Regional Development Perspectives of Production and Utilization Renewable Fuels in Hungary

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Abstract. The main aim of the present article is to highlight the regional development perspectives of production and utilization renewable energy fuels in Hungary. Due to our model it is possible to examine the relations between the terms mentioned above. In the model area the most significant elements are highlighted in relation to renewable fuels and sustainability. It implies the importance of holistic approach that is crucial in these investigations. Only marginal attention is paid to the regional impacts of renewable fuels. Taking every result into account, this methodologically complex subject is possible to examine from the point of sustainability. Sustainable development can not be grasped easily, but the production and utilization of renewable fuels can be one of the tools to further the practical implementation of regional sustainability.

Keywords

Sustainability, renewable fuels, regional and spatial development

1. Introduction

The environmental pollution and the decrease of the oil based fuels are the greatest challenge of the automotive-industry at the start of the 21st century. Until 2010 the EU directives plan to achieve 5,75 % renewable energy rate on the field of fuels to decrease energy dependency. One of the biggest groups of fuels are biofuels. These fuels can be used clear or can be blended with fossil fuels. The solution mentioned above has the advantage that the characteristics of the blend is very similar to the fossil fuels, thus this might be used only with minimal change of the modern motors. Furthermore, the blend does not need very high percent renewable energy and this amount can be produced with the present production capacity as well.

In addition to this, the fuels based on farm produces have several advantages for the agriculture. On one hand, it might be the solution in the case of agricultural overflows, wastes, secondary products and the utilization of produces that are inappropriate for human consumption. On the other hand, it can mean the increasing possibility of the independency from oil. The biofules can have a significant role in job creation. According to the Common Agricultural Policy (CAP), the agricultural based fuels may cause approximately 35000 – 50000 new working places.

The main aim of our investigations is to highlight how the renewable fuels can influence the practical implementation of regional, local sustainability.

The main object of this paper is to work out a model that can summarize the regional and spatial effects caused by the production and utilization of renewable fuels from the point of sustainable development.

Sustainability – which is a way of thinking, life, production and consumption – covers all dimensions of human existence, its relation to natural resources, the economy and society. Sustainability can be the solution – beside research and development processes – to global problems like globalising economy and market competition, global warming, poverty and famine. The actions of the United Nation from Rio to Johannesburg and EU decisions seem to underpin this. Sustainability attempts up to the present have been global with few results.

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The European Union, taking into account that all main documents include or at least mention the requirement of realising sustainability what is necessary for realisation in practice, can be considered as leading in enforcing the idea of sustainability. The question is how coherent (convergent and connected to one another) and consistent (not contradictory) are the various goals, programs and strategies.

2. Barriers of the investigation

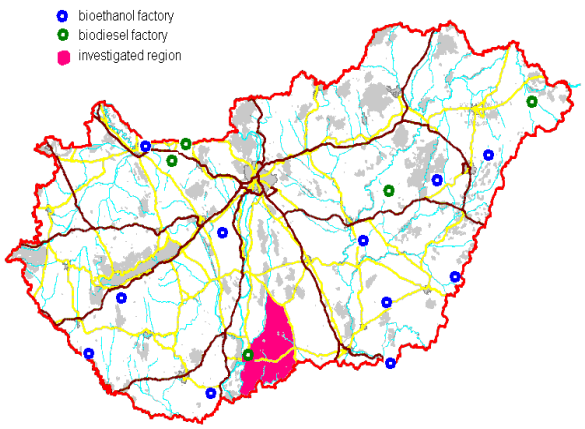
The investigations based on the data of the Hungarian Statistic Institute and the international publications, and former results of the authors.

Some impoundments had to be done to investigate the accurate regional effect of the production and utilization of biofuels.

A. Fuel impoundment

We have investigated the bioethanol and the biodiesel from the agricultural products and raw material product able biofuels in Hungary. These two fuels have the main chance to substitute fossil fuels in Hungary[1]. Otherwise our model can be let out in the future in the direction of biogas and second generation (Fischer-Trops biodiesel) biofuels.

B. Regional impoundment



The regional impoundment is very important element of the model. The regional effects can be shown with very precision regional barriers. The extant and in the building phase bioethanol and biodiesel refineries were sized up during this phase. The result is shown on the Fig. 1. The chosen area is in south Hungary near to the Serbian boulder, it is called Bácskai löszhátság. The main city of this region is Bácsalmás. This region has traditional very good production from maize, wheat and corn.

3. Agro-ecological parameters of the region

The newest agricultural data of the investigated region is shown on the table I. The 2 tons/hectare rapeseed and the 7 tons/hectare maize production are over the national average.

TABLE I
AVERAGE PRODUCTION IN BÁCSKAI LÖSZHÁTSÁG

	production [ton]		productive area[ha]		avg. production [kg/ha]	
	2004	2005	2004	2005	2004	2005
maize	137 380	151 158	194 56	19 247	7 061	7 853
sunflower	20 604	17 597	8 200	8 460	2 513	2 080
rapeseed	3 135	3 433	1 249	1 561	2 510	2 200

Source: Statistical Yearbook [5]

The local utilizations of the feedstock are unknown but an assumption can be done from the national tendencies. These are seen on the Table II.

TABLE II
NATIONAL MAISE UTILISATION TENDENCIES

Human consumption	6%	6%
Industry	6%	6%
Animal feedstock	40%	42%
Agricultural utilization	0%	0%
Export	16%	12%
Other	0%	0%
Losses	0%	0%
Closing amount	32%	34%
Total	100%	100%

Source: Statistical Yearbook [5]

The percentage of bioresource can be estimated from Table II, which can be used for biofuel production. In the case of maize it can reach the 46-48% of the total production. Same calculations were made for rapeseed and sunflower. The results are shown in the Table III.

TABLE III
BIOFUEL RESOURCE POTENCIAL IN THE INVESTIGATED REGION

Product	Potential biofuel resource [% of total production]
maise	46-48%
sunflower	45-48%
rapeseed	63-91%

4. Production Calculations

The quantity of the bio resources were calculated that can be used for biodiesel and bioethanol production. It can be calculated from the agricultural productions

statistical data. The exported amount and the overflow can be used as feedstock of renewable fuels.

TABLE IV
BIOFUEL QUANTITY IN THE NORTH BÁCSKA AREA

	Production for fuel resource	Biodiesel	Bioethanol
Maize	67 806	-	20 720
Sunflower	8 786	1 738	-
Rapeseed	2 463	1 377	-
Total	-	3 115	20 720

The potential biofuel quantity showed on the table IV, based on the table III. Table IV shows the results of the calculation about the fuel quantities. The calculation based on an the following average numbers:

- Sunflowers biodiesel yield is 230 litre/ton
- Rapeseeds biodiesel yield is 650 litre/ton
- Maize bioethanols yield is 387 litre/ton

In the investigated region there is a biodiesel factory under construction, thus the rap seed and oil flower production can be pressed and estherificated there. A new bioethanol factory is needed to build in the region. We have calculated the parameters of this new factory (Table V.).

TABLE V
BIOETAHNOL FACTORY PARAMETERS

Capacity	25 000	Ton of bioethanol/year
Resource requisite	83 000	Ton of maize /year
Investment cost	2-3,5	BILLION HUF
New working places	50-60	Pieces
Kept agricultural workplaces	100-111	Pieces

The factory has to be sized greater than the demand of today, which it can deal with the future calculated quantity improvement. Ethanol factory is a secure market for the farmers thus they can increase the yield, improve their techniques. The improving of the yields is waited for the plant breeding that can help to have a better climate change resistance and a better content value.

For the biodiesel production is occasional to utilise the biodiesel factory of Baja, which will open in 2008. Their parameters are the following:

TABLE VI
BIODIESEL FACTORY PARAMETERS

Capacity	35 000	Ton/year
Resource requisite	100 000	Ton/year
Investment cost	8	BILLION HUF
New working places	80	Pieces
Kept agricultural workplaces	130-140	Pieces

5. Fossil fuel savings

The produced biofuel should used in the same region to have the benefit of the closed CO_2 circle. Estimations were made about the amount of the substituted fossil fuels and the lower emission advantages. The results are shown on the table VII.

TABLE VII
FOSSIL FUEL SAVINGS

	Biodiesel	Bioethanol
Production volume [ton/year]	3 115	20 720
Heating value rate	0,85	0,66
Fossil fuel saving [ton/year]	2 751[1]	12 432[2]

[1] Biodiesel: normal diesel heating value rate
[2] Bioethanol: gasoline heating value rate

6. Decreasing emissions

By the utilization of bioethanol and biodiesel can not only the quantity of the fossil fuel decreased, but it helps to reduce the emissions. Based on engine test measurements and vehicle test the following reduction can be expected. (Table VIII).

TABLE VIII
EMISSION TENDENCIES OF THE UTILISATION OF BIOFUELS

Emission type	Bioethanol	Biodiesel
CO	-5 to -30%	-8 to -15%
NO_x	-10 to -60%	+ 1 to 10%
CH	-10 to -55%	-10 to -15%
CO_2	-5 to -25%	-15 to -20%
particle	(no data)	-15 to -20%

Source [3,8]

7. Regional effects

In the examined area it is possible to highlight the most significant elements, factors in relation to renewable fuels and sustainability. The forthcoming paragraphs are going to summarize the regional development effects of the planned renewable fuel investment in the frame of a matrix from a holistic perspective.

TABLE VII.
THE IMPACT MATRIX OF BIOFUEL PRODUCTION IN RELTAION TO
THE DIMENSIONS OF SUSTAINABLE DEVELOPMENT IN THE EXAMINED AREA

Biofules	Environmental issues	Social effects	Economic impacts
Raw-material production	- reproduction of soil productivity - positive effects connected with crop rotation - optimal utilization of different chemicals, minimizing of environmental issues - improving biodiversity with forests defensive effect on the fields - developing the quality of environment in case of settlements, households, agricultural industry	- fostering sustainable agriculture and rural development - helping to hinder migration from rural territories especially in case of agricultural labourers - according to the investigation, the examined model helps ca. 230-250 people to remain in agriculture that has a positive effect on employment problems	- rationalization the activity and expenditures of local farmers - remaining agricultural production in a profitable way - reducing costs of settlements, households, farms, agricultural industry - developing their own energy basis
Logistic	- agricultural production area fit to the capacity of the factories - reducing pollution with minimizing of the transport distance - thoughtful planning of raw-material supply - delivery of secondary products and wastes to close places	- contribute to the livelihood of local conveyors, freighters - growing job opportunities - fostering income possibilities	- increasing incomes of logistic companies, freighters, conveyors
Biofuel production	- the sizing of factories production capacity to market demand and farm production area - the rationalization of different investments in the field of production, raw-material processing, selling, promotion taking the aspects of logistic and utilization into consideration	- new job opportunities connected with the factory capacity in the examined area, it means 130-140 new working places in this territory that contribute to improve local living circumstances, growing incomes - fostering to hinder migration from rural territories	- mending employment conditions - developing industry in the area, accelerating local enterprises - growing incomes of local governments - development of regional competitiveness - reusing, recycling of waste and secondary products connected to biofuel production - improving the innovation potential of the region
Utilization of biofuels	- decreasing pollution - fostering its role in mitigation of and adaptation to climate change - diversification of energy utilization, positive effects on natural environment, preservation of biodiversity - developing sustainable energy management	- improving the quality of life on local level - improving medical conditions - to have the opportunity for a healthier environment	- contribute to reduce the dependency from energy import - growing spatial incomes - decreasing the medical costs of local inhabitants

Source [Own complilation.]

The most significant, basic aim of regional development is strictly connected with the decrease of differences in the quality of life in the interest of social justice, solidarity and hindering desolation. Both the national and international experiences can prove that those areas where the number of inhabitants is gradually decreasing, the living circumstances of the people who did not move to another place are unfavourable and the quality of life is lower compared to the average. Thus this territory presumably might become to a damaged, weedy, deserted and neglected territory without the chance to step forward, to progress towards the idea of a liveable countryside.

It is well known that the easiest and the most cost effective way to keep local environment in good condition is trying to reduce or stop migration keeping the local inhabitants in place. For instance, it was early realized in the Central Eastern Alps (Austria, Switzerland). (It is worth mentioning that it is better to foster the incomes of some forester and farmer families than just live the lawn, the forests to get to be ruined without them that can lead to erosion, degradation, mud-avalanches and to falling rocks as well. It means desertification and wind-erosion on a plain.)

From Table VII. the regional effects of biofuel production can be seen. From Table VII. it can be concluded that the bioethanol and biodiesel production in the area of Bácsalmás is useful to improve the living standard, because:

1) One basic cause of the differences among territories is strictly connected with the employment possibilities. The production of bioethanol and biodiesel can foster the increase of job opportunities especially in case of raw-material production, farm produces, investments and logistic. In our model the new bioethanol and biodiesel factories can lead to approximately 50 -60 new working places in our examined area. Furthermore, according to our investigation the remaining job opportunities in the agriculture can be estimated around 230 – 250 agricultural labourers in relation with both factories.

2) Taking the development of traditional farm production into account (for instance the use of GPS technologies) it easier to preserve not only the productivity of soil, but it is possible to take care about biodiversity as well. Moreover, the realization of sustainable agriculture may be fostered at the same time.

3) The incomes from raw-material production, from farm produces could have a positive impact on local farmers who are living totally or partially from agricultural activities. This positive effect is in relation to regular buying up of raw-materials i.e. needed to biofuel production thus decreases the risk of sales.

4) The investment by means of constructions, suppliers etc. has a positive impact on the infrastructural conditions. It is in connection with job opportunities that can be useful also in that case if only it is temporary.

5) The examined biofuel factories mean permanent employment possibilities. In relation to our investigation in case of the bioethanol factor it means 50-60 persons and at the biodiesel factory approximately 80 new working places.

6) The logistic act through improvement and employment upon the social – economic conditions of the examined area.

7) The gradual rise in the price of fossil resources, the cost-effective production of raw-materials increases the security of fuel supply. Furthermore, it has positive effects with the good rate of expenditure : yields in the examined area.

8) The independency from fossil fuels, the local cover of fuel demand may lead to the development of the competitiveness in the Bácska area.

9) Through liveability of settlements and improvement of medical conditions can have the pollution decrease positive spatial impacts.

8. Conclusions

The main aim of our paper was to highlight the connection between biofuel production and sustainable regional, spatial development.

In our model we examined a special area of Hungary. According to the numbers that would be calculated an impact-matrix was worked out. This matrix summarizes the effects of biofuel factories in the area of Bácsalmás in relation to regional development from the aspect all dimensions of sustainable development.

Some significant effects are worth mentioning as mending employment rate, decreasing risk level in agriculture connected with new market possibilities of farm produces, the rational use of soil, increasing incomes, locally produced fuel, decreasing energy dependency, cost reducing impacts and improving regional competitiveness.

This model might be useful all the stakeholders including decision makers, local inhabitants, NGO's, employees, farmers and investors as well. Furthermore, it underpins all of the impacts from the holistic aspect of sustainability.

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