

Czech-Austrian Winter and Summer School

Biofuels – Are they a good solution for the future?

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1.) Introduction

1.1.) Problem

For the past couple of hundred years fossil fuels were and are still nowadays one of the most important sources in mankind. Fossil fuels powered the industrial revolution and helped to turn the Western world in what it is today. But fossil fuels are limited and we reached its peak long time ago. For the future the demand of fossil fuels will not reduce, because countries with large populations like China and India become more and more developed and they are going to use an increasing amount of fossil fuels. Because the usage of fossil fuels is so important for sustaining our future, but they are limited, we have to find alternatives. The other big problem is that fossil fuels seriously harm the environment. The threat of climate change has made it obvious that we have to decrease the emissions that we produce. If we don't find other alternative solutions and start planning to get alternative energy sources, there will be a big problem for economy and especially mankind at some indefinite future date.

1.2.) State of the Art

In 90th of last century biofuels seemed to be a good alternative to fossil fuels. The main reasons for using them were impaired environment, political instability in countries which are the main oil producers, development of the local economies and utilization of agricultural surplus. Nowadays the results are not as positive as they seemed to be. The ecological benefits are ambiguous and Europe is still fully depending on fossil fuels.

1.3.) Goal

We want to give an overview of one specific substitute for fossil fuels in transport. Biofuels are one of the alternative energy sources, which are already used in transport. Especially in Europe the usage of biofuels is getting more common and the EU tries to intense the usage of biofuels more and more. Austria and the Czech Republic put also their focus on producing biofuels like biodiesel or bioethanol. The main question is, are biofuels sustainable for the future? Are they only a partial solution to the automotive sector or just some kind of a blind development branch? We try to answer those questions, especially by focusing on Austria and the Czech Republic.

2.) Definition and Usage of Biofuels

2.1.) What are biofuels?

The biofuels are one of the alternative energy sources. They are made from biomass which could be produce in two ways: as a product specially determined for energy use or as

rubbish from agriculture, forest industry, industry or households. There exists no proper classification of biofuels. In the biofuels business and in the references there are some common used kinds of classification.

Physical condition classification:

- Liquid biofuels
- Solid biofuels
- Gaseous biofuels

Classification according to the generation of biofuel:

- First generation biofuels = they are made from agriculture commodities which could be also used as a food (for example rape, corn, sugar cane, sugar beet or potatoes)
- Second generation biofuels = they are made from rests and rubbish from households, agriculture and forest industry (for example rests of plants and woods)

2.2.) Types of Biofuels

Classification according to the directive 2003/30/ES of the European Parliament and of the Council¹:

- **Bioethanol** = can be produced by any starch contained plant such sugar beets, corn or wheat
- **Biodiesel** = methylester made from vegetal or animal oil
- **Biogas** = Biogas refers to a gas produced by the biological breakdown of organic solids in the absence of oxygen
- **Bio-ETBE (ethyl-tercio-butyl-ether)** = kind of bioethanol of which is 47% in bio – ETBE
- **Bio-MTBE (methyl-tercio-butyl-ether)** = kind of biomethanol of which is 36% in bio-MTBE
- **Biohydrogen**

¹ This directive is really important for the biofuels problem because it order to member countries the obligation of minimum share of bio ingredient in the fuels.

3.) Use of Biofuels in Austria and the Czech Republic

3.1.) Situation in Austria

Because of the directive 2003/30/ES of the European Parliament all the EU countries must have a use of 5,75% of biofuels in there national transport energy content in 2010. In Austria the most common used biofuels are biogas, bioethanol and biodiesel.

Biogas refers to a gas produced by the biological breakdown of organic solids in the absence of oxygen. Organic waste like dead plants or normal waste from houtholds can be converted to biogas. 2005 there were around 222 million m³ biogas produced in Austria. But they are more common in heating housing systems than in transport.

Bioethanol can be produced by any starch contained plant such sugar beets, corn or wheat. Austria has only one biogas plant, which was built in Agrana, lower Austria. In Agrana they especially use wheat, maize and sugar beets for the production of bioethanol. Since the construction in 2008 the Austrian market for E5 is covered. But a big problem is that in the current situation in Austria the production of bioethanol is more expensive than petroleum. For example in Brazil the production of bioethanol is much more cheaper than in Austria or Europe because of the large amount of sugar beets and so in Brazil it is a much bigger opportunity.

<u>Country</u>	<u>Mio. Liters</u>
USA	24599,87
Brazil	18999,73
EU	2518,82
China	1839,71
Canada	799,86
Rest	1197,33
Total amount	49595,31

Chart 1: The worldwide production of bioethanol in 2007

On the chart above you can see that the North American and the South American continents are more intent on producing bioethanol, because there conditions of producing bioethanol are much better and cheaper than in Europe.

Biodiesel is the biggest used biofuel in Austria. The reasons are on the one hand because Austria is a classic country of diesel vehicles and on the other hand biodiesel is produced in a big amount more than over 10 years. Also the whole Off-Road transport² is diesel powered. Also most of the public transport is using biodiesel and were one of the pioneers using biofuels. Biodiesel is produced of every oleiferous plant, also known as FAME.³ In Austria biodiesel is mainly produced of rapeseed and sunflower. Biodiesel is produced since the mid-nineties and nowadays there are 15 plants which can produce more than 600.000 to biodiesel per year. For 2010 Austria produced 289.000 to biodiesel.

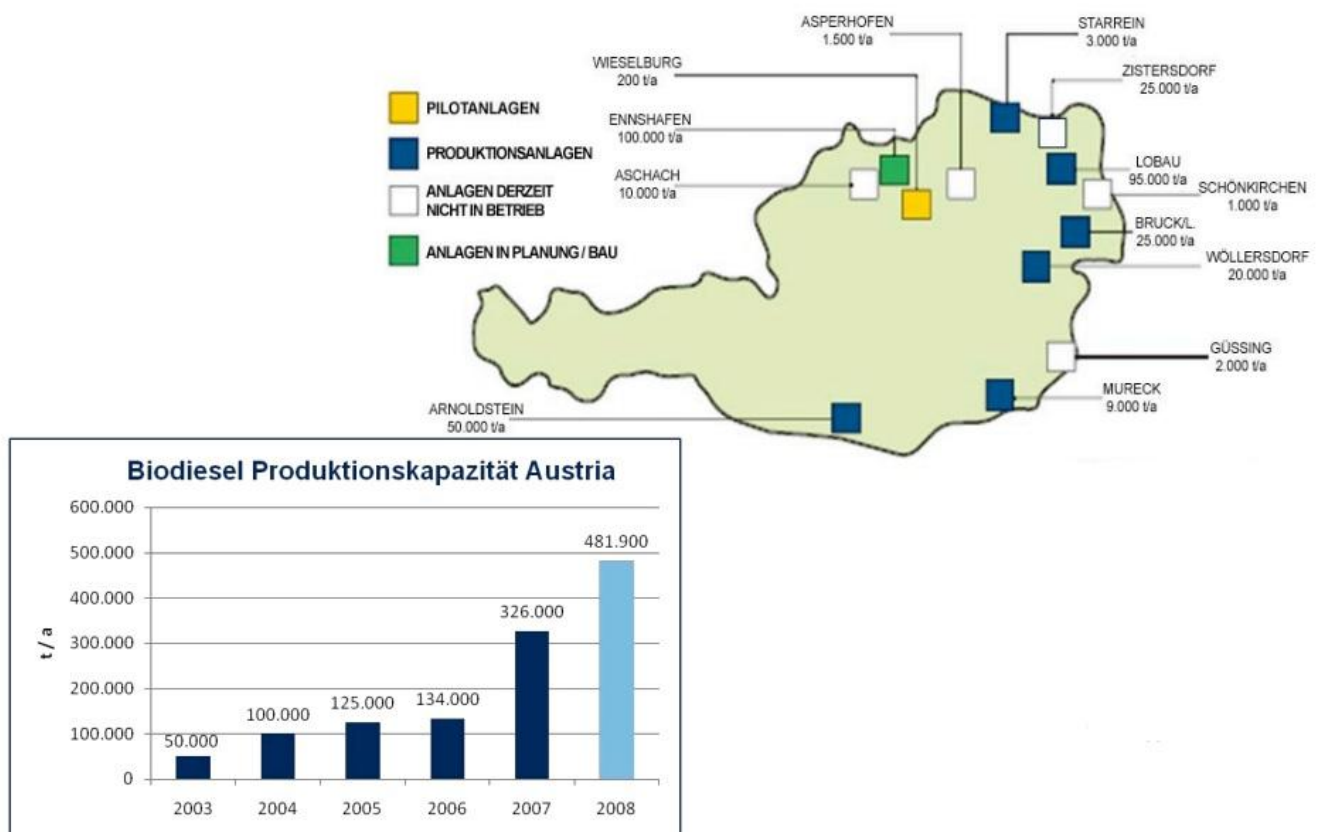


Image 2: Biodiesel plants and the production capacity of biodiesel in Austria

Source: <http://www.fwf.ac.at/de/downloads/pdf/ampuls4-hilber.pdf>

3.2.) Situation in Czech Republic

In the Czech Republic the most common biofuel is biodiesel used in transport. There are many reasons why the others are not so common. Firstly in the Czech Republic there is nearly no usage of biofuels as a heating, people are used to another kind of heating systems

²Off-road transport are for instance all vehicles in agriculture like farm tractors or construction vehicles.

³FAME is an abbreviation for Fatty Acid Methyl Ester.

which are nowadays cheaper than this ecological one. Secondly the bioethanol business is still developing in the Czech Republic and there are bad distribution and promotional channel for biogas. But it represents a possibility for Czech producers and also consumers (especially in the situation of high level of petroleum price). Finally our climate conditions are quite good for rape production, so the Czech Republic could not only produce for own consumers, but also for export. That also knew the Ministry of Agriculture at the beginning of 90 when started “Oleoprogramme”. The programme supported the usage of rape oil as an alternative fuel and position of this fuel on the Czech market. Presently there is no longer state support of biofuels in the Czech Republic.⁴

The situation with the rape in the Czech Republic illustrates the table below. The data are partly from internal materials and partly from the Czech-statistic office.

Year	Seed surface (ha)	Production (t)	Yield (t/ha)
2008/2009	356924	1048943	2,94
2009/2010	354826	1134857	3,2
2010/2011	368824	1036000	2,8

In comparison with the rest of the world there is a quite productivity. The world average yield is 1,9 ton. The European average yield is 3,3. There are no ecological problems in the Czech Republic such as cutting down forests. Some ecologists say that there is a “yellow avalanche”, but in fact all the oil plants are grown on the 18,7% of agriculture land, the rape on 15% of that. In comparison with for example grains, which are grown on 59% of agriculture land, is not so much.

Even if the productivity is good and the seed surface average, the problem is the lack of raw seeds. See table below. The data are from the internal materials.

Name of the factory	Day capacity (ton/day)	Used seeds
Setuza Ústí nad Labem	1300	Rape , sunflower
Preol Lovosice	1200	Rape
ADM Olomouc	850	Rape, sunflower
Total	3350	

⁴ The only support is the one from European Union which is paid to all the farmers no matter what they produce (SAPS and TOP-UP). It is paid for the agricultural land.

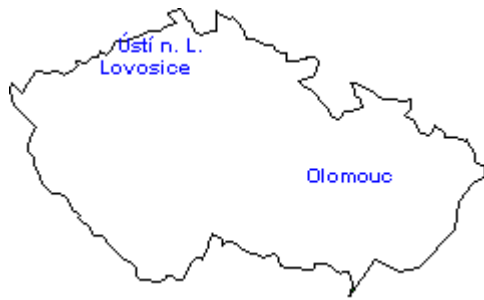


Image 3:

4.) Uncertainties about Biofuels and their Future Development

4.1.) Controversial points of View about Biofuels

The idea of the directive 2003/30/ES of the European Parliament and of the Council was that the biofuels are good of many reasons. Firstly they could help us with reduction of CO₂ in the atmosphere, secondly they could make Europe more independent on Arabic petroleum and finally they could help European agriculture by creating new jobs in the countryside or just by using the overproductions. During the years of this European regulation there were lots of studies about biofuels and practically everyone was opposite to the previous one. There are some examples written down.

You can see lots of different opinions about reduction of CO₂. There is the European Commission's study from 2006 which told us that thanks to the first generation biofuels we can save up 60% of CO₂ emissions. And thanks to the second generation of biofuels can we save even more – 80% of emissions which will be produce out of fossil fuels. The other studies (for example the one made by Paul J. Crutz, the Nobel Prize laureate) told that the biofuels produce 70% more emission than the fossil fuels. The problem is that in the time the directive and the studies were made most of the scientist thought that the bio-energy is carbon neutral. They compare only the amount of CO₂ plant absorbs during the life-time with the amount of CO₂ produced by biofuels burning. And that is not objective because some kinds of emission are also produced during the production of biofuels. The LSA method (life cycle assessment) counts with all of them and the new results are not positive for the biofuels. For example there is a table below which shows the emissions formed during the production of bio ingredient for the diesel. The data are from the 2010 from the Czech Union of biodiesel producers and the used method is LSA.

Production stage	Emission gCO ₂ eq/kg	Emission g C0 ₂ eq/MJ
Rape growing	1073	29,0
Oil production	203	5,5
MERO production	367	9,9
Transport and distribution	37	1,0

Total	1680	45,4
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The other results of study were: if you use 100% MERO⁵ the emissions are zero and the emissions produced by diesel production and usage are 83,6 gCO₂eq/MJ. So the solution is that the CO₂ balance depends of the kind of biofuel.

The other ecological problem often relate to biofuels is cutting down the rain forest. It happens in Asia or South America because there is shortage of land suitable for agriculture and the high prices of product used to make biofuels are inspired people to cut down the rain forests. Actually this is not the problem of Europe and both the Czech Republic and Austria do not need to deal with it. But still the European Commission tries to certificate biofuels and not import those destroying the rare ecosystems.

In the Czech Republic some people discuss the ecological problem with the rape growing. They call it “yellow avalanche”, which means that the amount of rape growing in the Czech Republic is increasing. And of course the surface on which we are growing the rape is also increasing. In fact it is not a problem. The rape is grown only on 15% of agriculture land. To compare the grain is grown on the 59% of agriculture land. The common argument is that the problem arises if we compare today’s data with the old one. And that is true; just compare the data in table below.

	1980	1990	1995	2000	2001	2002	2003	2004	2005	2006
Seed surface (thousands ha)	65	105	252	325	344	313	251	261	268	292

The number is increasing, but in fact it is not possible to compare the data from 1980 with today’s situation. In the 1980 we had the different variety of rape plant. And that one was not able to grow in that part of Czech Republic where can be the new variety. And as we can see in the table, the surface was not extremely increasing in the past few years.

The same controversial questions are about our independency on Arabic oil or improvement of European countryside. The biofuels were suggested as an alternative to the Arabic oil. They were meant as a way to be more independent. This aim was not reached, because we are still dependent on the import of oil. And we probably will for the next years. We have not so many raw bio materials to satisfy all the customers who use the Arabic oil today and we have no infrastructure to distribute the bio solution. This problem could be solved only with the long time research which will cost a lot of money. But the possibility to use the biofuels only is there. Especially, if you considerer the hydrogen as a new fuel. The

⁵ MERO = raps oil methylester

improvement of countryside is the goal we reached. The economic problem is that we don't know if the new jobs were taken by the unemployed people or not. The possibility is that the new jobs were taken by the people from the other branch. There could be the "crowd out effect".

The most discussed problem is the "food problem". The usage of biofuels should protect Europe from the food surpluses. For some people it is even immoral to talk about food surpluses. For the others seems to be immoral to burn food as a biofuel if there are some people and children with malnutrition in Africa. Of course we know about the malnutrition problem. But the material we used as a biofuels is not able to solve food problems in Africa. And it is almost impossible to send these surpluses to other continent. The best solution is to teach people how to grown their own food, to give them education and technologies.

4.2.) Feasible Problems of Biofuels in the Future

Because our fossil fuel stock is strongly limited and more and more depleted, it is really important to switch to alternative fuel systems. If biofuels are going to substitute petrol for the long run is fraught with uncertainty. But the rise of oil price is an important factor to boost the competitiveness of alternative fuels. Because the increasing oil prices lead faster to find a substitution to work with. But there are a lot of pro and cons about biofuels. From a macro economical view biofuels are a good solution because they bring job opportunities and a big development for the countryside. But to substitute fossil fuels by biofuels utterly nowadays is quite impossible, because the capacities of producing biofuels are too low and too expensive and the usage of fuels is increasing rapidly. The main goal is to use the environmental benefits, including the potential to reduce emissions, such as greenhouse gases and CO₂ and of course biofuels are a good solution for reducing them, but the problem is that the production of biofuels often produces more CO₂ than the use of them actual is reducing. So the future role of biofuels in the long run depends on profitability and new technologies. We are heading in the right direction with the development of the second generation of biofuels but continuously technological progress is very important. Technological advances and efficiency gains such as higher biomass yields per acre or more gallons of biofuels per ton of biomass could steadily reduce the economic cost and could increase efficiency. Also a big problem for Europe is that a lot of producing technologies are more profitable in tropical areas where growing seasons are longer. For example Brazil is one of the biggest and cheapest producers of bioethanol in the world, because the sugar production is one of the main productions in Brazil.

But perhaps one of the biggest flaws of biofuels is that they represent a serious competition for food production. The competition of the production of biomaterials increases the demand

and so the rise of food prices is increasing rapidly. Because of the increasing demand from biofuel production, world food prices increased by 140 per cent between 2002 and 2007. Food prices will rise dramatically if the biofuel production is increasing rapidly. Because of a rapidly increasing population, we are already running out of space to produce food to sustain the world's population and if the prices are increasing more and more also poverty is growing.

5.) Conclusion

5.1) Are they a good solution for the future?

There are no doubts about the lack of crude oil. The world reserves are enough only for next fifty years. That means that the oil price will be constantly increasing in the future. And the increasing oil price causes the higher food and other stuff prices. The biofuels seem at least some solution for now. Their production is expensive and with current technologies and reserves of raw materials they cannot be produced in the same amount as crude oil. On the other hand the biofuels help with developing agriculture and jobs opportunities in Austria and Czech Republic. But for the long run they are not a solution. It is necessary to develop another alternative fuel.

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