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**THE ROLE OF SOLID BIOMASS USED FOR ENERGY PURPOSES IN
SETTLEMENT DEVELOPMENT**

Szilárd biomassza energetikai célú hasznosításának szerepe a településfejlesztésben

KONCZ Gábor

Abstract

The utilization of renewable energy resources became the one important segment of local economic development in recent years. These resources are located decentralized and provide opportunity to realize investments in those regions which not stand in the limelight of the other economic activities. Only those solutions are really favourable for rural communities that have positive effects economically and socially too, not only from environmental point of view. In Hungary the solid biomass (especially firewood) has the greatest importance in heat generation and in electricity production too. This renewable energy source has significant traditions, mature technology and wide range of base materials. The set off of natural gas by biomass can result significant savings in the heating expenditure of local authorities that aroused the interest of the management of municipalities. In the beginning the biomass sources available for free helped significantly the acquisition of biomass boilers. The growing number of biomass users causes competition for biomass resources and claims more organized activities. Co-operations become necessary at local and small-regional level among self-governments, producing and supplying companies, professional institutions and non-profit organizations.

Keywords: local economic development, firewood, biomass heating plants, regional co-operations based on energy supply

JEL code: Q42

Összefoglalás

A megújuló energiaforrások hasznosítása a helyi gazdaságfejlesztés egyik fontos szegmensévé vált az utóbbi években. A decentralizáltan elhelyezkedő erőforrások azokban a térségekben is lehetőséget biztosítanak beruházások megvalósítására, amelyek más gazdasági tevékenységek esetében nem állnak az érdeklődés középpontjában. A vidéki közösségek számára csak azok a megoldások igazán kedvezőek, amelyek helyben váltanak ki pozitív hatásokat nem csak környezeti, hanem gazdasági és társadalmi oldalról is. Magyarországon a legnagyobb jelentőséggel mind hőtermelésben, mind villamosenergia-termelésben a szilárd biomassza (különösen a tűzifa) bír. Ennek a megújuló energiaforrásnak vannak jelentős hagyományai, érett technológiája és széles alapanyagbázisa. A települések vezetésének érdeklődését elsősorban az keltette fel, hogy a földgáz biomasszával történő kiváltása jelentős megtakarításokat eredményezhet egy-egy önkormányzati intézmény fűtési kiadásában. A biomassza kazánok beszerzését az eleinte ingyen hozzáférhető biomassza források jelentős

mértékben elősegítették. A biomassza felhasználók számának növekedése és a versenyhelyzet kialakulása ugyanakkor a tevékenység szervezettebbé tételét, települési és kistérségi együttműködések kialakítását igényli az önkormányzatok, a termelő- és szolgáltató vállalkozások, a

szakmai intézmények és a civil szervezetek részéről.

Kulcsszavak: helyi gazdaságfejlesztés, tüzifa, biomassza távfűtőművek, energia alapú térségi együttműködések

Introduction

In the last years the topic of renewable energy sources becomes the centre of interest in economic and environmental point of view (Pimentel et al. 1994, Darmstadter 2003, Kaltschmitt et al. 2007, Aswathanarayana et al. 2010). In Hungary the utilization of solid biomass had got a significant role as well as in fulfilment of objectives required by the European Union and in reduction of heating expenditures of inhabitants. The energetic production and consumption of solid biomass may be an important element of utilization of local resources in case of many Hungarian settlements. Although the energetics is not one of the main tasks of the local governments, more and more governments use solid biomass fuels in favour of retrenchment in spending of maintenance the local institutions. Because of the increasing number of biomass consumers the sustainability of utilization can be realized only based on regional cooperation and by the help of professional planning and coordination (Tóth 2013).

The contribution in local energy services such as local public service belonged to the authority of local governments in Hungary according to the unabolished legislation till the end of 2011. In most cases the local governments fill up only formal role among service providers and consumers by implementation of settlement planning. The primal tasks of self-governments in power supply are consumer protection and promotion of supply development and security. The increasing number of energy production devices and the progression of technology are resulted the participation of self-governments in the market of electricity (Németh 2007, Fábrián 2010).

In practice of urban planning the opportunity for utilization of renewable energy resources didn't get accentuated role in the past years. At the same time the enhancement of energy efficiency was formulated as fundamental expectation in favour of affordable overhead costs and improvement of quality of settlement environment. The act CLXXXIX of 2011 in Hungary on local authorities didn't mention the issue of energy supply, not even as optional authority. However the local governments must give attention to enhancement of self-supporting capacity of the settlement, utilization of local resources and exploration of development opportunities (Flowers et al. 2000). From this point of view the decentralized located renewable energy resources get a significant role, the biomass particularly (Tóth 2013).

In the past decades the utilization of inner resources of settlements got a less dominant role in practice of settlement development than the substitution of missing resources form outside of the region. However in many instances the attraction of external investors and acquisition of significant assistances not generated sustainable developments in long term (Czene-Ricz 2010). The redistribution of resources contributed to deprivation of resources in the peripheral

regions with weaker ability to enforce interests and these regions have not remained possibility to start new local initiatives.

One of the fundamental principles of local economic development contains that the inhabitants of rural regions regulate one's life to local circumstances and take purchase on inner resources of their regions in the higher degree. The local economic development is a conscious local community intervention into economic processes in favour of sustainable local development. Beside the economic effects these interventions emphasise the producing of positive social and environmental effects (Lengyel 2010). For this reason the approach of local economic development is involving multiple actors and considers equally economic, social and environmental aspects. In this approach the local economic development focuses on utilization of previously utilised but nowadays unutilised or underutilised local resources which claim the application of new instruments according to the actual economic and social circumstances (Nagyné Demeter et al. 2012). The solid biofuels possessed a significant role in energy production in the past centuries but not within the present-day technologies and the socio-economic frames.

In other countries, especially in Germany there are increasing discussions and calls for shifting towards 100% renewable energy. The German Competence Network for Distributed Energy Technologies lists more than 120 municipalities that have committed to reaching 100% renewable energy and approximately 50 municipalities have already reached this goal in 2012. These municipalities utilize different renewable energy resources and installed biogas plants, wind turbines, solar power plants and geothermal heat and electricity generators. There are three forms for finance the renewable energy projects. The invested capital was raised by the municipal-owned company, an external investor or the capital was mobilized by making the citizens investors (Busch-McCormick 2014).

The aim of the study was to explore the potential significance of renewable energy based energy production among local economic development activities in the circle of municipalities. Within this subject the energetic use of solid biomass got an emphasized role. In relation to redemption of fossil fuels the majority of self-governments consider the possibility of change and use biomass. However the trade press gave information about numerous unsuccessful attempts and the bankrupt of several specialized enterprises in the past years. In long term the most significant obstacle of biomass utilization could be the availability of biomass resources in appropriate amounts. The increasing number of retail consumers enhances the competition for biomass resources.

Material and Methods

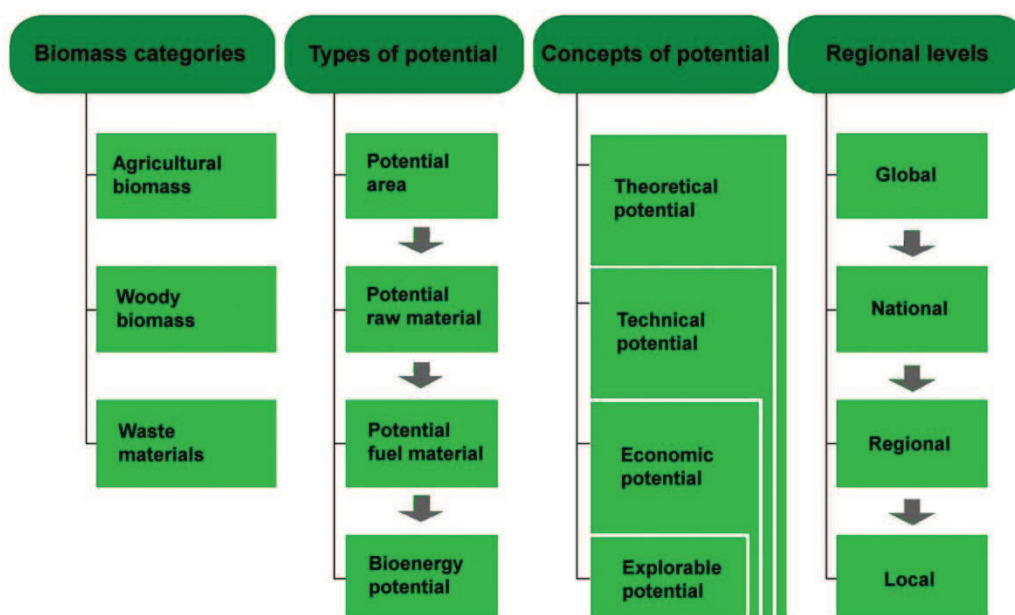
For the preparation of study I used the results of short case studies published earlier, the experiences of study tours in Hungary, Germany and Austria and statistical data published by Hungarian Central Statistical Office (2003-2012) and information about projects supported by the EU and published by the Hungarian Government.

The large number of biomass producers and consumers and the limited quantity of resources necessitates the knowledge of biomass potential in the territory of the settlement and the small region for the concerned self-governments (Figure 1). The stable and sustainable exploitation of this potential infers the mutual knowledge and cooperation among the significant actors of the local and regional market.

The biomass includes the vegetation of forests and meadows, the agricultural products and by-products, the aquatic vegetation, the manure, the sewage and the organic elements of garbage dumps (e.g. scraps of food). The volume of organic matter produced by plants is named primary biomass production. The main and by-products generated in stock-farming compose the secondary biomass production thanks to the animals which consume the plants. The organic matters originating from processing industry and community activities are named tertiary biomass production. The secondary and tertiary biomass production has a great potential in a few settlements, but widely the solid primary biomass (especially the woody biomass) is utilized for energy production. At the same time the sustainable usage of biomass resources postulates the knowledge and planned utilization of the combination of the three type of biomass production (Láng 1985, Szendrei 2005 & 2008).

Figure 1

Biomass potentials form different point of views



Source: Schubert et al. 2012.

Results

The role of solid biomass in the Hungarian energy production

The renewable energy sector of Hungary is mostly known by the determining share of biomass sources (83 percent in 2010). Beside the biomass the significance of geothermal energy utilization is considerable on international scale (Koncz 2008). The solid biomass received a distinguished role in fulfilment of obligations towards European Union for enlargement of renewable energy utilization. Thanks to this process the proportion of biomass in the total Hungarian primary energy production increased from 4.5 percent (in 2003) to 12,2 percent (in 2012) accordingly to the data of HCSO.

Thanks to the large coal-fired heat power stations the solid biomass came into primary position not only in generation of heat-energy but in generation of electricity. The coal-fired heat power blocks switched over to mix heating. These power stations burn the coal and the biomass together. The proportion of electricity produced based on renewable energy resources

increased from 1.1 percent (in 2003) to 4.6 percent (in 2006). This value was one percentage point higher than the obligation towards EU until 2010. However the utilization of large volume biomass was combined with low efficiency and lack of substantive rural development impacts. The small sized and effective utilization forms have a clearly larger social benefit and acceptance. The further rapid improvements are still restricted by nature conservation considerations the first place. The causes of these considerations are the pressure putting on natural forests and pollution induced by the transport at great distances. The solution of this problem is the operation of decentralized power-plants in small regions or settlements (Balcsók-Koncz 2009, Láng 2009).

As well as in the case of large consumers the interest for energetic utilization of solid biomass is increasing in the circle of retail consumers too. The proportion of firewood in the energy consumption of the Hungarian households was about 5 percent in the mid 90's that increased to 7 percent till 2007 and the significance of firewood surpassed the significance of district heating. The proportion of firewood using households was 20 percent in 2008, but this proportion is more than 40 percent in the case of villages. The change was caused by the increasing price of natural gas. Natural gas heating is available in 2874 settlements of 3154 members' settlement network of Hungary. The number of consumers is 2 762 644 and concerned the 63.4 percent of the housing stock. The quantities of gas supply per average domestic user show a significant standard deviation among the settlements that relates to the efforts of people to reduce or take out the gas consumption. The primary instrument of reducing the gas consumption could be the utilization of solid biomass. On the basis of financial considerations the suitable materials could be the agricultural wastages (e.g. bale of straw, vine-shoot). However from point of view of convenience the agglomerated biomass products can be a competitive accomplishment for heat supply of households (Durkó 2013).

The role and opportunities of local governments in energetics

The scopes of utilization of traditional fossil fuels in most cases point beyond the authority of local governments. Conversely the utilization of renewable energy resources and extraordinarily the utilization of solid biomass are possible at local level throughout the country. The limited volume of the biomass sources claims the long-term cooperation of the potential actors.

The rural development and the renewable energy sector have several common objectives: increase of income generating ability of the settlements, creation of new workplaces and business opportunities, establishment of innovations, strengthening the local communities and assuring affordable energy for local people (OECD 2010).

The local governments can undertake a more significant role in heat production, since the heat supply is connecting to the individual settlements, while the networking of electricity supply demands at least micro regional cooperation. The different size of settlements assures different opportunities for biomass utilization. The volume of biomass per head is larger in the settlements characterized by low population density. However in the larger city an opportunity presents for switch the supply of district heating of housing estates from natural gas to biofuels (e.g. Komló, Miskolc, Szolnok). If the heating plant is located close to the city centre that indicates significant logistic and environmental problem. The total logistic costs are the highest in the case of direct supply that is justified only for shorter distances (1-3 km) (Tégla et al. 2012). The only one brand new district heating system based on biomass was

built up in 2005 in a small village called Pornóapáti that has barely more than 400 inhabitants (Table 1).

Table 1

The proportion of dwellings connected to district heating systems in different population categories of settlements in Hungary

Settlement categories based on number of inhabitants (head)	Number of settlement	Number of settlements having district heating system	The proportion of dwellings connected to district heating in the concerned settlements (%)	Average quantity of heat per dwellings (GJ)
0-2000	2404	1	56,1	23,3
2000-5000	478	9	24,5	39,8
5000-20000	213	40	20,6	33,9
20000-50000	40	30	24,3	33,6
50000-207594	18	16	35,6	27,6
Budapest	1	1	26,5	36,1
Total	3154	97	28,5	32,2

Source: own construction, based on HCSO, 2011.

In the budgetary period between 2004 and 2006 the Environmental Protection and Infrastructure Operational Programme (the Hungarian abbreviation is KIOP) of the I. Hungarian National Development Plan afforded possibility for local governments to realize energetic developments. Within the frame of action called “Environment-friendly development of energetics” (KIOP 1.7) 18 winner applicants received circa three billion forints for development of renewable energetic infrastructure all over the country.

Between 2007 and 2013 the 4th priority axe of Environment and Energy Operational Programme (the Hungarian abbreviation is KEOP) helped the enlargement of utilization of renewable energy resources. The support of energetic biomass use had got a primary role among the operations of this priority axe. The amount of financial assistance was multiple than in the former budgetary periods. Large volume investments were realized or started on the basis of energetic solid biomass utilization thanks to this financial assistance in Balassagyarmat, Szolnok, Komló, Kapuvár, Miskolc, Salgótarján, Mohács, Solt and Kalocsa. The investments were usually executed by enterprises in majority ownership of the local governments. In the most cases the connecting communal network was built up and the change of boilers was the essential part of the investment. The numbers of Greenfield investments are tiny, but Solt previously not possessed district heating system. Only Salgótarján received assistance to establish a low power connected heat and electricity producing power station (12,5MW+24MWth) on the basis of biomass. Moreover several smaller developments were realized in communal institutions and in company seats of enterprises. The energetic utilization of biomass was combined with utilization of other renewable energy resources in many cases.

The development of regional cooperation for utilization of renewable energy resources

The energetics in the past years has got significant role among regional management questions too. Regional energy agencies were formed at NUTS 2 level, which were focusing on utilization of renewable energy resources, but the activity and successfulness of these agencies were not similar. Renewable energy strategies were compiled at level of NUTS 2 regions, but the effects of these strategies were small on market actors (L. Gergely 2010).

The county level (NUTS 3) between 2007 and 2013 has got a less important role in regional policy of Hungary. From 2014 the counties have greater important, because based on the act CXCVIII of 2011 about modification of certain acts connected to regional development and regional planning the county is the most important unit of regional development. The regional development programmes of numerous counties emphasize the significance of renewable energy resources in transition to a green economy. At NUTS 4 level the operations of multifunctional association of small regions were primarily limited to reorganization of a public-utility services and common maintenance of institutions. The numbers of development activities were minimal. The LEADER local action groups had the opportunity to support the micro-enterprises in which several biomass projects were interested (e.g. buying new power-machines, building storage for wood chips, configuration of bio briquette plants). The settlements realized mostly independent investments. In the last years the START Public Works Program provided major role for value adding activities, in which the utilization of biomass of public spaces are included that generated microregional co-operations in some cases. In Hungary there are not regional organizations specializing in utilization of energetic biomass or renewable energy resources at all, but there are associations or occasional cooperation's that target these objectives.

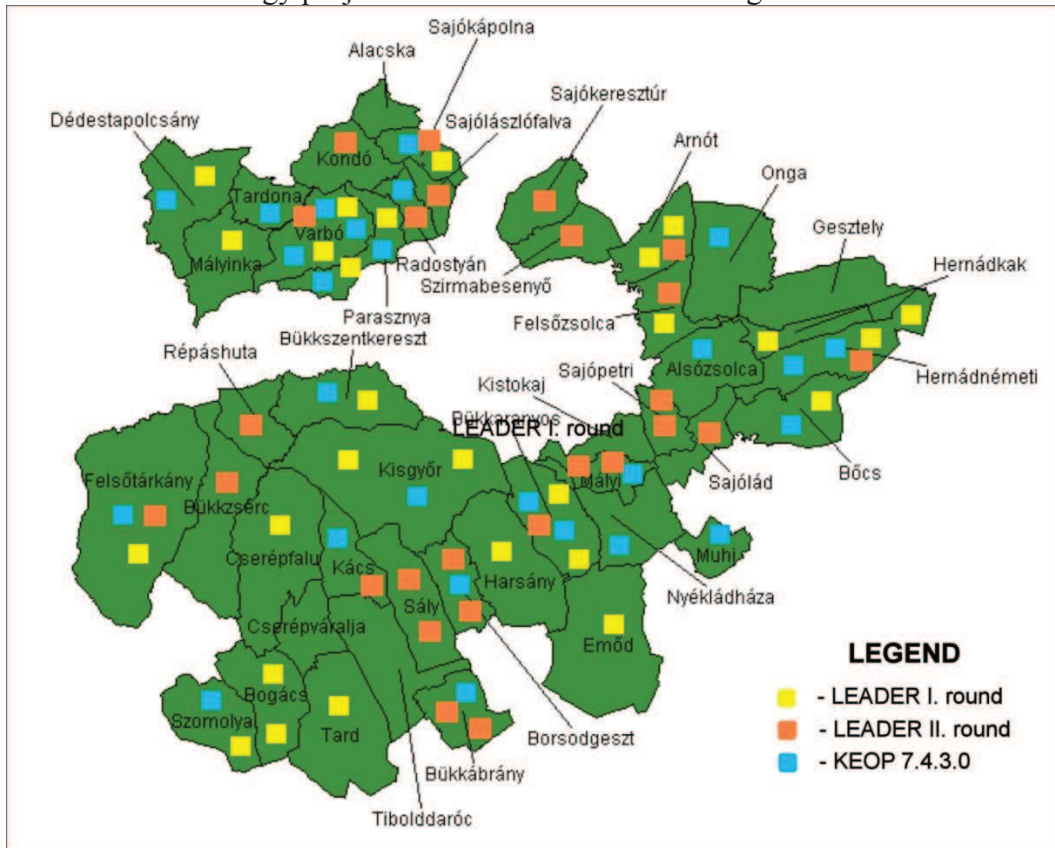
The role of LEADER local action groups in development of cooperation of energetic purposes

In Hungary 96 LEADER local action groups were formed for the management of rural development assistance in collaboration with Agricultural and Rural Development Agency. The area of local action groups in certain cases is equal to a small region in other cases the territories of a local action group extend to the area of two or three small regions. These local action groups possess specific rural development strategies that were the base of distribution of financial assistances ordered to 3rd and 4th axis of the New Hungary Rural Development Programme. The Bükk-Region LEADER LAG offered a unique opportunity for energetic investments in Hungary. The energetics got a distinguished role in the strategy of this LAG and 52 renewable energetic investments were supported form two rounds of LEADER grants. Two biomass furnaces were put in operation and several solar energy utilizing devices (Figure 2).

The aim of LEADER-programme is the connection of actions made in favour of rural economic development. Two of five main objective of Bükk-Region rural development community are closely connected to utilization of renewable energy resources that opened an opportunity to intensify regional energetic cooperation and realize renewable energy investments. About 61 percent of LEADER grants were devoted to development 27 energy yards of village communities between 2008 and 2012. The LAG successfully participated in renewable energy based regional development competition of Environment and Energy Operational Programme in 2011 that made further investments and cooperation possible.

Figure 2

Renewable energy projects in settlements of Bükk-Region LEADER LAG



Source: Local rural development strategy of Bükk-Region LEADER LAG (2008-2013).

Bioenergy regions in Germany

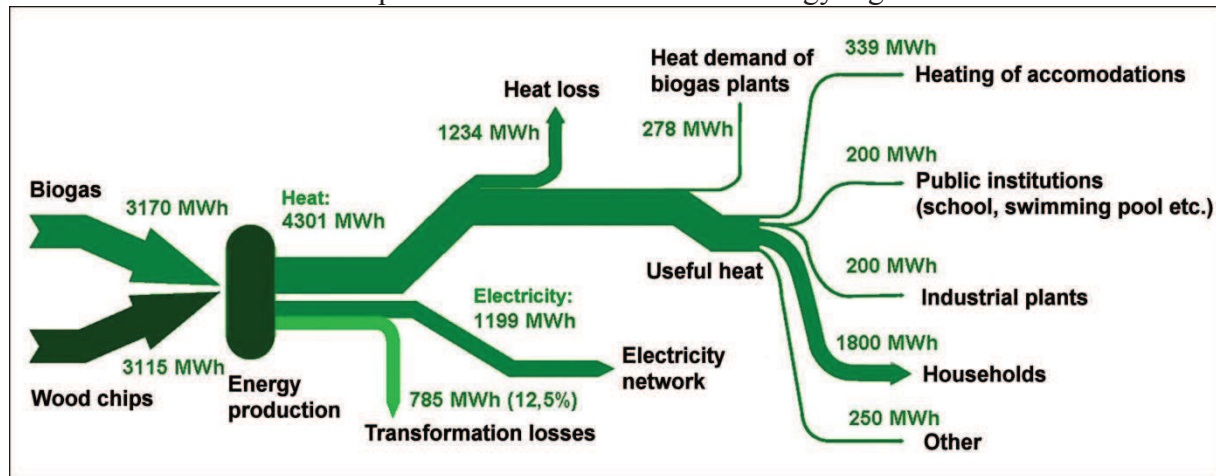
In certain regions of Germany the settlements are in more favourable position when local communities would like to realize developments for energetic utilization of biomass. In the 23 active bioenergy regions addressed grants are available for this purpose. In 2008 a competition were announced for establishment of bioenergy regions. 201 regions submitted an application and 25 winner were chosen on the basis of the own bioenergy regional development concept. For the detailed elaboration of development objectives the bioenergy region has got 400 thousand euros in the next three years. In the best performing bioenergy region 30 million euros investment were realized in the renewable energy sector. The bioenergy initiatives serve different objectives such as climate protection aspects, increase the utilization of inner resources of rural regions, increase the employment rate, and counteract the deprivation of incomes and invested capital from the region (Schubert et al. 2012).

Beside the “hard” results the German experts consider the “soft” results very important too, such as mobilization and networking of potential actors, exchange of experiences, dissemination of innovative methods, and implementation of model developments. The energetic utilization of biomass supported by detailed surveys, development plans and advisory network. The bioenergy regions cooperate with the other actors utilizing renewable energy resources as well as actors in agriculture and silviculture. The activities within the sector are well-organized. The participants of investments are not only local governments and singular enterprises, but also a wide range of local actors together with non-governmental

organizations and individuals. The energy production based on solid biomass and biogas well complement each other at local and regional level (Figure 3).

Figure 3

Example for material flow of a bioenergy region



Source: Schubert et al. 2012.

Conclusions

According to the legal regulations in Hungary the energy supply is not an obligatory task for local governments. Following the local economic development guidance's they make efforts to reduce the dependence from external actors and get the local actors into better position in the field of energetics. In achievement this purpose the solid biomass has an emphasized role among the renewable energy resources. The more significant investments connected to the infrastructure built up earlier. The number of complex Greenfield projects is smaller but will surely enlarge in the future. According to the growing number of biomass consumers the exact knowledge of explorable potential and cooperation of the actors becomes more important in favour of long-term financial and environmental sustainability. The local governments need to know properly the own potential and at the same time regional advisory network is needed to help their work to avoid the conflicts with actors within and outside of the biomass sector.

Comparing the Hungarian to the German situation it can be stated that the energetic utilization of the biomass mobilizes major capital expenditures in the examined German regions and the sector is better organized. The professionals of biomass based regional or local co-operations focus only on energetic use of solid biomass and biogas. They not handle other renewable energy resources or other affairs that require regional cooperation. The projects are well prepared from environmental and economic point of view and the opinion of local people is thoroughly explored. In Hungary the majority of municipalities are in the beginning stage of energetic biomass utilization, and the local and regional co-operations among economic and administrative actors are missing or incidental. Among the Hungarian municipalities the solid biomass has almost exclusive role while in Germany the biogas has remarkable importance. In Germany the local actors have the opportunity to participate in the biomass projects not only as consumer but also as investor. The bioenergy plants serve the heating supplies not only for a single building of public institutions, a residential estate or a greenhouse but a complex system of local consumers.

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Author

Gábor KONCZ (PhD)
associate professor
Károly Róbert College
Institute of Agricultural and Environmental Sciences
36. Mátrai str, Gyöngyös, H-3200
konczg@karolyrobert.hu

