Liquid bio-fuels in Hungary: effects and contradictions

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Summary: The increase of living standard requires ever more energy, despite energy saving measures. Domestic growth was 100 PJ between 2000 and 2006, and 77% of the total utilization was imported (Hungarian Central Statistical Office, 2008). Sustainability was endangered not only in our energy and commerce policy. Our domestic natural conditions are suitable for plant production; however, the stagnation of the domestic population and decreasing livestock numbers restrict inland marketing. Therefore, significant surpluses from year to year had to be stored and sold abroad, and the fact that the interventional purchase of corn and the expected stringent new EU regulation of the sugar beet sector, make the strategic significance of these branches uncertain. The difficult marketing opportunities make the better utilization of our opportunities in producing liquid bio-fuels possible from marketing aspects, while environmental issues and realizing the EU directions enforce to do so in a longer term. Over the short term, agricultural and competitive aspects will determine its spread, which cause different effects in Europe in comparison with the developing countries. According to Nábrádi-Ficzeréné Nagymihály, 2008, one of the breaking points of Hungarian agriculture lies in the utilization of alternative energy sources.
During the past period, many contradictory opinions came forward relating to economies, agricultural effects, food risks as well as the energetic and environmental efficiency of bio-fuels. One thing is certain: these fuels are already used today and their significance has been increasing. Although due to technological development, spread of new products and processes (cellulose-based bioethanol, bioethanol, biogas, hydrogen, biomethane) will obviously have to be expected in the future, at present biodiesel and bioethanol are determent among bio-fuels, thus I deal with these as well as their energetic and agricultural effects in my study.

1. The Clue Numbers of the Spread

The expectations of the EU for bio-fuels determine its future in every member state. These aim at increasing the present ratio (only 1 to 2% even at EU level) to 5,75% by 2010 and to 10% by 2020, with the help of a tax allowance or compulsory mixing. In every member state, the allowances are restricted to bio-fuels of standard quality and mixing into traditional fuels is restricted to 5% (to 7% in case of ETBE). In addition to clear biodiesel, E-85 is also considered as standard fuel. The domestic regulation under a ratio of 4,4% of bio-fuels, burdens 8 HUF per liter extra fiscal tax to every traditionally traded petrol and diesel oil. However, these figures are not directly comparable, as the EU expectation relates to heating value, while the domestic regulation applies to volume (liter). This disparity has two consequences. (1) The fact that in which ratio bio-diesel and bio-ethanol are used also plays a role in realizing expectations, as their heating values are significantly different. Additionally, the domestic spread of diesel cars may contribute to the spread of biodiesel, which may increase the mixable biodiesel quantity due to the greater utilization of diesel oil. (2) By mixing 4,4 volume% (because of the lower heating value of bio-fuels), we are still far from the expectations, which may be fulfilled only by a great use of B-100, or E-85. But for this purpose, presently used cars are unsuitable. The increase of bio-fuels being mixed into fossil fuels to 10% is planned, as is making the output values stricter. This stands, however, in opposition to the interests of certain (European, Japanese) car producers.

2. The Domestic Relativity of the Economies

At first glance, the mentioned change of the Fiscal Act (+ 8 HUF per liter penalty tax), as well as the present standards (above 5% extra 40 HUF per liter fiscal tax), make mixing in the case of 4 to 4,5 volume% reasonable from economic aspects. If tbio-fuel is more expensive than the traditional component, naturally the 4,4% (the minimum value) should be mixed. The price should of course be related not to liter but heating value (maybe the more effective burning should be considered)., It is worth investigating what it would cost to drive the same distance with different fuels. Although the bio-fuel may be more expensive, it will be worth mixing. A commercial firm may choose from two bad alternatives. (1) Either it will not mix the more expensive bio-fuel and have to calculate 8 HUF per liter extra cost, or (2) it will mix because its loss is lower than this 8 HUF, and this loss will be passed on to the customers. The 4,4% ratio is 1/23 part of the total quantity (100%), as a consequence, if the bio-fuel is more expensive by 23 HUF per liter than the replaced fossil fuel, the rise is only 1 HUF per liter in the case of a mixture. On the basis of this calculation, only a price difference of 23 x 8 = 184 HUF per liter (relating to the same heating value) may make the exclusion of bio-fuels from mixing under the

domestic regulation reasonable. Such a great difference, however, does not exist at all. As a consequence, the standard fuels will probably be more expensive to a small extent due to the bio-component, but this rate will drop to a level that would make it seem as if they were not being utilized at all. It is presumably not MOL* that will bear the rise, but the consumers, who will evaluate this as change in oil prices.

2. The Effect of Oil Prices

The most important factor of the world economy is change in the oil market (supply, prices). The sound and continuous economic development of the EU, the USA, Japan and China in the near past precipitate the rise in oil prices. This affects every segment of economic life, increases inflation and makes it necessary for central banks to raise interest rates. This move leads, in turn, to recession, which (besides its many disadvantageous consequences) reduces the energy requirement, which again results in a reduction in oil prices. These market fluctuations provide hope for decreasing this dynamic price growth, in contrast with the 1970s, when prices rose in a multiple way from political and not from economic reasons. The last seven world wide recessions always came after a significance growth in oil prices. Today, however, it is not only prices which mean problems and not only the anxiety that is from what sources energy will develop, but also the question of whether enough energy will still be available in several decades (*Roberts,* 2004).

An oil price of 100 USD per bbl is 117 HUF per liter raw material cost considering 187 HUF per USD (the average of 2007) exchange rate. This is supplemented by the costs of processing, transportation, commercial, the profit of processors and traders, as well as state taxes, which result in 290 HUF per liter petrol price and 300 HUF per liter diesel oil price at petrol stations. Thus, the cost of the raw material is influenced not only by oil prices, but the HUF/USD exchange rate. The costs of processing and trading are much lower than this; the profit need is obviously not public. If this were so, there would not be any reliable data available as cross-financing reasons against other products traded by the MOL may influence this. However, taxes may be examined in an objective way, as the effect of oil prices has two directions. First, they directly increase the cost of raw materials, but at the same time, they also increase the HUF-value of taxes imposed in%.

The quantity-based tax (fiscal tax) is the determent element in the domestic price structure. In this way, the change in oil price modifies only the value of the Value-Added Tax (VAT). Other costs and profit need are also independent from oil price change. Because of the different taxes (and processing costs), the effects of oil process will also be different in the cases of petrol and diesel oil. Thus, it has a different effect on the replacement value of biodiesel and bioethanol. On the basis of data from September 2007, taxes constitute 55% of the price of petrol and 50% from the price of diesel oil, from which the fiscal tax is 103,5 and 85 HUF per liter. One USD/bbl price change equals 1,18 HUF per liter in the case of a 187 HUF/USD exchange rate. Between January 1 and January 18, 2007, the oil price rose by 0,21 USD per liter, the domestic petrol prices by 0,35 USD per liter, the diesel oil prices by 0,41 USD per liter, considering the actual USD exchange rate. These figures suggest that the rate of price following was 1,67 times higher for petrol and nearly two times higher for diesel oil. A longer time series would provide more reliable consequences, as in price and exchange policies other factors may appear in a short run. If we consider the 55-week-long period as reliable, in theory one USD/bbl oil price change would cause 1,78 HUF per liter price change in petrol and 1,72 HUF per liter price change is diesel oil. Not incidentally, domestic finances will be in a favourable situation, and there will also be the macro-economic advantages: if bio-fuel is not mixed in, there is a surplus fiscal tax of 8 HUF per liter; if the bio-fuel is mixed in, there is a surplus VAT on the net price. This latter case is only true when the bio-components are more expensive than the replaced fossil fuel. Oil price rises and technological development of producing bio-fuels may overwrite all these, even in the near future.

3. Agricultural Aspects

Plant production, in comparison with other domestic economic sectors, requires more capital investment due to the land need, typically reflects lower profit margins because of the disparity between agricultural and industrial prices, and the losses due to unpredictable weather. Energy plants are suitable for improving the security of production, as they diversify the activity of farmers and produce marketable products of significant added value which are also useable by the farms themselves. Energetic plants may be grown on what were formerly areas for sugar beet or on set-aside areas by hybrids of higher yields and special content (HTF and hybrids of high oil-acid content). The area of agricultural land out of cultivation was 240 thousand hectares in 2007. Until 2006, the inland use of cereals was 8.5 million tons per year, its average price was 44 thousand HUF per ton. Both cereals and oil plants experienced a significant price increase (151 to 174%) over results from the previous year. At the same time, prices have stagnated (90 to 110%) in animal breeding. Additionally, forecasts predict a continuing decrease in livestock numbers. This decline means less fodder will be required, and therefore sets even more areas aside for other potential uses. which results in the fact that further fodder area will get out of cultivation. Formerly, the decrease in livestock was caused by the unfavourable change of market situations, to which the new bio-fuel market partly contributes. It is worth remembering that after producing bio-fuel, there remains a protein containing by-product which is mainly used as a component of fodder for ruminant

* Hungarian Oil Company

animal stock. The domestic market of oil plants requires 700 to 900 thousand tons of production annually, from which 600 thousand tons are utilized for meal purposes; the average producer's price in 2007 was about 89 thousand HUF per ton in the case of sunflower and (because of the early harvest) only 62 thHUF/t in the case of winter rape (www.ksh.hu, 2008). *Table 1* summarizes the previously mentioned factors.

Table 1: Major Data of Domestic Markets of Plants Usable as Even Bio-Fuels

Product	Price Change* (%)	Cropping Area, 2004-2007 (Mha)	Inland Need**, 2004-2006 (Mt)	Total Yield, 2004-2007 (Mt)
Beef Cattle	97			
Cow Milk	112			
Hogget	89			
Hog	88			
Broiler	115			
Cereals	151–174	2,8–3	8,6–8,7	9,6–16,8
Sunflower Seed	163	0,48–0,53	0,65–0,82	1,04–1,19
Rape Seed	109	0,10–0,22	0,06–0,08	0,28–0,49

* price from November in 2007 in percentage of the price from January in 2007

**: with loss

Source: www.ksh.hu, 2008

The potential cropping area is restricted by soil conditions (the best soils) in the case of corn production, by landscape for rape seed (danger of winter loss) and by crop rotation for both plants. At the same time, raw material supply of bio-firms has to be decolonized from the effects of years, as the decrease of fixed costs of the extremely significant investment may only be realized by better capacity utilization (*Bainé Szabó,* 2005). In this way, an over-sized capacity may make even the inland food and fodder supply unstable and make strategic inventory management necessary. The question can be asked even in a different way: what is more favourable to Hungarian farmers and rural areas in the case of exports of plant products (1) if it is sold as plants (raw materials) abroad with its uncertainty and low added value, or (2) if it is sold as animal products (which can hardly be made competitive in comparison with foreign concurrent products and even quotas regulate the marketing) or (3) if products (fuels) with unlimited barriers are produced in Hungary by creating jobs, local markets and infrastructural developments. This latter naturally has dangers too, not only from the aspects of raw materials, but because of the interest validation ability of foreign capital. It must not be neglected that bioethanol producing capacities of 1.5 million tones per year are available directly from our neighbors and a part of the domestic (mainly biodiesel) firms process foreign raw materials due to the closeness of the borders and the reduction of transport costs. The SAPS supplementary payment of 45 €/ha (about 11.000 HUF/ha) for energy crops improves the interests of plant producers, which doubt the willingness of traditionally marketing the same crops. At the same time, it is not sure that this payment makes the produced fuel competitive with the concurrent products; moreover, after 2010 the further payment of the subsidy is not guaranteed.

In case of figures mentioned in plant production, the cropping structure in 2007 (cereals in 2,8 to 3 million hectares, oil plants in 720 thousand hectares) is able to produce 5 million tons cereals and 0,6 to 0,8 million tons oil plants in an average year besides meeting the traditionally inland requirements. The stabilization if this may be carried out by ensuring intensive conditions (good soil, irrigation, fertilization), which may contribute to the biggest spread of corn, as this crop is able to produce a much more ethanol yield on one hectare than cereals and reacts better to the intensive production technology. It must be noted that only 9,6 million tons cereals were produced in 2007, which could have covered only the domestic processing bio-fuel supply. Primarily cereals will probably grow on the presently set-aside areas, which area freeing effect will be lower than 240 thousand hectares. The indirectly effect of this will be more significant, as probably cereals will grow on these areas. The raw material demand of the domestic mixing, taking the fuel consumption in 2007 and the EU expectations for 2010 into consideration, is 400 thousand tons corn and about the same amount of oil crops (*Popp,* 2007), which constitutes only fragments of the opportunities. The land even in an average year makes a significant export possible, in comparing to the EU countries, corn and sunflower production produce raw materials for bio-fuels by lower prime costs. However, there is an uncertainty with all of them: (1) whether the corn will

Table 2.: The Most Important Economic Data of Oil Plants in Hungary (2000–2007)

Denomination	Unit	2000	2001	2002	2003	2004	2005	2006	2007	**Mean**	**Disper-sion**
Prime Cost of Sunflower	thousand HUF/t	*56*	*54*	*55*	*57*	*51*	59	63	70	**58**	**6**
Average Marketing Price	thousand HUF/t	47	60	65	52	56	50	54	85	**59**	**12**
Average Yield (national)	tons/ha	1,80	1,90	1,97	1,96	2,57	2,17	2,18	2,04	**2,07**	**0,24**
Average Yield (HB County)	tons/ha	1,60	1,94	2,00	2,30	2,56	2,19	2,38	2,48	**2,18**	**0,32**
Prime Cost of Rape	thousand HUF/t	*55*	*49*	*59*	*69*	*43*	53	61	65	**58**	**10**
Average Marketing Price	thousand HUF/t	43	54	53	53	47	53	57	62	**56**	**14**
Average Yield (national)	tons/ha	1,42	1,87	1,69	1,41	2,75	2,31	2,34	2,26	**2,01**	**0,48**
Average Yield (HB County)	tons/ha	1,70	1,61	1,80	1,01	2,86	2,26	1,66	1,74	**1,83**	**0,54**

Source: HCSO (2000-2008), www.akii.hu (2008), *Bai-Pfau* (2007)

Note: 00-07 = 2000-2007, HB = Hajdú-Bihar county

be competitive with the Brazilian sugar cane; (2) only sunflower is unsuitable for producing standard quality; on the other hand, rape can be produced with much higher risks and lower yields in Hungary, especially in the Eastern part of the country *(Table 2.)*, than in Western Europe.

There is a twice as much fluctuation in the prime cost and yield of rape than the national averages in comparison with sunflower. The difference is somewhat lower in Hajdú-Bihar County, where the average yield of rape is 10% lower than the national average.

All in all, the farmer can count on more certain marketing opportunities and higher product prices thanks to the demand market, and lower transaction (storage and transportation) costs because of the domestic (incidentally local) utilization not only in energy crops but, due to the reduction of cropping areas of other crops, even in other plant production branches. The use of more intensive production technologies is necessary for safe raw material production. Yet, this is accompanied by an increase of prime cost, which was exceeded by the change of prices significantly.

4. Factors Affecting Economies

For any success, it is obviously necessary for producers to be concerned about producing raw materials, processors and sellers should be interested in producing bioethanol and finding markets, and the consumers should have the willingness to purchase the products. The replacement value of the products is determined by the oil price, its competitiveness depends on factors which influence prime cost in the most effective way, such as raw material cost, by-product utilization, (in case of bioethanol) the price of the used heat and firm size (as well as its utilization). Because of extension limits, I am going to introduce my calculations relating to only maximal raw material costs being deduced from petrol and diesel oil prices.

4.1. Bioethanol

Figure 1 illustrates for how many HUF it is worth participating in verticum purchasing, producing bioethanol under the present economic conditions and what maximum corn price may be reached considering average figures of technologies in the case of a petrol price of 281 to 298 HUF per liter. The latter reflects the expected effect of 10 USD/bbl oil price change. In theory, 153 to 163 HUF per liter prime cost in bioethanol equals with the examined petrol prices, the totally solution or leeway of by-product utilization equals with about 10 thousand HUF per ton price difference in purchase of raw materials. If not the total quantity is utilized or the smaller the rate of the by-product utilization is, the more costs go to the prime product, in this way the production of bioethanol will be more expensive.

The total utilization of the available opportunities in the future would go with significant risks:

- It may make the utilization of by-products problematic and expensive (because of transportation).
- Changes of world market prices of crude oil, sugar and fodder all influence the economies of bioethanol production as replacing or replaced products. In this way Hungary cannot influence prices.
- The Brazilian competition seems to pose the greatest danger in the near future. Up to now, the import duties kept Brazilian bioethanol (and also sugar) out of European markets. As it is considered to be an agricultural product (in contrast with biodiesel), everywhere in the world ethanol is hit with import duties., Reduction of these is expected to occur, in accordance with the IEA (International Energy Agency) recommendations and as a result of WTO (World Trade Organization)-EU negotiation. The competitiveness of domestic ethanol remains, therefore, uncertain. If sugar and fodder prices rise, the compulsory mixing rate will increase in Brazil, and the ethanol demand of the Far Eastern markets is able to absorb the remaining surplus. This time ethanol production based on domestic corn may be competitive in a longer term.
- From global aspects, land use and cutting rainforests will put cellulose-based ethanol production of bigger yield forward, which may be based on by-products, too, and even the spread of other second generational technologies (bioethanol, biobuthanol from DDGS). The EU lags behind the USA in these technologies, on the other hand supports biofuel production (mainly from agripolitical aspects). If we are only waiting for the appearance of the more developed technologies, we miss out on the use of these sources, but our corn

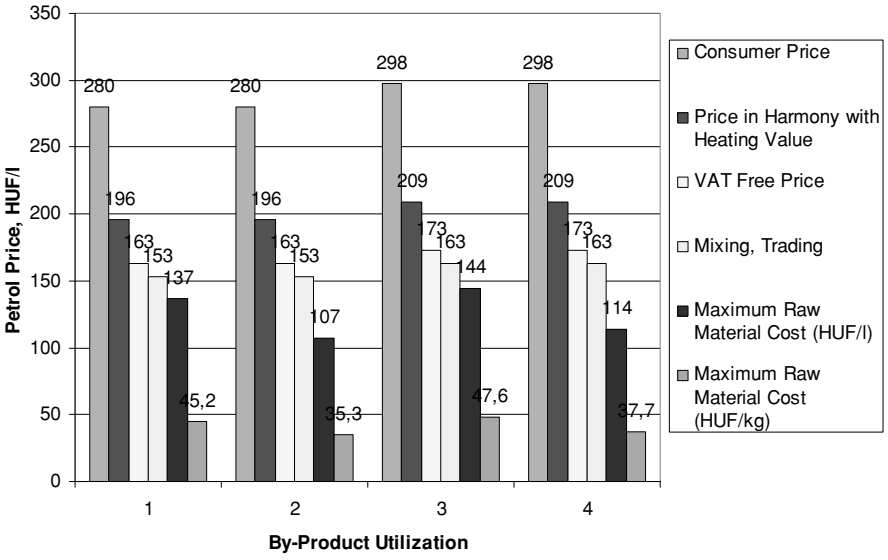

Figure 1.: The Economic Barrier of Bioethanol in the Participants of the Verticum

will become bioethanol in the same way, However, we will have to import it from another country.

4.2. Biodiesel

In case of biodiesel, the following consequences can be made with the vertical analysis mentioned in the previous chapter *(Figure 2.)*. In theory, in the case of MOL, it is worth taking over biodiesel at 200 HUF per liter (which almost equals the German wholesale price). Farmers might get a takeover price which would be lower than the present inland prices, but having significant profit content if the other participants of the verticum did with the fact that they do not have any loss. Naturally, this situation does not reflect the reality from two aspects. First, the interest validation abilities of producers and consumers are the weakest, thus the major portion of the reachable profit will expectedly spring to other participants (mainly to traders) having bigger economic power. Secondly, reaching profit may be doubtful due to the following factors:

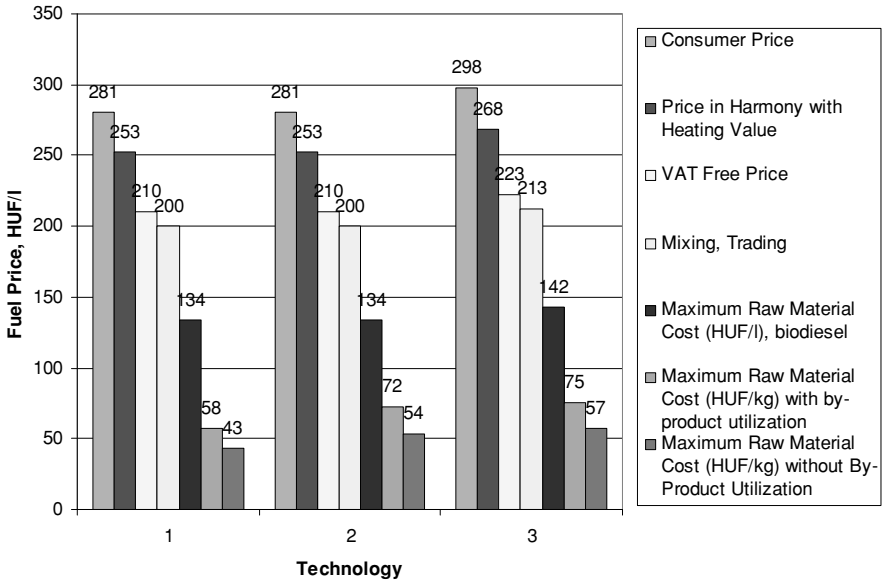

Figure 2.: Economic Barrier of Biodiesel in the Participants of the Verticum
Sources of Main Data: www.oil-price.net, www.bloomberg.com, www.gkm.hu.
Notes: 1. technology: 281 Ft/l diesel oil price, 32% oil yield
2. technology: 281 Ft/l diesel oil price, 40% oil yield
3. technology: 298 Ft/l diesel oil price, 40% oil yield

- The interval of the factual prime cost may fluctuate within wide borders depending primarily on firm size and the used raw material, with a very important supplementation: if the total quantity of the produced by-products is managed to market/process at value-ratio price! Their quantity is 1,5 to 2 times higher than that of main products, utilizing oilseed sleet needs huge livestock (mainly ruminants), glycerin requires cleaning firms, the neglect of the utilization may increase the prime cost of biodiesel by about 46 to 60 HUF per liter, in this way marketing would suffer losses.
- The world market prices of crude oil, fodder and glycerin are significant and heavily influenced similarly to bioethanol. The expected decrease of crude oil prices naturally may reduce the competitiveness of biodiesel, as well. In case of a diesel oil costing 281 HUF per liter and 32% (considered as unfavourable) biodiesel yield, the break-even would be at only 58 thousand HUF per liter raw material price, thus smaller sized biodiesel firms having worse output indicators may easily suffer losses.

Composting and burning glycerin may solve the problem of by-product utilization in firms having a capacity of lower than 10 to 15 thousand tons per year. In bigger firms, it is practical to establish an own cleaning unit and to produce standard (medicine book) quality (*Hancsók,* 2004). In theory, oilseed sleet may be used in biogas plants. The products produced in this way have a much lower value than fodder or medicine book value. The oil and biodiesel may be utilized for producing electricity and operating stable engines. These are preferential and tax-free opportunities in Hungary. Significant relieves are expected in the near future in case of use in experimental and public transport.

Summary

By carrying out technical and technological development in plant production, producing raw materials of biodiesel and bioethanol may become one of the successful branches of Hungarian agriculture; at the same time making fulfillment of EU directives and the gain of export revenue of significant added value possible. The latter goal may be restricted by foreign competitors, available land and the interests of animal husbandry. The present oil and fuel prices even in the best case would realize zero profit by calculating a corn price of 45 to 47 thousand HUF per ton and oil seed price of 72 to 75 thousand HUF per ton, although due to the different interest validating ability of the participants in the verticum, farmers may count on smaller values. At the same time, the technological and genetic development, the increase of oil and fodder prices can make the production of biodiesel and bioethanol more favourable in Hungary for a longer period of time.

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