Sustainable biofuels in Hungary and Europe – self-defeating incentives?

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SUMMARY FINDINGS, CONCLUSIONS, RECOMMENDATIONS

Substituting fossil fuels has been a prominent issue in the EU in recent years. Energy security, agricultural and environmental considerations have all played a part in the development of alternative fuels and in the creation of incentives promoting their use. The system, like big systems in general, cannot react to new developments quickly and it seems there are elements that we should seriously consider removing or replacing to avoid adverse effects. This paper will attempt to summarize the current issues and propose possible solutions in the form of seven recommendations to make the European incentive system more effective in the interest of sustainable rural development, an area that is of prime importance for Hungary.

SHORT INTRODUCTION TO BIOFUELS

The idea of powering engines and other machines with fuel from crops such as corn or rapeseed is not a new one. In fact, *Rudolph Diesel* designed his first engine to run on peanut oil. Over the years that followed, cheap and easily accessible fossil fuels have been preferred. The situation has changed, however. The global impact of transport and its environmental, social and economic effects are inescapable. We are now aware that the oil reserves available are finite, the impact on the environment resulting from their use in transport is proven to be harmful and there is growing concern over energy security as well. As a response to these problems, a wide array of technologies have been developed to cope with the enormous task of feeding the millions of cars (over 700 million by some estimates) in use worldwide. These solutions were hailed as the answer to not only the problems related to the emissions from automobiles, but also as a way out for farmers that have been losing their markets and have seen their profits diminish over the last few years, especially within the EU. Producing crops without the intention to actually use them as food was also preferred by the agricultural incentives that existed and in some part still exist today.

Although there were (and still are) technological problems to be addressed (such as shelf life, gelling, corrosion, etc.), it seems like the social aspect of widespread adaptation (new technologies need to gain awareness and acceptance from their future consumers before becoming widespread) and the chicken – and – egg problem are greater barriers. The latter seems to be a Gordian knot since without availability, there will not be sufficient demand for such new products. However, building new petrol stations or adapting the existing network is such an expensive investment that no investor will risk initiating

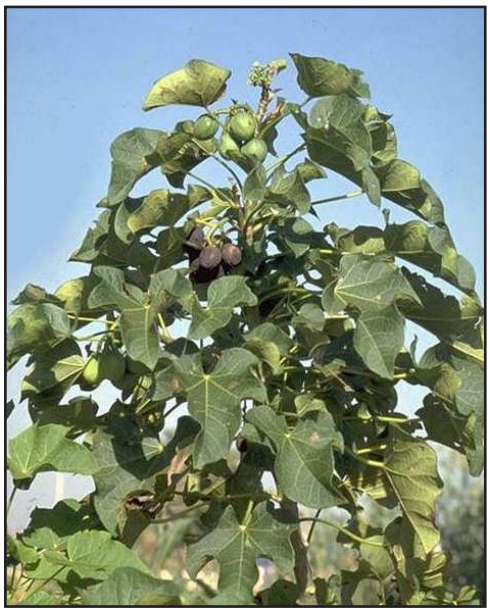
unless there is a clearly visible demand for these products on the market. Power and energy density of biofuels (W/m^2, J/kg) are also contested, but this issue is outside the scope of this article. Social and organizational aspects must also be taken into consideration, since producing and utilizing green energy requires all stakeholders to have a long-term, fair and mutually beneficial cooperation, which in turn depends on a sound organizational framework (*Gergely, 2006*).

As the introduction of these new technologies was somewhat slow in gaining traction and achieving widespread use because of these barriers, different *incentive systems have been developed* to facilitate this process. These are mostly aimed at making biofuels more competitive by changing market conditions so that biofuel production and use is preferred. As another element of the strategy, *biofuel share targets have been set*. There are countries in the world where the alternative fuel sector has indeed changed the way mobility demands are met while also contributing to sustainability (such as Brazil and its ethanol program, although not all aspects of the program have proven to be beneficial). There is already a growing and well founded concern about the *import of raw materials from South America and Asia* (a prominent example of this phenomenon is the palm oil import from Indonesia).

There are more hardy crops available for biofuel production, however, that could be utilized in inferior conditions. Just to give one example, *Jatropha curcas* is worth mentioning. In December 2008, a test flight was conducted by Air New Zealand (*Green Tech Media, 2009*), the first flight with a commercial airliner ever with a blend of Jatropha-based biofuel and conventional jet fuel (Jatropha is a hardy, drought and pest-resistant plant whose seeds contain 27-40% oil, see Fig. 1).

Figure 1

Jatropha curcas, a possible raw material for biodiesel



Source: Wikipedia

This was an interesting initiative because Air New Zealand had the following requirements for the fuel:

1. The land used for the production of the raw material for the fuel (Jatropha) was not forest or virgin grassland in the last 20 years.

2. Soil and climate were not suitable for food production.

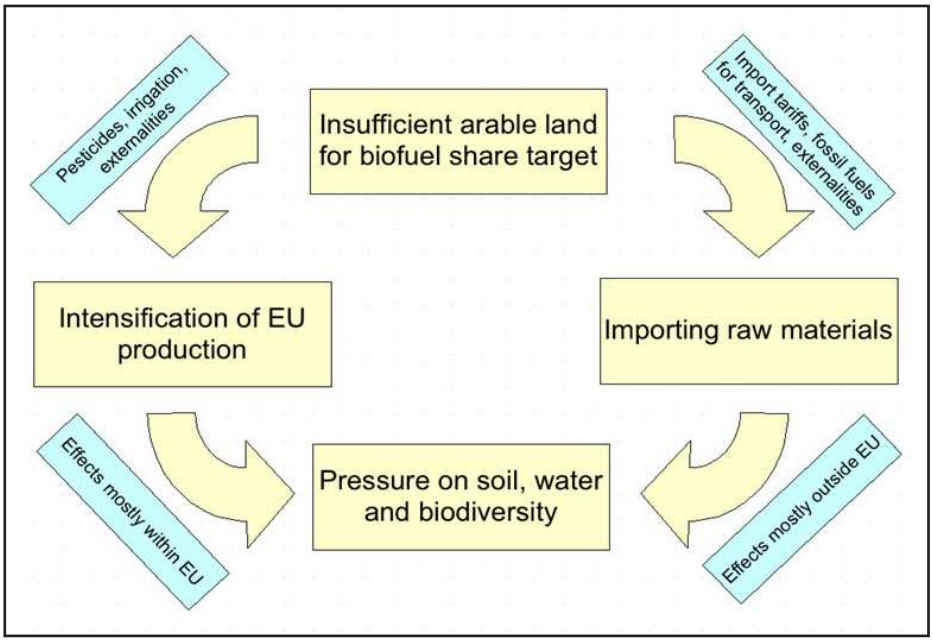
3. Land is rain-fed instead of mechanically irrigated.

These requirements would likely *disqualify most first-generation alternative fuels* used and imported by the EU. This also underlines the necessity of the considerations outlined in this paper.

By outsourcing production to Third World countries the EU gives up control over the sustainability of the production process *and requires a substantial amount of fossil fuels for transporting raw materials*, thereby exporting the risk to other countries and defeating the purpose of using alternative fuels in the first place (Fig. 2). However, according to some experts, we also influence food prices indirectly through the market (*Dinya, 2009*). Since land use is profit-driven, subsidies have an effect on the amount of crops produced to be used as biofuel raw materials (*OECD, 2007*). Therefore it can be stated that importing raw materials to be used for biofuel production should not be preferred (*DFT, 2006*).

Figure 2

Adverse effects of the 10% biofuel share target



Source: own compilation

These changed conditions and knowledge about the impacts and sustainability of first-generation biofuels *have not resulted in any substantial policy response* yet. In light of these developments, it would be beneficial to reassess the priorities, options and possible future avenues for development.

It is very important, however, to *distinguish between first and second generati-*

on biofuels. First generation biofuels are produced by using food crops as raw materials, such as corn or sugar cane. Second-generation biofuels use waste, residues such as leaves, husks, stems, etc. or crops that are not used for food production purposes (such as switch grass) as raw materials and are therefore more sustainable and do not compete for the same resources (with the exception of arable land) that we also use for food production. Although second-generation biofuel crops may have a large water footprint, they are more efficient than their first-generation counterparts, and some can be grown in inferior conditions otherwise unsuitable for food production.

Despite these facts, policies and incentives in Hungary as well as Europe *remain somewhat focused on first-generation biofuels* by providing tax exemptions and other forms of support. Environmental, economical, social and agricultural problems may be created by this practice, and therefore this article will focus on first-generation biofuels primarily, although some of the statements and suggestions may be more widely applicable.

THE STATUS OF BIOFUELS IN HUNGARY

Because of its geographic location, resources and other characteristics, Hungary is, and has historically been, dependent on imported energy. It is also worth considering that our energy efficiency on a national level is lower than that of other OECD members (*Réczey – Bai, 2006*). However, due to its agricultural potential, climatic and economic conditions, it is well suited to the production of biofuels. Corn, wheat, rapeseed and other possible raw materials can achieve a relatively high yield. Overproduction, one of the major problems in recent years seemed to be a very good source of raw materials (*Gyulai, 2006*). As an agricultural country, Hungary can not only produce energy crops (such as rapeseed and sunflower) efficiently, but crop production is likely to exceed domestic demand in the long term as well (*Bai et al., 2002*).

It is widely believed that the alternative fuel sector may provide a boost to agriculture through creating a new market for its products and also creating jobs in the process, thereby stabilizing the sector. However, the tendencies have shown that producing raw materials for first-generation biofuels such as biodiesel and bioethanol *favors intensive, large scale agriculture* that generates fewer jobs for the same agricultural output or area than small farms while also resulting in changes in land use, and potentially having adverse environmental effects by putting pressure on soil, water and biodiversity, conflicting with the objectives of sustainable rural development. The most devastating example of this phenomenon is deforestation, although this is not as problematic in Hungary or in the EU as in developing countries.

It is important to note that there is *no substantial biodiesel or bioethanol sale* in Hungary. All fuels available at petrol stations are blended (4-5%), but alternative fuel products such as the E85 produced by Hungrana at Szabadegyháza are exported. Blending is achieved by substituting MTBE (methyl-tert-butyl-ether) with ETBE (methyl-tert-butyl-ether) processed from bioethanol. These materials are oxygenate fuel additives that raise the octane number of the fuel. The provider of alternative fuels for blending by the Hungarian oil company, MOL, is selected through a tender instead of using domestic resources. It has been shown that Hungarian consumers consider low prices and supply security to be more important than environmental aspects. Their *price-sensitivity* will lead them to choose cheaper products over others that are more environmentally friendly (it is important to note that as

far as price goes, first-generation biofuels are not yet competitive on their own, although rising oil prices may change that in the future). People are aware of the environmental issues resulting from the emissions of the transport sector, however, and their behavior could therefore be changed for the better by linking environmental benefits with lower energy dependence and supply security in campaigns (*Political Capital, Green Capital, 2008*). Initiating such a campaign to make Hungarians more environmentally conscious and to change their consumer behavior could be key in making the transport sector more sustainable than it is today.

BIOFUELS AND SUSTAINABILITY

Targets previously set for biofuels share in the EU have not been reached (2% for 2005 and 5.75% by 2010). Despite these failures, in 2007 the EU has raised its target to an ambitious 10% by 2020. After careful analysis of all the impacts and conditions involved, perhaps it would be beneficial to *rethink the approach to a mandatory 10%* share by 2020. The problems are twofold.

First, EU member states are net importers of biofuel raw materials such as palm oil. There is a discrepancy between the efficiency of production, demand and the pricing of environmental values that makes these imports key factors in the sustainability of the biofuel market. It can generally be accepted that the imported raw materials can often be efficiently produced in countries where demand for biofuels is low and environmental values are not adequately priced. In developing countries, European incentives for biofuels use *may lead to the replacement of ecosystems with farmland.*

Interestingly, the imports also generate demand for conventional fuels, since transport almost exclusively uses fossil fuels, thereby linking the market price of biofuels and conventional fuels. *Together with the import tariffs of the EU*, this keeps biofuel prices artificially high (*OECD, 2007*). Market price is one of the main reasons why subsidies are necessary to keep biofuels competitive.

Second, millions of Euros are spent each year on subsidies and tax exemptions for biofuels. These not only distort market conditions, but it has also been shown that they may indirectly influence food prices as these two areas compete for the same resources. The incentives have also attracted venture capital to this new market, investments in this sector have multiplied in recent years. This new market has also piqued the interest of GMO producers, who, after meeting consumer resistance on the food markets of Europe, see the biofuel business as a better alternative for their products.

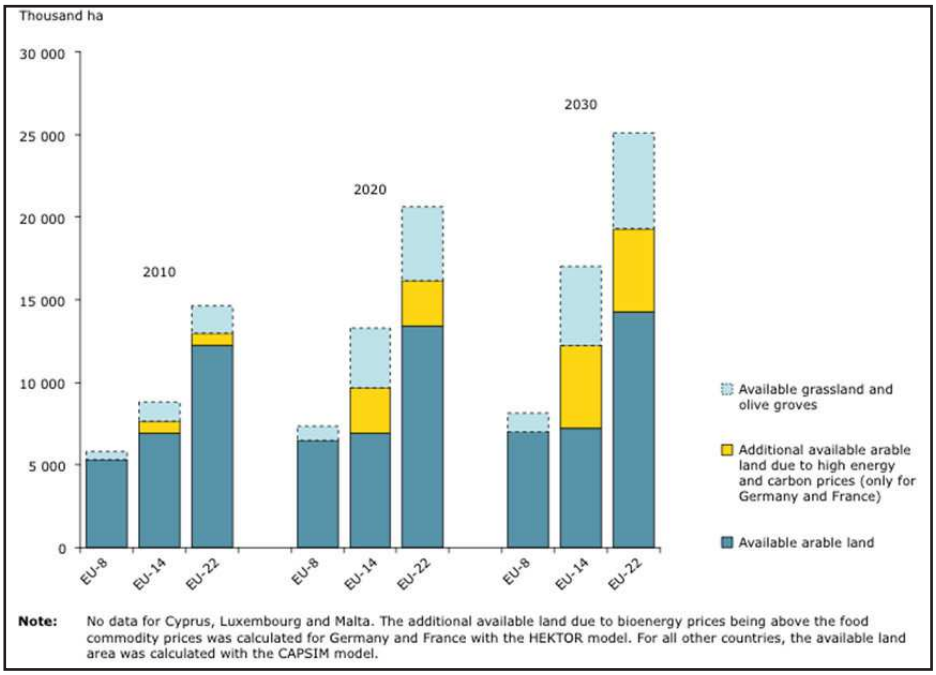
However, the present incentive systems in place *cannot be sustained indefinitely*. Some of the growth that has been experienced in this sector is not organic. The subsidies in place have created an investment climate that was very favorable, but this artificial growth also means that once these incentives are discontinued, some of the businesses in the sector will not be competitive and will fail, creating uncertainty and contracting the market for the raw materials they previously used. The greatest weakness of the current subsidy system, however, is that it does not always address the wide array of technologies available. In other words, it is *technology-driven* (think tax exemptions for biodiesel and bioethanol), but does not differentiate between production methods, raw materials, etc. A far better solution would be to introduce an incentive system that is technology-neutral, and allows all the technologies to benefit from it. The carbon tax could be such a solution, but it is still in its first stages of development. The effects related to its future introduction should be evaluated carefully. For example, it will not be success-

ful if it is only introduced in the EU, since it will harm, among others, the competitiveness of enterprises engaged in transportation directly, and this effect will have an impact on all goods and services indirectly. Successful introduction of the carbon tax would require that *at least the greatest competitors of the EU* (such as the US or China) agree to similar measures. Reaching such a consensus is unlikely in the short term.

Research is definitely the key to addressing these issues. It would be worth contemplating whether the funds spent on subsidies would not be *better utilized by being allocated to R&D* and demonstration projects for 2nd generation biofuels. It has now become clear that first-generation alternatives are not preferable for a number of reasons (cost-effectiveness, energy balance, competition with food production, imports, etc.). Since it can be accepted that using biofuels to substitute fossil fuels in a necessity, it is not expedient to use available funds to support technologies we know to be lacking. Instead, we should strive to improve them and discover new means to meet our needs, this can be done by diverting funds to R&D from subsidies. The amount of arable land needed for Europe's goals is also a major issue. The European Environmental Agency has made estimations as to the arable land available without adverse environmental impacts (see Fig. 3; *EEA Report, 2006*).

Figure 3

Arable land available in the EU for biomass production for energy



Note: No data for Cyprus, Luxembourg and Malta. The additional available land due to bioenergy prices being above the food commodity prices was calculated for Germany and France with the HEKTOR model. For all other countries, the available land area was calculated with the CAPSIM model.

Source: EEA Report No. 7/2006

As far as available arable land for dedicated bioenergy crop cultivation goes, Hungary was found to have a mediocre potential (good potential for its size) at 413 000 ha in 2010, 512 000 ha in 2020 and 547 000 ha in 2030. For comparison, the values for Poland were around 4 000 000 ha. Overall the report has found that it would not

be possible to reach the 10% target based on EU resources alone without seriously compromising other areas, such as food production or environmental protection.

The environmental impacts of biofuel production and use need to be researched more extensively, since the effects of the ambitious 10% target are difficult to predict or control. Given these problems and uncertainties, it would be advisable to *either drop the 10% biofuel target, or suspend it* until the costs and benefits can be more clearly seen. Several key organizations such as the European Council and the Advisory Board to the European Environmental Agency have already expressed these concerns in recent years.

One of the solutions proposed solutions to the issues brought on by importing biofuel raw materials (deforestation, heavy use of pesticides and fertilizers, etc.) would be certification. By employing this method, the production process could be controlled, driving suppliers to more environmentally friendly practices. However, such a system would be difficult to implement, and it would be imperative to introduce it worldwide, or it might only cause market segmentation. An inefficiently designed or introduced system could result in the displacement of biofuels, increased costs and bureaucracy. The ISCC (*International Sustainability&Carbon Certification, www.iscc-project.org*) is a very good initiative in this area, but a lot more groundwork is necessary before the benefits can be realized.

One way of reducing the footprint of alternative fuel production would be relying on domestic resources whenever possible. This would have other significant benefits such as reduced transport costs and related emissions, and also creating demand for local workforce, creating jobs in sectors and areas where it is very much needed. A likely downside would include higher prices, but this would likely be offset by the positive effects outlined above.

It appears that the policies of the European Union are somewhat stiff and slow to react to changing situations regarding alternative fuels. Despite growing concern over the disadvantages of currently used first-generation biofuels, the policies, legislation, subsidies and general approach have changed little. Since this is a rapidly developing area, these aspects should be reassessed on a regular basis. Since this has not yet been done, it would be advisable to conduct a review as soon as possible.

However, no policy or legislation will vindicate biofuels as long as there is insufficient demand. Lack of awareness and trust is an important factor from this point of view. Due in part to the initial resistance from car manufacturers and oil companies, there is a lot of mistrust and misconceptions regarding alternative fuels that mist be dispelled before this market can gain significant traction. This requires a comprehensive and easily understandable public campaign to persuade consumers about the benefits of using alternative fuels.

The new programming period would be an excellent opportunity to address some of the issues outlined herein. These measures often need to be addressed on a European level. They will have their results in Hungary as well, but national regulations are not sufficient or feasible in most cases. In my opinion, some of the problems and setbacks that are experienced in the alternative fuel sector could be addressed by the following measures:

1. Using a portion of subsidy funds for R&D instead, thereby promoting new, more efficient technologies.

2. Suspending or dropping the 10% target for 2020 in order to avoid unwanted or unknown effects.

3. Promoting technology-neutral incentives thereby increasing their effectiveness.

4. Minimizing imports or introducing a comprehensive certification system, preventing adverse and external effects.

5. Promoting the use of domestic resources where possible, minimizing transport costs, emissions and creating jobs in the sector.

6. Reassessing policies in light of new developments to adapt to new situations.

7. Initiating public campaigns to change consumer behavior.

It is not contested that new means need to be developed to meet the challenges posed by the ever-increasing mobility demands in Europe and around the world. First generation biofuels were the first step along the way to a more sustainable transport system. As our technologies and understanding have improved, policy responses have lagged behind. *It is extremely important to adapt our incentive system to changing conditions, acknowledging new scientific results and promoting sustainable development.* It is also important to remember that biomass is not the only renewable energy source available (for example, Hungary has excellent, poorly utilized geothermal power potential). A holistic approach is necessary, since no alternative energy source will be sufficient to displace fossil fuels alone, a combination of different renewable and sustainable technologies should be used. With a few adjustments and more research, we can be on the right track for a greener transport sector.

REFERENCES

(1) Bai A. et al. (2002): A biomassza felhasználása. Szaktudás Kiadó Ház, 140 p. – (2) DFT (2006): International Resource Costs for Boidiesel and Bioethanol, British Department for Transport. (http://www.dft.gov.uk/pgr/roads/environment/research/cqvcf/internationalresourcecostsof3833) – (3) Dinya L. (2009): Fenntarthatósági kihívások és a biomassza alapú energiatermelés. Gazdálkodás, 53. évf. 4. sz., 311-324. pp. – (4) EEA report (2006): How much bioenergy can Europe produce without harming the environment? European Environment Agency, Report No. 7/2006, ISSN 1725-9177. – (5) Gergely S. (2006): The primary factors of the national strategy for utilising "green energy" (biomass) by incineration technology. Gazdálkodás, 50. évf., 17. sz. spec. ed., 1-9. pp. – (6) Green Tech Media (2008): Biofuel Powers Air New Zealand Test Flight. (http://www.greentechmedia.com/articles/read/biofuel-powers-air-new-zealand-test-flight-5436/) – (7) Gyulai I. (2006): A Biomassza-dilemma. Magyar Természetvédők Szövetsége, ISBN-10: 963-86870-8-8, 41-43. pp. – (8) OECD (2007): Biofuels – is the cure worse than the disease? Round table on sustainable development. OECD study. SG/SD/RT(2007)3, Paris, 11-12 September 2007 – (9) Political Capital, Green Capital (2008): Lehet-e Magyarország bioetanol-nagyhatalom? Szektorális elemzés háttéranyag. Budapest – (10) Réczey G – Bai A. (2006): Background to the production and use of bioethanol as a fuel in Hungary. Gazdálkodás, 50. évf., 17. spec. ed., 10-15. pp.

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