,
- to identify, formulate and solve engineering problems,



- to understand the interface between biology and engineering,
- to use modern engineering techniques, skills, and tools,
- to operate and manage machines in relation to the utilization of the biomass for energy purposes,
- to understand global and societal impacts,
- to engage in life-long learning,
- to know contemporary issues.



- to design both parts of the technical systems and whole systems to match the economy, effectiveness, safety and environmental requirements ,
- to use their knowledge and skills to create subsystems and systems and implement them in suitable climatic, natural and production conditions ,
- to cooperate and collaborate with the production engineers, machinery systems users and experts from other profession,
- to work in the position of technical managers and also they are able to carry their own business.



**The experts for biomass utilization for energy purposes should be specialized according to the classification of the agricultural biomass.**



# Experts for the biomass incineration:

- biomass heating, warming of the utility water, product drying, generation of electricity from different types of biomass),
- using of phytomass (straw), dendromass (solid wooden chops, wood for heating purposes,
- using of wastes after wood processing), energy crops

# Experts for the biofuels production:

- Production of methylesters of the plant oils as a component to the diesel (rape, grains),
- Production biofuels in the form of bioalcohol as a component to the gasoline (maize, grain crops, sugar beet, potato, etc.,)

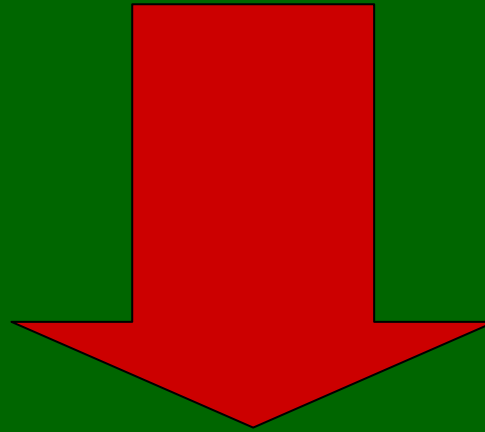
# Experts for the new technologies:

- Technologies for the decomposition of the dendromass to obtain bioethanol or decomposition of cellulose and lignin to obtain biobuthanol),

# Experts for the production of biogas

- combined production of the heat and electricity by cogeneration (using of slurry, green crops, silage, dendromass).

**The establishing of the  
BIOENERGY study programme  
can be considered as rational step.**



**It can positively effect  
the employability of the graduates  
of our faculty on the job market**

# Job titles for graduates of BIOENERGY Study programme

- production engineer,
- natural resource engineer,
- bioenergy management engineer,
- bioenergy plant engineer,
- director of bioenergy plant unit,



# Job titles for graduates of ABE

- biomass systems analyst,
- biofuel engineer,
- biomass project engineer,
- biomass processing engineer,
- biomass systems design engineer.





**Thank you  
for your attention...**