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Theoretical Approach of A Possible Value-Added Chain in the Biomass Industry in Rural Areas Giving the Example of A Hungarian Microregion

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Abstract

The future of biomass energy in the global energy system depends on many major factors, among others on the attitude of society in rural areas to the biomass energy and the renewable energy resources. Biomass energy plays increasing role in rural areas with its contribution to the self sufficiency of people in the countryside. The paper deals with the analysis the opportunities of utilization of biomass energy sources giving example of a Hungarian study area and to study the possibilities of the cooperation and management regarding biomass industry in a certain rural region. Furthermore, the aims of this analysis are on the one hand to predict the potential renewable energy of the Eger Micro-region and on the other hand to research the theoretical possibilities of a value added chain in biomass industry. The main conclusion of the paper is that economic benefits can be locally embedded through local distribution of profit generated by sales of energy or financial benefits from energy saved by efficiency activities local training and employment opportunities and local shareholding. Furthermore shareholding can also involve individuals resident outside of the local community, forming part of a more spatially dispersed 'community of interest' involved in, and supportive of, the development.

Keywords:
Biomass industry, Rural micro-region, Actors in biomass industry, Value added chain

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INTRODUCTION

The role of biomass energy in rural development

Different kinds of biomass have been important energy resources of mankind for thousands of years (Hadiyanto *et al.*, 2012). Producing and using bioenergy from biomass is a significant agricultural activity, particularly in rural areas. Using biomass (energy crops, crop processing waste, agricultural residues) in order to produce energy benefits people in countryside. Bioenergy and rural development are intrinsically intertwined, namely providing energy at local level, bioenergy can make a significant contribution to social and economic development in rural areas (Rosillo-Calle, 2000).

Many effects can be mentioned as advantages and drawbacks regarding biomass. Rural benefits feature new sources of income for farmers, more jobs, and economic development all achieved while preserving the high quality of life, local control, and clean environment that help make rural area a good place to live (Internet 1). Living conditions in rural areas are greatly affected by the amount and quality of available energy, which is currently a major limitation in the countryside but the increased energy use can be of any benefit only if it provides essential services e.g. cooking, lighting, heating, water pumping, transport, industrial uses (Rosillo-Calle, 2000). Accordingly it is very important to evoke discourses not only on economic questions, but on natural and social issues as well. (Scheer, 2007). Some authors think that growing demands on biomass based energy resources endanger equilibrium of natural ecosystems mainly in sensitive areas (e.g. tropical rainforests). (Leemans and Kleidon, 1996) Secondly a threat is predicted that energy demands on the rise are going to increase food prices worldwide and in poorer countries it causes famine. (Schade and Pimentel, 2009).

The increasing use of biomass as energy souce will also bring many environmental advantages. Biomass wastes encompass a wide array of materials derived from agricultural, agro-industrial, and timber residues, as well as municipal and industrial wastes (Zafar, 2012).

However, bioenergy should not be regarded as the panacea for solving agricultural and energy problems in the rural areas, but as an activity that can play a significant role in improving agricultural productivity, energy supply, the environment and sustainability (Rosillo-Calle, 2000).

The importance of the role of biomass as a source of energy is a current topic in the countries of the European Union, among others in Hungary. The European Environmental Agency (EEA) forescasted in 2006 EU primary energy requirement at 1.8 billion tonnes oil equivalent (toe) in 2020 and projected biomass to be able to contribute with 13 % or 236 million toe, compared to 69 million toe actually provided in 2003 (EEA, 2006). According to data of the EEA is thus reasonable to assume that biomass could account for two-thirds of the renewable energy target in 2020, furthermore agriculture seems thus to be key for a genuine, large expansion of biomass supply in rural areas.

In accordance with Directive 2001/77/EC Hungary undertook to increase the share of its electricity production from renewable energy sources to 3,6% by 2015 (at the time of the undertaking its share was less than 1%) but among the member states Hungary targeted the lowest figure and was the first member state to fulfil it at 4,4% in 2005 (Hujber *et al.*, 2009).

In Hungary the most important renewable energy source with significant increase is biomass, makes circa 90% of all renewable energies in 2011, followed by geothermal energy, renewable waste and hydro power. The Northern Hungarian Region (Észak-Magyarország) is one of the part of Hungary with huge potential regarding biomass utilization as more than 50% of its area covered by forest while agricultural area also accounts for around 40% (Bujdosó *et al.*, 2012). The studied area below is a fine example for the possibilities of biomass as a tool of rural development.

The studied area and aims

The spatial (geographical) unit of this paper called Egri Micro-region is located in the Northern Hungarian Region (Észak- Magyarország) consisting of 14 settlements, i.e. in addition to the Town of Eger, 13 villages. Basically, the micro-region can be considered as the catchment area of the Town of Eger, with a total number of inhabitants of 79,500 (Figure 1).

The area was designated for research as micro-regions are the places of bottom-up regional co-operation as well as are the smallest spatial units of development policy. Micro-regions are units well-analysable as they indicate significant differences within larger regions, i.e. counties, regions, are suitable from the point of view of data collection, are an optimal place for co-ordination within the regional economy, have a strong rural identity. Furthermore, Eger Micro-region is a rural area with small villages where the energy production could be served by renewable sources.

The aims of this analysis are on the one hand to predict the potential renewable energy of the Eger Micro-region and on the other hand to research the theoretical possibilities of a value added chain in biomass industry.

MATERIALS AND METHODS

Data collection has carried out by two ways. Primary data collection meant deep interviews with local actors while during secondary data collection data were collected from institutions (village-masters, offices of the micro-region, the Agricultural Agency of the County of Heves, census of vine-lands and orchards by the Hungarian Central Statistical Office, Hungarian National Forest Service, institutional statistics).

RESULTS AND DISCUSSION

Basis for agriculture and forestry in the Micro-region of Eger

Physical endowments

The Micro-region of Eger is part of the meso-landscape also referred to as Bükk-region with, due to its varied topography, specific physical endowments of which a detailed description is given below.

Climate

The Bükk Mountains is an island-like mountain elevated from its environs which fact is of key importance in forming the vertical gradient of climate, i.e. with the increasing height above sea-level becomes the yearly amount of precipitation more abundant. Spatial differences are also caused by the openness of this area to the Great Hungarian Plain (Bükkalja region) or by its enclosedness (Bükklába region) as well as its relatively protected character against the intrusions of cold air masses (Eger).

Variability in the hours of sunshine is rather low (ranging between 1900 and 2000 hours per year) which is a consequence of the fact that the higher regions of the mountains receive more irradiation compared to the lower regions with more frequent cloudiness.

During the winter, thick snow cover is witnessed; the Bükk Plateau is covered by snow between 15th November and 1st April. The number of foggy days is also high, being 80-100 days at the lower regions. Due to its topography, areas with various micro-climate are found here (Table 1).

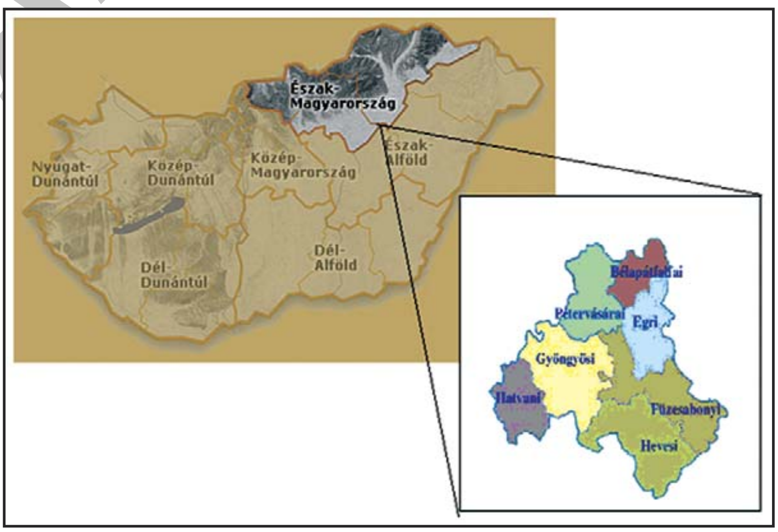

Figure 1: The broader environs of the studied area (Egri Micro-region)

Table 1: Some of the relevant climatic data for the Micro-region of Eger

Climatic element	Eger (180m)
Annual mean temperature	9.9 oC
Mean temperature, January	Ĥ 2.3 oC
Mean temperature, July	20.9oC
Precipitation	582 mm

Source: Marton-Erdős, 2005

Soils

Soils formed at the Bükk-region are primarily determined by extraction caused by precipitation and by the soil-forming rocks. The most common soil type at the limestone surfaces of the Bükk Plateau is rendzina. In case of a thicker detritus, brown forest soils with clay inwash are present. At the clayey-muddy slope sediments of the SE-Bükk, Ramann brown forest soil at the schists of the SW- Bükk acidic non-podsoil brown forest soils are formed. This is also the most common soil type in the Northern Bükk, however brown forest soils with clay inwash also has a significant share. The predominance of this second soil type is a feature of the Bükklába region. The most manifold pedological picture is present in the Bükkalja region where, in addition to the Ramann brown forest soil and brown forest soil with clayex inwash, on the volcanic rocks vertosoils, and at the southernmost regions, chernoziem brown forest soils are also present.

Land use

The Bükk Plateau, from a geomorphologic point of view, is an elevated karst plateau that consists of, due to the varied level of its elevation, hill and mid-mountainous plateau segments. Agricultural activities are not characteristic here. Most of the plateau is part of the Bükk National Park at whose area, the share of forests is 95%; the forest stock represents a rather outstanding economic value, from the point of view of timer industry. With the Bükk National Park established, regulation of silviculture became an issue of key importance, as without harmonising the interests of nature conservation and forestry, objectives of the Bükk National Park will not be achieved.

The Bükkléba region, with its extensive, intensively and moderately jointed hill-counties and climate, similar to the Central Bükk region, is suitable for agricultural production. At the Bükkalja region, predominated by less jointed, southern slopes, traditions for viniculture and fruitery date back for centuries (Balga and Villangó, 2012). Adjacent to the wine region of Eger with its high-quality red wine, vine is also grown at the Bükkalja, however primarily for the purpose of champagne production. To the south, vineries and orchards are replaced by ploughlands.

Biomass potential in the Micro-region of Eger

Aggregate bioenergy potential in the micro-region of Eger

Based on the above, the biomass potential annually generated in the Micro-region of Eger can be determined. At present, the aggregate potential of biomass generated in the micro-region, unutilised for energy purposes, primarily burnt in an environmentally-polluting way is summarised below:

Table 2: The aggregate biomass potential of the Micro-region of Eger

	Energy potential (GJ)
Wine-branch	80 000
Cuttings of fruit-trees	5500
Field crops	115 000
In total	**250000**

Source: Gergely, S, 2009

To this, the potential energy generated in the micro-region from silviculture is added. Based on the above, the annual yield of timber in the Micro-region of Eger is 112 460 bm3, of which 46457 tonnes of biomass can be planned (Gergely, 2009). To this, approximately 500 t of other wastes of timber industry can be added, therefore, an annual sum of 46957 tonnes of arboreal biomass for energy purposes can be realised.

The present use of biomass in the studied area

The use of biomass for energy purposes in the micro-region and its surround is at its very first stages; only two facilities related to this activity can be mentioned. The main activity of the Mátra Power Plant with its depot in the Village of Visonta is electricity generation based on the lignite supply of approx. 1 billion tonnes found nearby. The installed capacity of the power plant is 836 MW made up by five blocks. Based on the data 2010, the following biomass types are combusted in the Power Plant.

The other facility utilising biomass is the semi-plant biomass central heating plant at Gyöngyös. The facility at the Tass-puszta was opened in September 2007 and primarily intends to advance the developments between laboratory and industrial in size.

The furnace suitable for studying semi-plant volumes with a total capacity of 1 MW (furnaces with capacities of 400 kW and 600 kW) were set to facilitate the combustion technologic examination of various biomass products and their mixtures with conventional (fossil) fuels. The biomass central heating plant primarily does not intend to meet the existing heat demands but it is mainly operated to accomplish combustion probe of various fuels, and by this experimenting the optimal conditions for combustion.

A systematisation and clusterisation of actors adjunct to the biomass industry

In the Eger Micro-region and its neighbourhood, a number of actors, adjunct to the biomass industry is present. As well as they can be competitive with each other, in order to achieve success, networking among them, to which a possibility is clusterization, is also required. Within the region, the establishment of a regional cluster in type can be implemented as the actors of the industry are geographically concentrated. The establishment of a cluster in the studied area had been already proposed in 2009 (Gergely, 2009). As claimed by the author the focal concern can be, in addition to the Mátra Heat Power Plant Close Corporation, heat power plants of towns and small-sized power plants to be established in the future.

An analysis of cooperation within the chain

Based on the results of the preliminary research carried out, the value chain potentially most suitable for development is related to dendromass (Figure 2).

1- On the producers' side, in addition to the number of private owners, a large extent of forested areas is under the management of the Egererdő Close Corporation. The company, beyond the regulated logging of forests, also undertakes processing activities (e.g. production of hardwood floor).

2- The Egererdő Close Corporation owns a high-capacity mobile wood-chipper to process biomass. Apart from these wood-chips, a company selling wood-pellets and producing appliances for the timber industry is also operating in the target area.

3- Although, there are deposits of fuel sales companies functioning in the micro-region, unlike are large-capacity warehouses providing appropriate conditions for wood-chips.

4- Combustion of wood-chips on a small-scale (e.g. in houses) is recommended by the literature only when the combustible is not to be conveyed to larger distances. Special furnaces can be procured now only from outside the target area as no company involved in the development or production of such appliances is existing in the area.

5- Wood-ash, depending on the way of combustion, even can be classified as hazardous waste. The low amount of wood-ash resultant

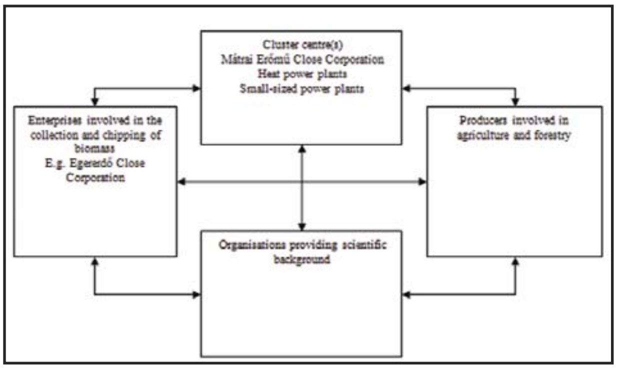

Figure 2: Actors adjunct to the biomass industry in the studied area Own edition after Gergely, 2009

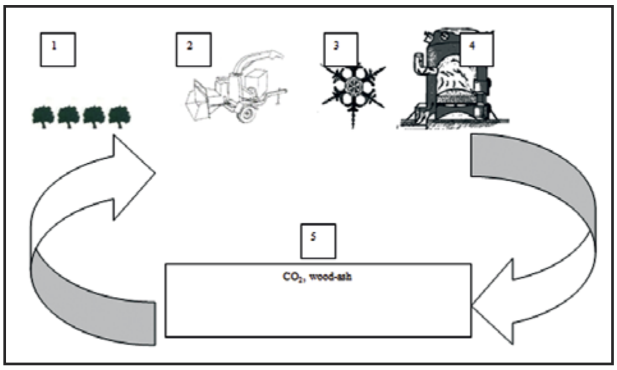

Figure 3: The graphic representation of a possible value-added chain. Own edition

from conventional burning was traditionally used by peasants' farms prior to the age of modernisation. At certain levels or in the case of application of given special technologies, it can contain heavy metals, hazardous substances that are important to be detected before recycling this material to nature (Figure 3).

CONCLUSION

In the primarily realizable chain the Egererdő Close Corporation is going to function as a key actor, being the producer of raw material and the processing partner as well. In the demand side firstly self-governments of the target area and their institutions (mayor's office, local culture centres, schools etc.) seem to be the proper partners with transferring their heating systems to the utilization of woodchips. In the second stage to bring enterprises and inhabitants into the process is also possible. Successful investments of local self-governments and the effects of savings in costs of heating can promote other possible actors as well.

The involvement of self-governments is crucial, in order to achieve this the contribution of the micro regional agency is compulsory, as they are in a day-to-day connection to local self-governments.

The involvement of enterprises can be done through the local Commercial and Industrial Chamber. The involvement of commercial partners is a must in the next steps of research and organizing. In order to gain it we must produce an outline of the value-chain and to discuss with primary partners.

This participation analysis seeks to identify all person and institution involved in a project, in addition to the target group and the implementing agency, and speculates on their expected support or opposition to the program. This analysis is used at the preliminary stages of a project in order to incorporate interests and expectations of persons and groups significant to the programme.

Organizations and authorities at different levels and interest groups have different motives and interests. It is of fundamental importance to analyze these interests and expectations both early on in the planning process and later again during the implementation of the project.

The most superficial example can be described as 'information-led', characterised by a situation where local people are informed of a proposed development; at this level, local people have no involvement with development other than as passive recipients of information. At another end of the spectrum, it is possible to envisage projects that are 'ownership-led' with a high degree of local control. In between these extremes, a range of positions will exist that can be described as varying degrees of 'partnership' between local people, interest groups, statutory institutions such as local authorities and private sector developers. More local or community-embedded examples of these could involve local use of energy generated by local plant, as might exist in a local district heating scheme, a 'private wire' mini-grid electricity network or generation technologies such as solar photovoltaic panels on community buildings. Economic benefits can be locally embedded through local distribution of profit generated by sales of energy or financial benefits from energy saved by efficiency activities local training and employment opportunities and local shareholding. Shareholding can also involve individuals resident outside of the local community, forming part of a more spatially dispersed 'community of interest' involved in, and supportive of, the development.

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