



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

THE IMPORTANCE AND PUBLIC ACCEPTANCE OF BIOMASS AND “GREEN ENERGY”– THE EXAMPLE OF AN UNDERDEVELOPED HUNGARIAN REGION

A biomassza és a zöld energia jelentősége és társadalmi elfogadottsága – egy fejletlen magyar térség példáján

BUJDOSÓ Zoltán¹ - PATKÓS Csaba² - KOVÁCS Tibor² - RADICS Zsolt³ - BAROS Zoltán⁴
- DÁVID Lóránt¹

¹Károly Róbert Főiskola

²Eszterházy Károly Főiskola

³Debreceni Egyetem

⁴NKEK Nemzeti Környezetvédelmi és Energia Központ Nonprofit Kft

Összefoglalás

A biomasszából származó energia jövője a globális (nemzeti, regionális és helyi) energiarendszerben számtalan tényezőtől függ, többek között a helyi társadalom megújuló energiaforrásokhoz való viszonyulását, beleértve a biomasszát is. A tanulmány egy Magyar példán keresztül foglalkozik a biomasszából származó energia hasznosítási lehetőségeivel valamint a hasznosítás társadalmi aspektusait, elfogadottságát vizsgálja egy alulfejlett térségben. A kutatáshoz az adatgyűjtés kétféleképpen zajlott. A primer kutatás kérdőíves vizsgálatot jelentett, amely a helyi társadalom megújuló energiákra vonatkozó elfogadottságát mérte, míg a szekunder adatgyűjtés különböző szervezetek adatait használta fel.

A kutatás eredményei alapján elmondható, hogy a biomassza hasznosítása, az egyes megújuló energiaforrásokhoz való hozzáállás a helyi társadalom részéről vegyes képet mutat, leginkább függ regionális és helyi szereplők összefogásától illetve a helyi szerveződések erejétől.

Kulcsszavak: Biomassza potenciál, Heves megye, társadalmi aspektusok, társadalmi elfogadottság
JEL kód O 13

Abstract

The future of biomass energy in the global (national, regional and local) energy system depends on many major factors, among others on the attitude of society to the renewable energy resources including the biomass energy. The paper deals with the analysis the opportunities of utilization of biomass energy sources giving example of a Hungarian study area furthermore to study the social aspects and public acceptance of biomass in a certain underdeveloped region. Data collection has carried out by two ways. Primary data collection meant questionnaire survey on the public acceptance of renewable energy sources, while during secondary data collection data were collected from institutions (village-masters, offices of the micro-region, the Agricultural Agency of Heves County, census of vine-lands and orchards by the Hungarian Central Statistical Office [KSH], Hungarian National Forest Service, and institutional statistics). According to our research the importance of biomass energy in the global, national, regional and local energy systems depends on many major factors, among others on the attitude of regional and local society to the biomass energy and the renewable energy resources.

Keywords: Biomass potential, Heves County, social aspects of biomass, public acceptance

Introduction

The shift towards renewable energy forms is an inevitable part of strategies trying to mitigate the challenges coming from climate change. Different types of biomass have been important energy resources for thousands of years (COYLE 2007, HADIYANTO 2012). Recent scientific and technological innovations made possible the exploitation of these traditional resources in many ways. First of all studies state, that biomass should be used to a greater extent in the supply side of energy market (INGERSON 2009). Biodiesel and bio-ethanol are expected as possible descendants of fossil fuels (HALL 1997, COYLE 2007). Nevertheless the issue is far broader than the realm of useful arts (SHADEEM 2009). Accordingly it is very important to evoke discourses not only on economic questions, but on natural and social issues as well (SCHEER 2007). These issues are far too important to deny them. Proposals to answer these crucial questions are born at global, national, regional and local level. Globally the United Nation's FAO has coordinated many programmes concerning bioenergy (e.g. Bioenergy and Food Security Criteria and Indicators (BEFSCI) Project or the FAO Support Package for Decision-Making for Sustainable Bioenergy: Making Bioenergy Work for Climate, Energy and Food Security). The FAO is the institution that has the ability to co-ordinate sustainable energetically utilized biomass projects worldwide. (HOOGWIJK et al. 2005; SCHEER 2007).

The future of biomass energy in the global energy system depends on many major factors, among others on the attitude of society to the biomass energy and the renewable energy resources (HUBERL et al. 2007, CHRISTOPHER et al. 2007, TAKÁCS et al. 2012, TÉGLA et al. 2012). The importance of local community in the utilization of biomass energy was researched by many authors (BAI et al. 2002, PÉNZES et al. 2005, TAKÁCS-GYÖRGY K, TAKÁCS I 2013, TÓTH 2013).

We think that one of the most important factors is the local community as inhabitants can benefit the advantages of biomass energy but locals suffer its backwards. That means the increasing importance of the society which gave to us the idea to study this topic

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). The issue of the renewable energy is a topical question in the European Union and new objectives are estimated.

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 35% of its area covered by forest while agricultural area also accounts for around 40% (BUJDOSÓ et al., 2012).

The aims of this analysis were:

- to predict the potential renewable energy of the Eger Micro-region
- to research the possibilities of using renewable energy sources (RES) in an underdeveloped region and
- to research the social background of the (possible) utilisation of RES in the Eger Micro-region
- to study the public acceptance of the RES in the region and the attitude of local actors to the utilization of biomass energy

Methodical procedure

Data collection has carried out by two ways. Primary data collection meant questionnaire survey on the public acceptance of renewable energy sources, while during secondary data collection data were collected from institutions (village-masters, offices of the micro-region, the Agricultural Agency of Heves County, census of vine-lands and orchards by the Hungarian Central Statistical Office [KSH], Hungarian National Forest Service, and institutional statistics). In order to research the social background of the utilisation of RES, questionnaire surveys were conducted for the designated target groups (inhabitants) in the study area. The study aimed to explore the general knowledge, innovative attitude, acceptance and willingness of application as well as the estimation of the benefits of the use of RES within the inhabitants.

To conduct this study, random sampling was applied for following number of units: inhabitants: 17 settlements of Heves County – 505 units. Below, results of the survey carried out for the target group will be summarised.

The main segment of the questionnaire compiled for inhabitants contains questions on renewable energy sources. First, we intended to obtain information on the type of RES the pollees had already heard anything at all (Figure 2). In this respect, according to the responses given, solar energy, wind energy and hydro-power (with a general knowledge exceeding 90%) proved to be the most well-known. The share of those had not heard about any of these technologies is only 1.4%.

Description of the analysed region

Heves County is located on the northern part of Hungary with very good connection to the largest cities of the country. It is a rural area with small villages where the energy production could be served by renewable sources.

The spatial (geographical) unit of this study is the Eger Micro-region consisting of 14 settlements, i.e. in addition to the Town of Eger, 13 villages (Figure 1). 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.

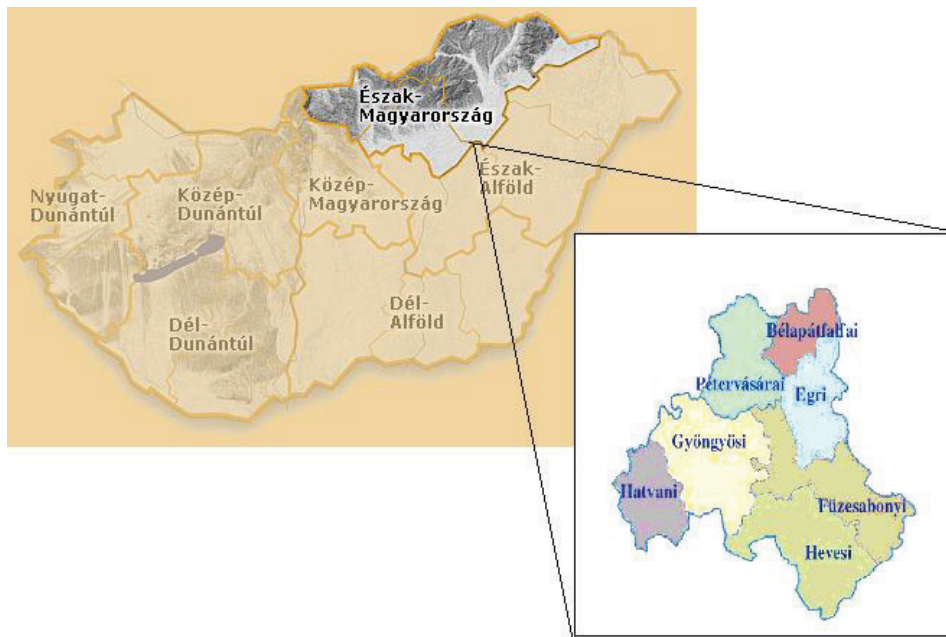


Figure 1: The broader environs of the Eger Micro-region

The area of our research

The area was designated for research as: Micro-regions are the places of bottom-up regional cooperation as well as are the smallest spatial units of development policy.

Results

Basis for agriculture and forestry in the Eger Micro-region

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 timber 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 Bükkháza 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 Bükkháza region, predominated by less jointed, southern slopes, traditions for viticulture and fruitery date back for centuries. Adjacent to the wine region of Eger with its high-quality red wine, vine is also grown at the Bükkháza, however primarily for the purpose of champagne production. To the south, vineries and orchards are replaced by plough-lands.

Biomass potential in the Eger Micro-region

Based on the above, the biomass potential annually generated in the Eger Micro-region 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 1).

Table 1. The aggregate biomass potential of the Eger Micro-region

<i>Biomass source</i>	<i>Energy potential (GJ)</i>
Wine-branch	80 000
Cuttings of fruit-trees	5500
Field crops	115 000
In total	250000

Source: Gergely S., 2005

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 Eger Micro-region is 112 460 bm^3 , of which 46457 tonnes of biomass can be planned (GERGELY 2005). 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.

Public acceptance of renewable energy sources in the study area

The knowledge on various bioenergy-related technologies can be regarded in general as moderate. Only somewhat 20% of the respondents had heard about short-rotation forestry, whereas biobriquette has a knowledge of 22.6% and bioethanol has nearly 25% – by this, them being the least well-known after photovoltaic technologies. On the contrary, knowledge on biogas, biodiesel and the combustion of biomass exceeds 40%.

The ratio of those obtaining at least basic knowledge on renewable energy sources indicates a similar tendency however with significantly lower values. Although many of the pollees have a rather explicit knowledge on these technologies, this fact is not indicated by the overall picture.

As the source of information, 85.74% of the pollees indicated television or radio, this figure followed by 61.78% of the press with far ahead all other categories. By this, our supposal according to which they are the primary channels of the spreading of information is seemed to be proven; apparently, it is also contributed by the low number of Internet connections. Nevertheless, the important intermediary role played by them is clearly drawn. In addition to this, the role of education can be mentioned, with especially the fact strongly emphasized that it should be strengthened at secondary school level.

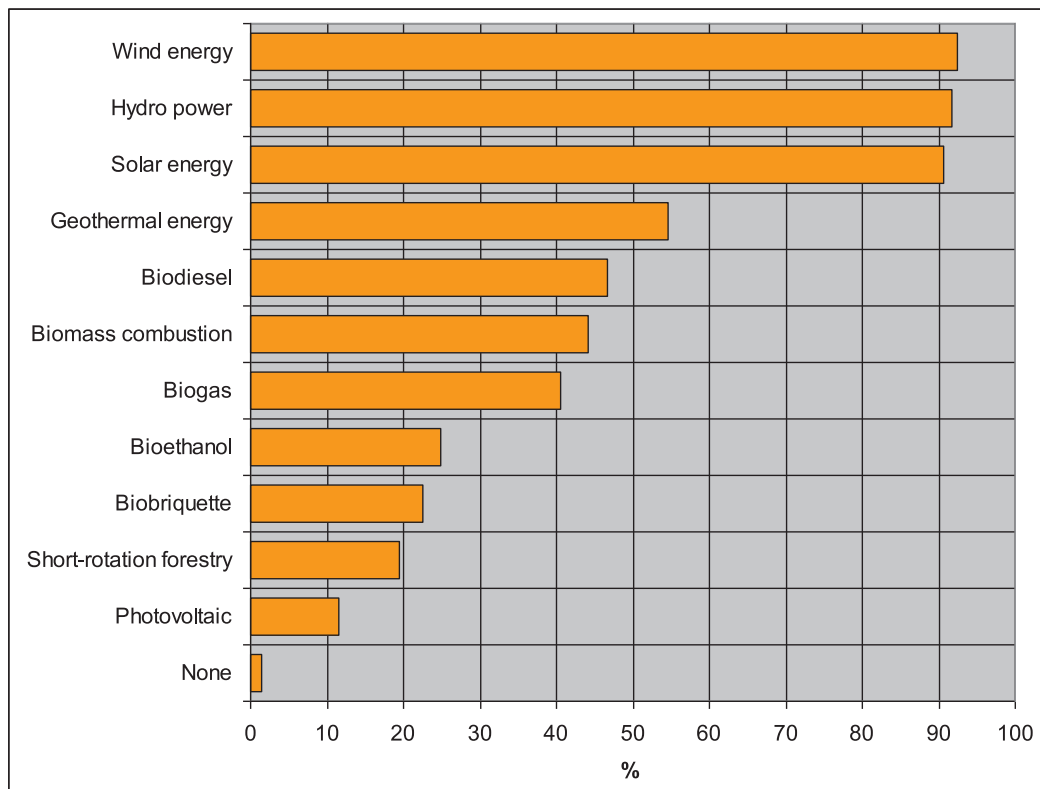


Figure 2. The general knowledge on renewable energy sources among the citizens (in percent); n=505

Source: own data

Among the most important benefits in relation to the use of RES, environmental aspects proved to be the most relevant (87.72%) (Figure 3). The respondents are, apparently, aware of the non-polluting nature of RES as well as of the fact that by the use of these technologies, cheaper energy compared to fossil energy sources can be produced (60.79%). Following this aspect, the possibility of local energy production was indicated by the most pollees (44.55%). Other options – making use of agricultural areas of poor quality, the improvement of employment, etc. – represent more or less similar percentages (ca. or under 20%). Knowledge on the funding available (e.g. funding demandable form municipalities, energy efficiency or energy saving programmes) is minimal.

In the final section of the questionnaire, the inhabitants were asked about the realisation of a hypothetic installation utilising RES, in connection to whether it would be supported and if yes, on what way and degree, what organisation should take the role of initiator, whether the settlements or those involved would benefit from such investment and whether such an installation would be accepted in the environment of the residence.

The share of those opposing this type of investments has proved to be rather significant (approximately 25%) despite which openness was experienced towards such new technologies. Half of the respondents offers primarily no-financial support. The share of those offering financial contribution to the establishment of such installation remains under 10%.

Regarding financial contributions, the results indicate that inhabitants intend to make contributions in order to establish such an installation primarily by the taxes paid (36.24%).

The share of those who do not intend to devote any sum on such purpose is rather considerable (44.75%).

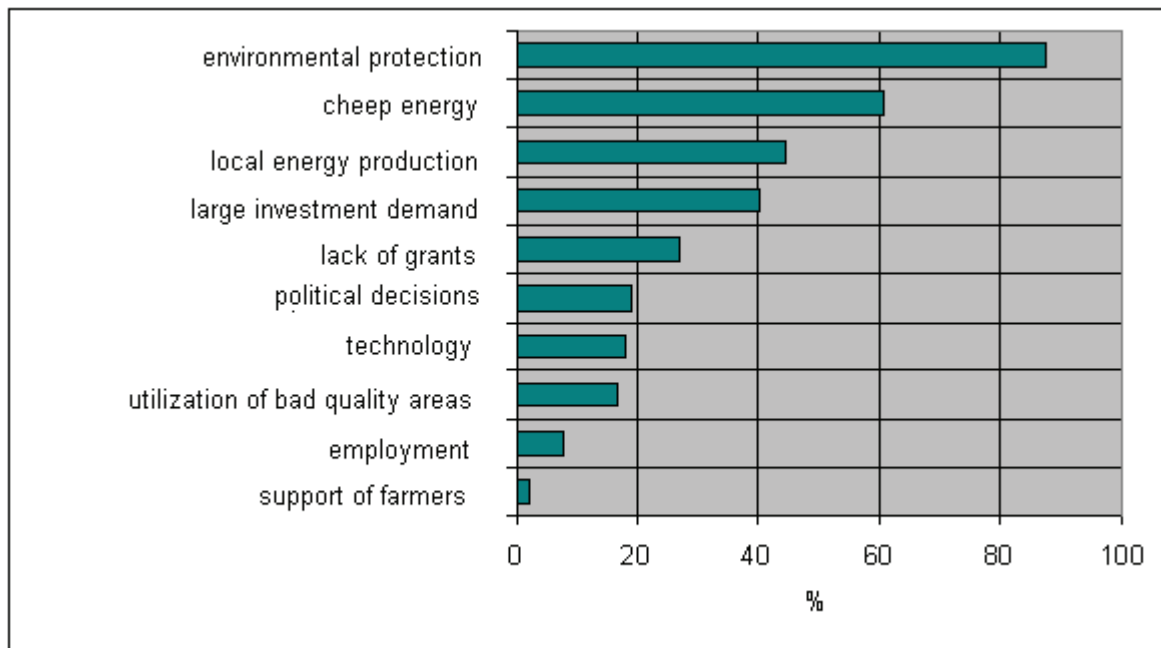


Figure 3. Benefits in relation to the use of RES n=505

Source: own data

The role of initiator (Figure 4), considered to be necessary to such projects, is put on by nearly 80% of the pollees to the central government. The relevance of regional institutes and municipalities of the settlements within the county remains moderate (40%). Far behind of these are all other responses giving such role to other potential actors, as e.g. civil organisations, entrepreneurs, among others.

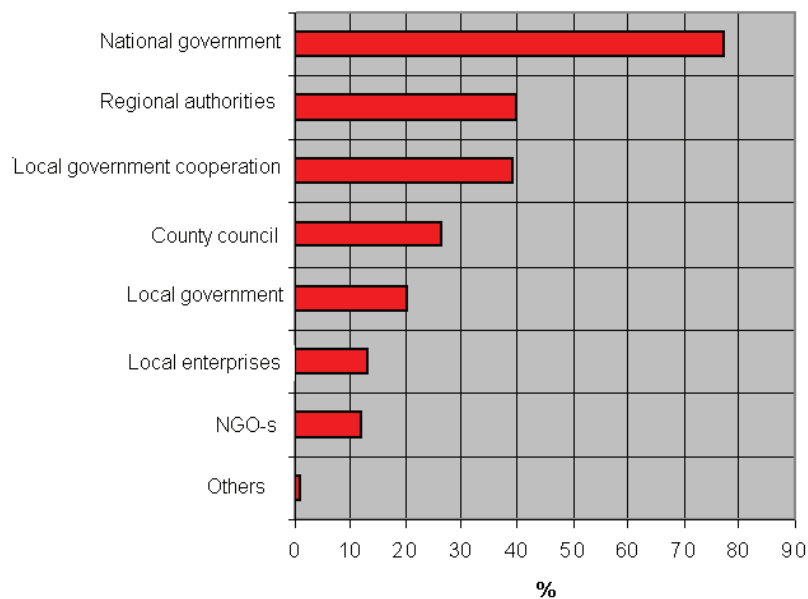


Figure 4. The role of initiator, considered to be necessary to RES projects (%) n=505

Source: own data

On the judging of benefits of an RES-related development on the level of settlements it can be claimed that about half of the inhabitants are aware of the fact that an installation to be implemented would not only bring environmental (cleaner air) but also socio-economic benefits (increasing tax revenues, creation of jobs). Only 11.68% thought that an investment of this kind would prove to be disadvantageous.

A similar picture is drawn for the benefits on the level of individuals, however socio-economic benefits for the inhabitants are recognised by significantly less (23.17%) than in the previous case.

No significant opposition was experienced against a RES project to be implemented in the neighbourhood of the residential area, only four of the respondents claimed to disapprove any of this kind of installations. The lowest number of those with support to these investments would approve a biomass-based heat power plant or a smaller hydro-power plant. The low rate of support for this heat power plant is due to the opposition against chimneys and smoke and dust not to the wood as raw material. Installation related to the use of wind and solar energy, among them especially solar cells and wind wheels enjoy much greater support.

Before knowing the opinion of the interviewed entrepreneurs in agriculture, we have found it important to introduce an objective index: the characteristic size unit. As it can be seen, in the case of more than half of the interviewed, the size of the own property land is between 0-4 or 4-8 hectares (Figure 5). Unfortunately, this type of fragmented land size is typical in Hungary and from the point of view of energy plant growing is definitely disadvantageous.

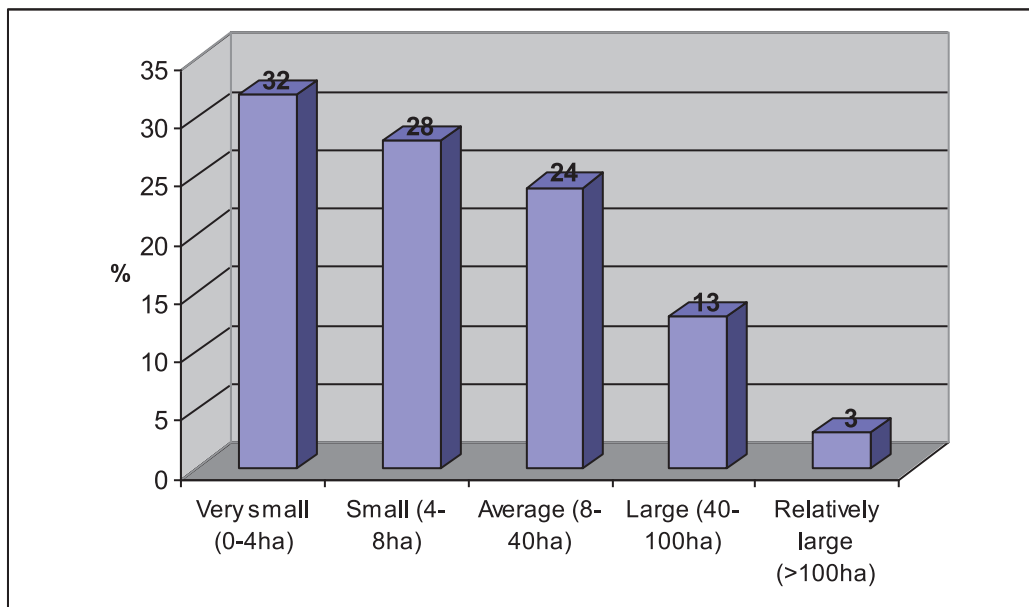


Figure 5: Size of the own property land of the interviewed farmers (%) n=505

Source: own data

For the interviewed farmers it is true that most of them heard of solar energy and wind-power (over 80% of familiarity). The familiarity of the bio-energetic branches is rather diverse (e.g. bio compressed slack 39%, biomass burning 74%), but all in all this result is positive. Wider familiarity can be explained by better professional concern of the farmers, as they show more interest in receiving information and they are more inquisitive concerning bio-energetic sources. This predicts a higher level of the acquired general knowledge compared to a directly less concerned consumer layer.

The rate of those using the mentioned technologies on their farmland is far behind. The highest rates (8-8 person) were shown referring to solar energy and burning biomass in boilers.

Then, stockbreeders were asked about the blocking factors of the generated secondary biomass (animal by-products) they can mention on their farmland as regards its energy utilization. As it can be seen from the answers, the two most important factors were the lack of subsidies and the uncertainty of the outlets (17-17%). The remarks concerning the lack of necessary knowledge and unformed technologies were also regarded important (Figure 6).

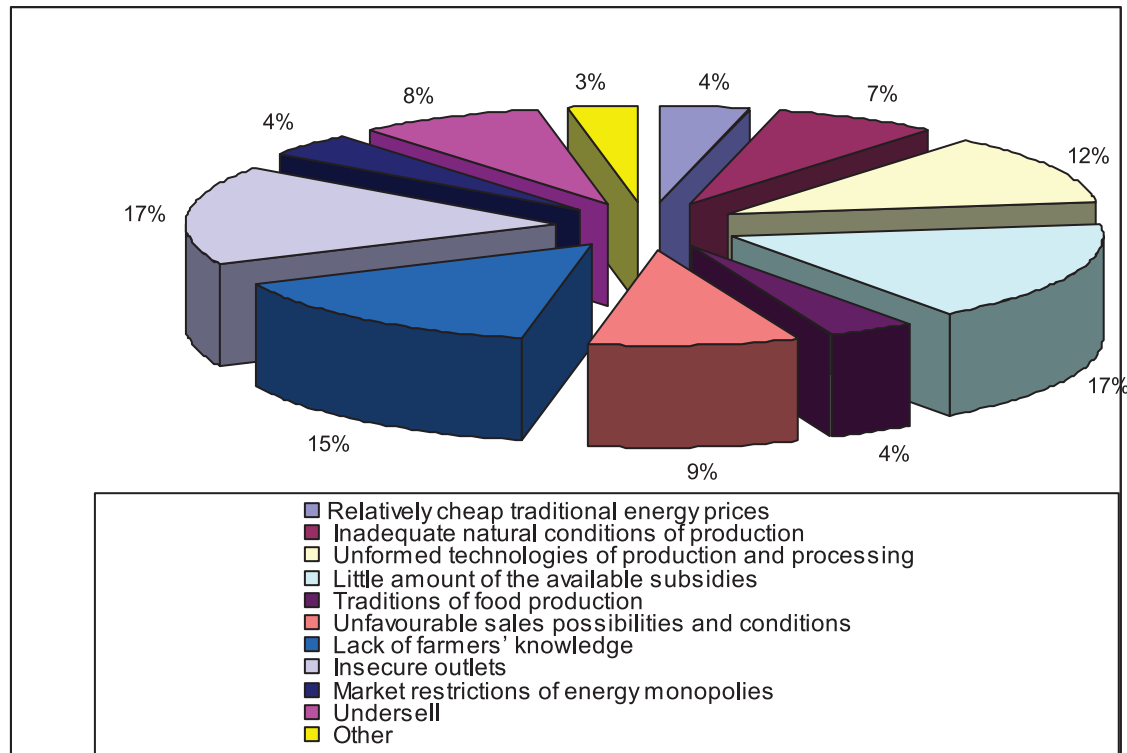


Figure 6. Factors blocking the energetic utilization of by-products generated from stockbreeding according to the interviewed farmers (%) n=505

Source: own data

The study made among plant growers has revealed what blocking factors can be found in agricultural production, rather in the potential production of energy plants according to the farmers most concerned.

As a result we can state that one of the firmest blocking factors is again the lack or insufficiency of necessary subsidies, yet the lack of adequate knowledge can be found on the very first place. Besides, similarly to the above mentioned, farmers concerned in this branch have to face the insecure outlets, unfavourable sales possibilities and technologic conditions as well. When mentioning these fears and blocking factors from the point of view of the farmers, it highlights the main issues emphasized by experts, too, i.e. the necessity of establishing the infrastructure and the production-technological background, providing the information database and the professional background of the information-service system, mostly in counselling, in forms of co-ordinator contribution.

The aim of the following group of questions in the questionnaire was to know if respondents have ever tried to grow plants from energetic point of view. Based on the potential answer alternatives, we created three characteristic segments according to the survey results.

The vast majority (67%) have not done such an activity before, only few of them (22%) would be willing to try it under certain conditions (Figure 7).

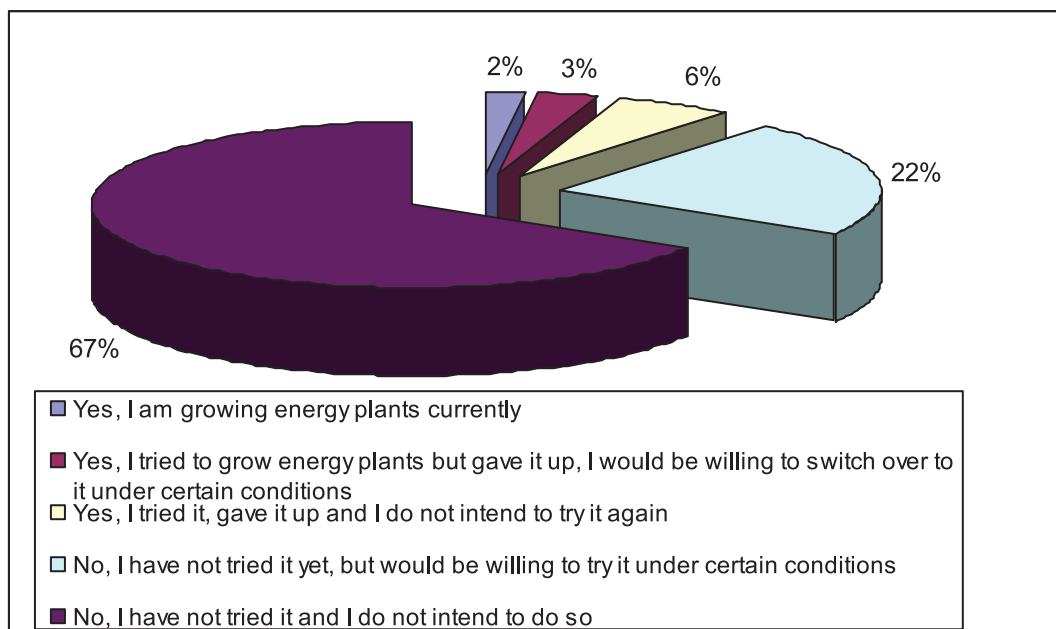


Figure 7. Approach to energy plant growing (%) n=505

Source: own data

The opinion of those having tried to grow energy plants, stopped it but would be willing to switch over to it under certain terms and conditions and of those not having tried to grow energy plants, yet would also show willingness to the switchover under certain conditions can be especially important in the long run, as their affinity is relatively positive, regarding the given issue.

Studying the financial conditions of the switchover (on the basis of the available own resources and subsidies), we can say in general that farmers would be willing to grow energy plants providing they were given a far higher amount of subsidy compared to their own resources. It means a smaller move towards the direction according to which the interviewed farmers are willing to or able to pay less for such investments, self-financed. They wish to cover most expenses using tender sources rather.

It can also be stated that the layer of the farmers whose approach towards energy plant growing is positive, wants to provide the energy supply mostly of their own household and estate. They would not undertake growing at larger scale or pre-processing even if other conditions were fulfilled.

Here we have to mention some previous results concerning the questions of organic waste, generated on the estate. The responses of the farmers show that most of them dig the organic waste back into the soil (32%). Many of them burn it in boilers (25%), transport it (23%), burn or compost it on the spot (24%). Those not collecting organic waste have four reasons to do so, almost equally (17-20%). There is no time to collect the waste, it is not profitable, there is nothing to do with it from technological point of view or it has not been collected before either. Similarly, stockbreeders use the generated animal by-product mostly for nutrient supply or producing solar energy. (Because of the low sampling rate real conclusions cannot be drawn).

Respondents with positive attitude were asked about the reason for going on farming like this. For this purpose we collected all those factors which can be motivating from this aspect. Energy plant growing is considered by experts to be the most perspective possibility of utilizing the otherwise out-of-use agricultural territory, emphasizing its multiplier effect. The low profitability of the food and feed producing agrarian economy, the unfavourable sales conditions one by one and altogether represent such a factor which enables to move towards an alternative kind of agriculture.

The future bioenergetics investment in the surroundings of the lands of the smallholders involved, projects a picture of a secure market among the farmers it is a highly motivating factor. The investment and the change of the region's farmers can serve as a positive example for others. If there have been models for it earlier, or the news of the successful investments of other regions goes round, it can have a positive influence on the way of thinking of the farmers concerned. It can also strengthen the willingness to switch over to energy plant growing.

Yet that raises the following question: what does the whole process of switchover require? (money matters, time consumption, etc). The more dramatic the change is, the smaller can be the willingness of the farmers. The following picture can be outlined based on the given responses:

The most motivating factor of the switchover can be the higher amount of subsidy (25%), besides, the appearing power plant would represent a more secure market (21%) according to the interviewed farmers. Further stimulation can be the low profitability of the economy together with the appearance of an integrator organisation supporting the production and sales process.

Conclusions

Biomass energy sources are the most promising, and most heavily subsidized renewable energy sources. The future of biomass energy in the global, national, regional and local energy systems depends on many major factors, among others on the attitude of regional and local society to the biomass energy and the renewable energy resources.

The knowledge on various bioenergy-related technologies can be regarded in general as moderate.

Furthermore among the most important benefits in relation to the use of RES, environmental aspects proved to be the most relevant

No significant opposition was experienced against a RES project to be implemented in the neighbourhood of the residential area, only four of the respondents claimed to disapprove any of this kind of installations

As a result we can state that one of the firmest blocking factors is again the lack or insufficiency of necessary subsidies, yet the lack of adequate knowledge can be found on the very first place.

To sum up we can draw from the analysis 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. 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.

References

- BAI A [2013] Simultaneous Energy- and Feed Production Based on Pig Sludge Journal of Central European Green Innovation 1 (1) pp. 11-20
- BAI A.-LAKNER Z.-MAROSVÖLGYI B.-NÁBRÁDI A. [2002] A biomassza felhasználása. Szakkönyv (Szerk.: Bai A.). Szaktudás Kiadó Ház Rt., Budapest, 225p.
- BUJDOSÓ, Z., PATKÓS, CS., KOVÁCS, T., RADICS, ZS., BAROS, Z. [2012] The Social Aspects and Public Acceptance of Biomass Giving the Example of a Hungarian Region Int. Journal of Renewable Energy Development 1(2) pp. 39-43
- CHRISTOPHER, B. F., CAMPBELL, J.E., LOBELL, D.B. [2007] Biomass energy: the scale of the potential resource Trends in Ecology and Evolution 23(2) pp. 65-72
- COYLE, W. [2007] The Future of Biofuels. A Global Perspective. Amber Waves 5(5) pp. 24-29
- GERGELY, S. [2009] Zöldenergia potenciál Heves megyében (Green Energy Potential in the County of Heves), Gyöngyös, Károly Róbert Kht 245 p. (second edition)
- HADIYANTO, SUMARNO, RUFAIDA NUR ROSTIKA, NOER ABYOR HANDAYANI [2012] Biofixation of Carbon dioxide by Chlamydomonas sp. in a Tubular Photobioreactor. Int. Journal of Renewable Energy Development, 1(1) pp. 10-14.
- HALL, D.O. [1997] Biomass energy in industrialised countries—a view of the future. For. Ecol. Manage. 91(2) pp. 17–45
- HABERL, H., ERB, K.H., KRAUSMANN, F., GAUBE, V., BONDEAU, A., PLUTZAR, C., GINRICH, S., LUCHT, W., FISHER-KOWALSKY, M. [2007] Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems. Proc. Natl. Acad. Sci. 104 (31) pp. 12942–12947
- HOOGWIJK, M, FAAIJ, A., EICKHOUT, B., DE VRIES, B., TURKENBURG, W. [2005] Potential of biomass energy out to 2100, for four IPCCsRES land-use scenarios. Biomass Bioenergy 29(2) pp. 225–257
- INGERSON, A. [2009] Wood Energy Options for the Mahoosuc Region. A Community Wood Energy Guide. The Mahoosuc Initiative 43p. Online http://www.mahoosucinfo.org/mah_bioenergy_final.pdf (25.04.2011)
- PÉNZES J. - TÓTH T. - BAROS Z. - BOROS G. [2005] A megújuló energiaforrások társadalmi támogatottsága a Cserehát területén. – In: A megújuló energiák kutatása és hasznosítása az Európai Unió országaiban. A Magyar Szélerenergia Társaság kiadványai No. 3. (szerk. Tóth T. - Baros Z. - Bíróné Kircsi A.), Magyar Szélerenergia Társaság és Debreceni Egyetem TEK TTK Meteorológiai Tanszéke, Debrecen. pp. 19-26.
- SCHADEM, C., PIMENTEL, D. (2009) Population crash: prospects for famine in the twenty-first century. Environ. Dev. Sustain. 12(2) pp. 245–262
- SCHEER, H. [2007] Energy Autonomy. The Economic, Social and Technological Case for Renewable Energy. EarthScan, London. Sterling, V.A. 321 p.
- TAKÁCS-GYÖRGY K, TAKÁCS I [2013] Arguments of optimization of biomass utilization for energy production In: Heiman W (szerk.) 3rd AGRIMBA-AVA Congress: Agribusiness and Rural Development as a Global Challenge. Budva: AGRIMBA, pp. 1-20.
- TAKÁCS I, NAGY-KOVÁCS E, HOLLÓ E, MARSELEK S [2012] Model for optimization of biomass utilization for energy production by energetic and economic requirements Review of Applied Socio-economic research REVIEW OF APPLIED SOCIO-ECONOMIC RESEARCH 4:(2) pp. 225-235.
- TÉGLA ZS, HÁGEN I, HOLLÓ E, TAKÁCS-GYÖRGY K [2012] Adoption of logistic principles in WOODY-biomass energy cluster Review of Applied Socio-economic research 4:(2) pp. 236-245.

TÓTH T. [2013] A megújuló energiaforrások társadalmi háttérvizsgálata a Hernád-völgy településein, különös tekintettel a dendromassza-alapú közösség hőenergia-termelésre Egyetemi Kiadó, Debrecen 163 p.

Szerző(k)

BUJDOSÓ Zoltán

PhD

Főiskolai tanár

Károly Róbert Főiskola 3200 Gyöngyös, Mátrai út 36

zbujdoso@karolyrobert.hu

PATKÓS Csaba

PhD

Intézetigazgató főiskolai docens

Eszterházy Károly Főiskola 3300 Eger, Eszterházy tér 1

patkoscs@ektf.hu

KOVÁCS Tibor

PhD

Tanszékvezető főiskolai docens

Eszterházy Károly Főiskola 3300 Eger, Eszterházy tér 1

kovacstibor@ektf.hu

RADICS Zsolt

PhD

Egyetemi adjunktus

Debreceni Egyetem 4010 Debrecen, Egyetem tér 1.

radics@delfin.unideb.hu

BAROS Zoltán

PhD

NKEK Nemzeti Környezetvédelmi és Energia Központ Nonprofit Kft. 1134 Budapest, Váci út. 45

z_baros@yahoo.co.uk

DÁVID Lóránt

PhD

Főiskolai tanár

Károly Róbert Főiskola 3200 Gyöngyös, Mátrai út 36

davidlo@karolyrobert.hu