Development of Wood Chips and Pellets market in Slovakia

Jozef Viglasky, SK-BIOM, Slovakia

Summary

Being on the list for accession to the European Union, the Slovak Republic will increasingly have to aim at environmentally sound energy generation and utilisation. Therefore, the demand for alternative energy sources is rapidly growing. With abundant biomass resources available, the market for energy from biomass looks very promising. Biomass energy has the potential to combine economic, environmental and social benefits. According to the current estimates, the share of renewables will rise to 5% in 2010, of which 40% covered by biomass energy (30 PJ). The ultimate potential of biomass energy lies between 100 and 400 PJ/a.

A clear market for bio-energy is still lacking in the Slovak Republic. However, biomass energy will become increasingly competitive in the coming years: prices for natural gas and electricity rice continuously to international market level. Moreover, fossil fuels, especially brown coal, will be significantly charged with environmental taxes.

Introduction

Current energy situation

The Slovak Republic has a poor domestic energy resource base: 90% of the total primary energy supply of 761 PJ (1999) is imported. Brown coal and hard coal still account each for 15 % of the total figure, but the share of natural gas, imported from Russia, is rapidly growing and expected to exceed 30 % in 2010.

The coal based plants are mostly characterized by low efficiency and high environmental pollution levels, in spite of recent large investments in flue gas treatment.

However, also utilisation of natural gas has considerble drawbacks:

- natural gas is a fossil fuel; combustion leads to net CO_2 emissions into the atmosphere, provoking global warming;
- import of natural gas affects the trade balance and does not contribute to the development of a local economy; moreover the price of natural gas is expected to rise in (nearby) future;
- especially in small villages and rural areas, the establishment of a gas network is costly; in a liberal energy market this will be reflected in the heat price.

The final energy consumption for the 1999 was 491 PJ, of which 407 PJ was heat and fuel consumption (83 %), while the electricity consumption accounting for the remaining 84 PJ (23.2 TWh). The difference between PES and final energy consumption of about 270 PJ is accounted for through conversion and other loses, and energy stock change.

Energy strategy

The current energy policy of the Slovak is aimed at the following issues:

- Secure, smooth and reliable energy supply, balanced with the energy demand, especially as the structure of energy demand is changing, i.e. energy demand from services and households is growing and energy demand from industry is shrinking.

- Innovation and restructuring of the energy production sphere aimed at the overall reconstruction and modernization of existing production facilities. Implementation of environmental protection measures for already existing and newly designed facilities is included as well.
- Increase utilization of renewable and secondary energy resources. Generally, Slovakia considerably lags behind in the utilization of renewable energy (RES) sources in comparison to what is actually available and technically feasible. For instance, the degree of actual geothermal energy utilization is 5%, biomass 30% and hydropower 57%. There is hardly any utilization of solar energy and no facility harnessing wind power. Currently RES supply 3.3% (23 PJ) of the total primary energy consumption in Slovakia. The share of RES in the total primary energy supply has been estimated to increase to about 100 PJ of this supply by the year 2010.
- Fulfillment of obligations set up in international treaties, e.g. harmonization of Slovak energy legislation with EU legislation, fulfillment of the European Energy Charter, legislation in the field of nuclear power, and the Framework Convention on Climate Change.
- Increase of energy efficiency and decrease of the share of energy costs in the Slovak GDP. A higher portion of GDP generation from the spheres of services, transport and light industry may positively influence the reduction of the energy intensive industry in GDP generation. This trend has already begun, as in 1990 the portion of heavy industry in GDP generation was 59%, while in 1995 it was only 33% in Slovakia.
- Minimization of the negative environmental impacts of energy production, predominantly focusing on measures such as penetration of technologies minimizing pollution generation ("clean" fossil fuels combustion), activities stimulating utilization of renewable and secondary energy resources, etc.

The market for biomass energy

Renewable energy sources like biomass, wind and solar energy, form a promising alternative to fossil fuels. Recent studies indicate that especially biomass energy offers good market opportunities. According to the current estimates, the share of renewable will rise to 5% in 2010, of which 40% covered by biomass energy (30 PJ). The ultimate potential of biomass energy lies between 100 and 400 PJ/yr.

Main biomass sources are:
- industrial wood residues in the north and central part;
- forestry wood residues in the north and central part;
- straw and other agricultural residues in south-west and east;
- rapeseed (for liquid bio-fuels);
- wet biomass like animal manure and sewage sludge (for biogas production).

A clear market for bio-energy is still lacking in the Slovak Republic. However, biomass energy will become increasingly competitive in the coming years: prices for natural gas and electricity will rise to international market levels. Moreover, fossil fuels, especially brown coal, will be significantly charged with environmental taxes.

On a short term, a number of biomass energy concepts seem to be the most promising:

- Replacement of small and medium scale (brown) coal fired district-heating system by wood or straw fired systems.
- Co-combustion of wood residues in existing coal fired power systems.

- Implementation of low cost anaerobic digestion systems with CHP generation, for treatment of wet biomass, i.e. animal manure, wastewater, sewage sludge.

The following concepts are expected to become more attractive on a medium to long term:

- Implementation of small to medium scale CHP combustion or gasification systems, provided that the electricity price has risen sufficiently.
- Cultivation and utilization of energy crops where no wood residues are available. From an agricultural point of view, cultivation of energy crops forms an attractive alternative for conventional food crop growing.

Biomass energy in Central Slovakia

Central Slovakia is a highly forested region with about 45% of its area covered by forests.
Wood exploitation is well developed: many forestry and wood processing companies are represented in the region. The massive introduction of cheap brown coal hampered the utilization of wood residues for energy purposes for a long period. However currently, as a result of the promising future market perspectives for biomass energy, there is a growing interest in the use of wood and other biomass residues in the region.

1993
The Forest Research Institute in Zvolen carried out a study on the utilization of different biomass resources in Slovakia.

1996
An in-depth study for biomass use for the region of Central Slovakia was initiated by the Slovak Ministry of Environment. Within this study, 24 biomass-heating projects were identified.

1997
The Slovak Ministry of Environment organized a seminar on "Environment Protection by Energy Saving". Main objectives were to prepare a shortlist of most attractive and feasible projects and to investigate potential (international) funds for those projects.

1998
The Dutch company BTG Biomass Technology Group and the Technical University in Zvolen developed a project proposal within the PSO-programme of the Dutch governmental agency Senter. In December the project was approved. The Slovak Energy Agency and the Slovak Ministry of Environment expressed their commitment to a biomass-heating project in Zvolen.

It is envisaged that the demonstration project in Zvolen will initiate similar projects in Central Slovakia and Slovakia as a whole. Especially in the wood processing industry, having a considerable heat demand and high availability of low cost wood residues, there is a large potential for biomass-based projects. In the Zvolen region, 55 private wood companies are listed, in the rest of Slovakia about 1000. It is expected that the Zvolen project will contribute to the further development of the local biomass market.

Biofuels market and expected growth of biofuels market

Being in the list for the EU enlargement, the SR will have to achieve the aim of energy generation and utilization in a more environmentally way. Therefore, the demand for alternative energy sources is rapidly growing. One suitable source is biomass.

Exploitable potential in the Slovak Republic annually is approx. 3 million tonnes of biomass totalling energy equivalent of 35.6 PJ. Woody biomass (dendromass) has a considerable share in this quantity. It is more than 2.3 million tonnes of biomass of energy equivalent to 27 PJ, which is more than 73 per cent of the entire amount of biomass.

With abundant biomass available, the market for energy from biomass looks very promising. Biomass energy has the potential to combine economic, environmental and social benefits. According to the current estimates, the share of renewables will rise to 6% in 2010, of which 40% covered by biomass energy (30 PJ).

In connection with decreasing supplies of standard fossil fuels and continually deteriorating environmental situation the task of energy exploitation of biomass becomes more and more relevant.

Wood pellets potential in the Slovak Republic

1. How much wood pellets does Slovakia produce today?

Approx. 5000 tonnes/year at 3 different plants (2 plants with capacity of approx. 20000 tonnes per year are in up building, production process in 1-2 years is expected).

2. What is the production potential in the future and when?

20-30 000 tonnes/year in 1-2 years.

3. How much wood pellets does Slovakia use today?

1000 tonnes/year, much more is exported.

4. What is the demand potential in the future and when?

50-100 000 tonnes/year in 5-10 years.

In the near future the main demand for regularly pellet consumption is expected by final implementation of the Project "Biomass as Pellets Utilisation in Schools". The Project deals with replacement of brown coal fired boilers by wood pellet fired boilers in 42 schools in the Region of North Slovakia. The Project is supported by the Danish Government.

One of the main barriers for extension of wood pellet production is lack of appropriate technology in Slovakia. Several types of pelleting machines are used at present:

- Rolling extruding machine
- Horizontal pelleting machines with rolls and rolls matrix
- Horizontal pelleting machines with roll matrix and pressing rotor
- Horizontal pelleting machines with gear-wheels
- Vertical pelleting machine with cylindrical rollers and round surface matrix
- Vertical pelleting machine with conic rollers and round surface matrix

Imported technologies are expected to be expensive for the present time being.

Wood chips

In a long-term perspective wood chips are very interesting means of wood waste energy exploitation. Their production is also appropriate for waste generated directly in the process of felling. Wood chips are usually produced from low value waste wood, thin branches, tinning and bark. There is future perspective seen for energy wood chips, in the process of energy valuation of fields of rapid growth energy crops.

To make the process of wood chips production from thin branches more effective. It is necessary to consider the pre-crushing of wood directly at the felling site. By this, the amount of waste is decreased and transport expenses are lower. Part of the above idea is that mobile technology lines for wood chips production should be built in parallel at the felling site. In these lines, wood will be processed to the required size and moisture content (MC). The fact that this shape of fuel enables a fully automated combustion process proves the positive perspectives of this technology.

Classification of users and market potential in the next two to five years in the SR:

1. min. 600 units with output of 15-50 kW - buildings in forest districts, including gamekeeper's lodges, common co-operative farms and farming settlements, etc.;
2. min. 120 medium size plants with average power output 100 - 800 kW - buildings of forest enterprises and forest plants, common buildings in the municipal corporations, concentrated objects of co-operative farms etc. ;
3. at least 30 district heating plants in towns and cities with more than 2 MW output.

Case study:

WOOD CHIPS FIRED HEATING PLANT

- **replacement of brown coal-fired boilers by a biomass-fired boiler**

BACKGROUND

This Contribution deals with an application of wood chips as biofuel in an energy system of a small size enterprise. The boiler was installed at the School Forest Enterprise (the SFE) Technical University in Zvolen under the framework of the Dutch Program for Co-operation in Central and Eastern Europe (PSO-programme). The total investment costs come to about EUR 450,000. The boiler has a capacity of 605 kW_{th} and is fired by clean wood residues from sawmills owned by the SFE. The special furnace design ensures that woody biofuel burns in an environmentally sound way. Emissions of dust and CO are extremely low and meet the Slovak standards and European norms. The fire heats water up to a temperature of approximately 95 °C. The buildings and workshops of the SFE are supplied with hot water for heating purposes.

Introduction

The biofuel-fired boiler replaced three old brown-coal fired boilers with low efficiency. It is estimated that the combustion efficiency is increased by more than 50 % also emissions of ash, dust and CO are significantly reduced.

Location

Zvolen, Central Slovakia – Pohronie, Slovakia and climatic/geographical characteristics as relevant to the project.

Objectives

A practical example shows and explains the possibility of biofuel application in an up-to-date heating system, which at present works fully loaded.

Duration

Start date - January 1999, completion date - December 2000, expected duration – 24 months and continuation – 6 months, activity focused on monitoring and evaluation of bio-energy parameters.

Partners

SENTER, Den Haag, The Netherlands,
BTG Biomass Technology Group B.V., Enschede, The Netherlands: project coordination
Technical University in Zvolen: local project coordination
Kara Energy Systems (NL): supplier of combustion system

Technologies and/or methodologies used

The boiler has a capacity of 605 kW_{th} and is fired by clean wood residues from sawmills owned by the SFE. The special furnace design ensures that woody biofuel burns in an environmentally sound way. Emissions of dust and CO are extremely low and meet the Slovak standards and European norms.

Total costs and contribution from external sources of funding.

The total investment costs come to about EUR 450.000; The boiler was installed at the School Forest Enterprise (the SFE) Technical University in Zvolen under the framework of the Dutch Program for Co-operation in Central and Eastern Europe (PSO-programme).

RESULTS

Energy saved: -

Energy produced by renewables: 4 012 GJ

Economic benefits

The impulse to reconstruct the boiler plant at the SFE of the TU in Zvolen was considered by several circumstances, e.g. the end of the life-time of engineering equipment, „discovery“ of possibility to use own wood „waste“ as a fuel, expected efficient performance of a new boiler plant and possibility to reduce emissions.

Environmental benefits

The aim of the project was to switch from brown coal to own wood residues (wood chips) – biofuel with significant improvement of boiler plant performance considering environmental protection.
Emissions achieved under reference conditions: Particulate = 80-120 $mg.Nm^{-3}$ (<<150 $mg.Nm^{-3}$ at the 11 % O_2), CO = 80-150 $mg.Nm^{-3}$ (<<850 $mg.Nm^{-3}$), NOx < 200 $mg.Nm^{-3}$ (<<650 $mg.Nm^{-3}$), VOC < 10 $mg.Nm^{-3}$ (<<50 $mg.Nm^{-3}$, it is unburned organic matter indicated as total organic carbon C in flue-gases), SO_2 does not considered because sulphur content in dendromass is negligible.

Jobs created: -

LESSONS LEARNED

Positive aspects of project implementation

Project provides information on possibilities offered by modern bio-energy system with capacity 605 kW_{th}, which replaced inefficient brown coal fired boilers (3 x 250 kW_{th}) in a boiler room at the SFE of the Technical University in Zvolen, within the framework of Dutch Programme PSO 1999/2001.

- Townships or region have influence on heat price.
- Further employment possibilities are arising – social issues are being solved.
- In the process of biofuel preparation, local and regional entrepreneurs are promoted.
- Money paid for heat remain in town budget (in full amount after payment of debts, otherwise partly).
- Biofuel is made of renewable raw materials, which normally grow regularly.

REPEATABILITY

Biomass (dendromass as well as phytomass) belongs mostly to solid fuel group, it is considered as the most perspective indigenous renewable energy source, awaiting for its wider implementation, mainly in the municipal sector. Based on foreign prognosis and experiences (in Austria, Denmark, Sweden etc.) it can be assumed, the biofuels based on biomass will become number one amongst fuels mainly for dwelling heating in the twenty first century.

PARTICIPANTS

ENAS,	Banska Bystrica:	local engineering
Cb,	Banská Bystrica:	local engineering
CONUS,	Banská Bystrica:	local engineering
ENERGYR,	Banská Bystrica:	local engineering
VUSTAM,	Povazska Bystrica:	local engineering

Contact for more information:

Main contact:	Assoc. Prof. Jozef Viglasky, PhD.
Project Web Site:	www.btgworld.com/cee
Name:	Technical University in Zvolen
Address:	T. G. Masaryka 24, SK – 960 53 ZVOLEN
Tel:	+421 45 5206 875
Fax:	+421 45 5206 875
Email:	viglasky@vsld.tuzvo.sk
Web Site:	www.tuzvo.sk

Host organisation:	Technical University in Zvolen	
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