Goal Conflicts in the Biofuel Market

Consequences for the Consumer

Biofuels not only help to avoid CO_2 emissions, but also provide a new sales channel for agricultural production; they are to create the basis for a "decentral biofuels industry", and to contribute to "promotion of rural areas". The two-pillar strategy was intended to create an independent market for neat biofuels (B100/E85). A great deal of funding was put into building an extensive subsidy system at the expense of consumers, making biofuels look competitive despite the fact that they are substantially more expensive. As with any intervention in the market economy, goal conflicts are inevitable.

1 The Goal of Promoting Rural Areas

Agricultural subsidies are by far the largest budget item of the European Union. As budget debates become more and more critical, and above all with a view to Eastern enlargement of the EU, it was necessary to find a new form of financing, a kind of debt rescheduling. The creation of a compulsory distribution channel for food crops by converting them to fuel was a solution to the problems of financing agricultural surpluses, and of lack of competitiveness in the global market. The cost of subsidies for farming is borne directly by consumers, in the form of higher fuel prices.

The calculation is working out. Agriculture benefits enormously from this development. The food market and the biofuels market are competing for the same raw materials. If more biofuel has to be blended with gasoline, but the supply of the necessary bio-materials is not available in the medium term, that will cause a price increase not only for biofuels, but also for food. In the present market, which is in a state of equilibrium, the biofuel trend has raised rapeseed prices by 50 % within two years, and more than doubled grain prices to the previous level in the same period, **Figure 1**. The goal conflict is evident – income improvements for farmers from biofuels versus higher food prices. The statement of one MP who wanted to make more use of compulsory blend quotas seems to provoke this development to go much further. A sense of proportion is needed for compulsory quotas, to enable growing of biofuels to keep pace for "table and tank".

2 The Goal of Promoting Independent Biofuel SMEs

The conditions for biofuels producers were initially a kind of paradise, with full tax exemption and low raw material prices. Especially in the biodiesel sector, that triggered rapid development, using relatively simple production plants, reaching peak capacities today of nearly 5 million tonnes. The hype promoted not only efficient, technically sophisticated operations, but also the creation and survival of inefficient facilities.

When the Biofuels Quota Act entered into force on 1 January 2007, that gave the industry a sales guarantee with planning security for a substantial proportion of their annual production, regardless of price developments. In addition, tax subsidy is granted for an unlimited quantity. In accordance with established political practice, this support is designed to decrease in the course of time, as in the case of the Renewable Energies Act (EEG). In responsibility towards the tax payer, the emphasis is now being put on innovation and improved efficiency, following years of incentive subsidies.

While this development is pleasing for farmers, it is now becoming a dilemma for biofuel producers. Rising raw material prices mean reductions in their earnings. In the extreme case, that means certain domestic production is no longer competitive. Ethanol made from grain can no longer compete with ethanol made from sugar cane, at the current prices in excess of 230 euros per tonne (calculated on the basis of the JRC WTW study). For the first time, this has caused one ethanol manufacturer to shut down a plant at least provisionally, **Figure 2**.

Government is coming under more and more pressure to support the profitable sale of increasing over-production of non-competitive biofuels by subsidies from the state budget, in combination with more stringent blend obligations. And there is another goal conflict for

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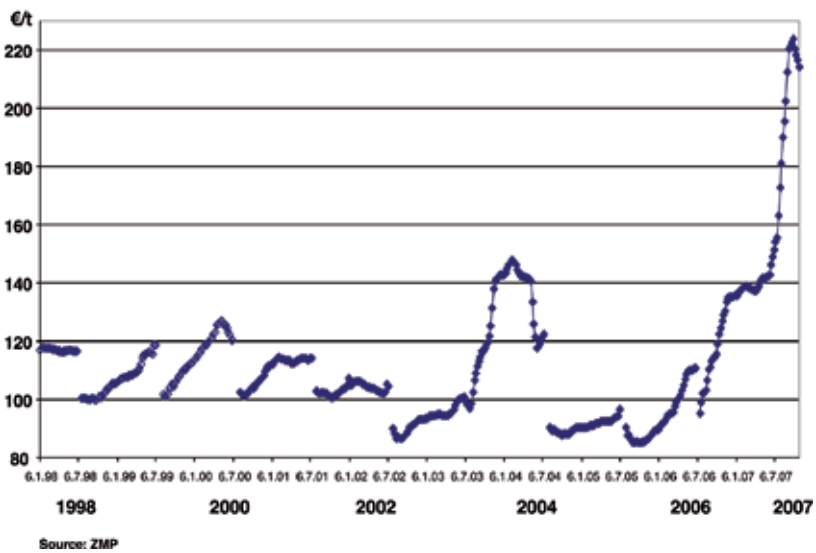

Figure 1: Wheat price development

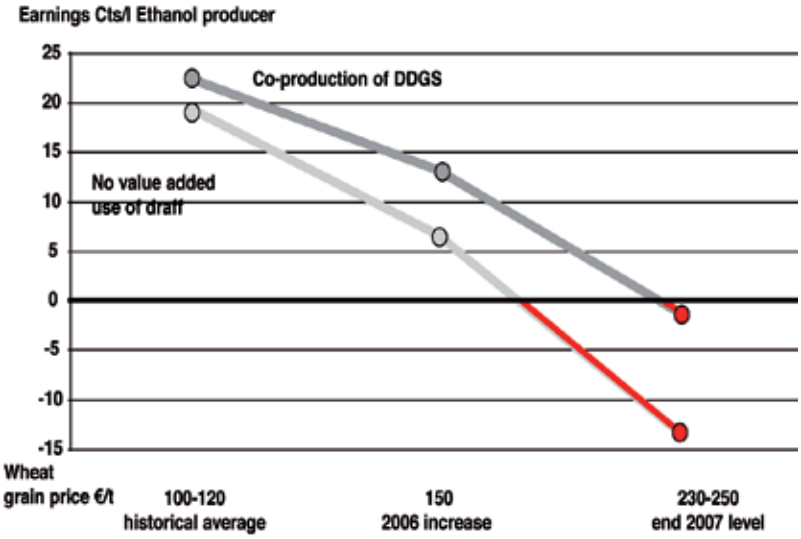

Figure 2: Cost of biomass (wheat grain) and profitability of ethanol production*

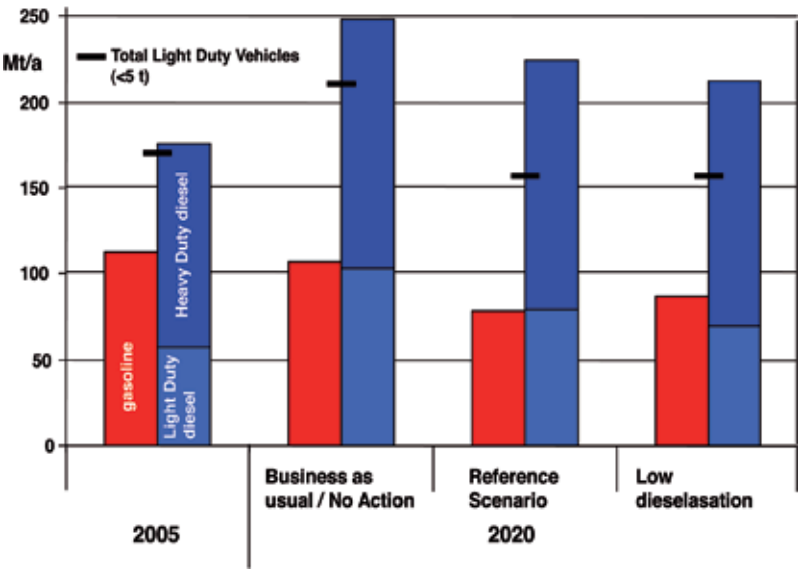

Figure 3: Diesel- und gasoline demand in 2020 according to scenarios

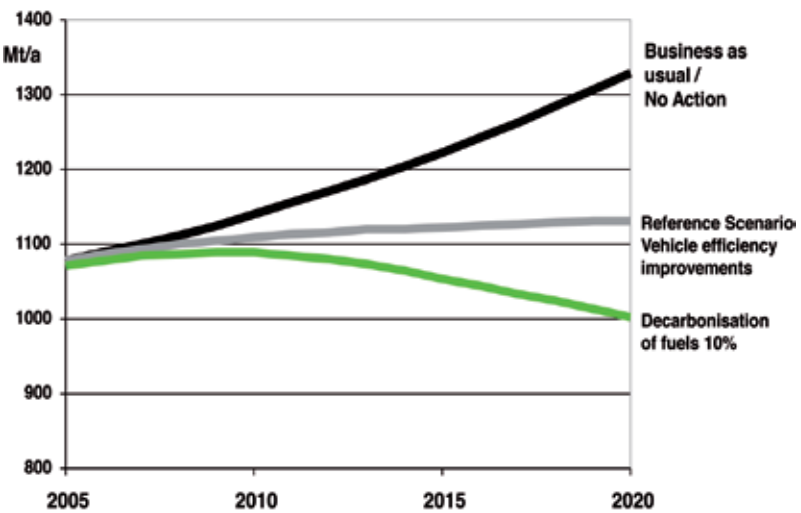

Figure 4: Total EU road transport GHG emissions

government – having abandoned the market economy approach by creating a subsidy system and introducing compulsory measures, it is now faced with the difficult decision on how far government is required to maintain non-competitive structures by means of permanent subsidies, or whether the consumer can be asked to pay more, indirectly by rising subsidies and directly by higher compulsory blending quotas.

3 New Political Framework Conditions

Government has given a clear answer with the new legal framework conditions applicable from 2015 onwards. This is a package which takes action both by the composition of the fuel pool, and by energy efficiency of vehicles. On the fuels side, the mandatory quota related to a given sales quantity will be replaced from 2015 onwards by a CO_2 reduction goal on WTW basis and a reduction target of 10 % by 2020. That means the framework conditions are set independently of the technology used, thus creating the conditions for competition for the most cost-efficient manufacturing process with the greatest possible avoidance of CO_2. Now that the self-obligation by the automotive industry to achieve 140 g CO_2/km in 2008 is evidently not going to be achieved, the EU Commission has specified binding goals of 130 g (125) CO_2/km for 2015.

4 Influence on the Fuels Market in Comparison between Scenarios

These framework conditions have a significant impact on the fuels market in the EU and thus on the refinery sector.

4.1 The Fleet und Fuels Model

The impact of different scenarios can be shown in a model. It is based on the historical data of the last 15 years, taking account of the average efficiency increase of vehicles. On this basis, the kilometres driven are calculated for the baseline year. The model assumes systematic further development of the efficiency goals up to 2020, and a level of 100 g CO_2/km.

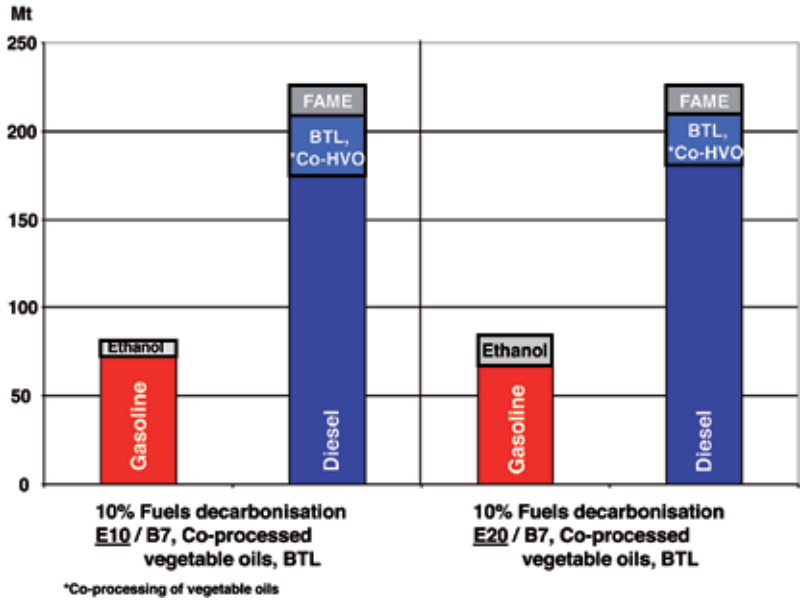

Figure 5: Gasoline and diesel pool mass composition in 2020 according to scenarios

The assumed increase rates in kilometres driven, and the inclusion of efficiency increase, permits conclusions to be drawn on new car consumption. Taking account of the service life of the vehicles, this gives the fleet consumption, whereby the data of the standard cycle are corrected by 10 % to get the real consumption levels. The model also takes account of 50 % more kilometres driven by new vehicles. For the truck sector, it is assumed that demand will increase, with increasing transportation requirements, and it is also assumed that there will be an efficiency increase.

The use of biofuels is increasing continuously. For gasoline, it is assumed that ethanol will be used and for diesel it is assumed that FAME, Co-processed vegetable oils (Hydrotreating) or BTL will be used. Based on the JRC WTW study, conventional ethanol from wheat, using natural gas as process energy, is assumed to give CO_2 avoidance of 40 %, and ethanol made from sugar cane is assumed to give 80 %. No consideration is given to ethanol made with lignite as the process energy, because it does not come up to the legally stipulated minimum avoidance level. FAME is assumed to achieve 50 %, while BTL and hydrated vegetable oils are assumed to give 80 % avoidance on average. That is valid only on condition that the vegetable oils used are grown under particularly low-CO_2 conditions. Unlike the situation with esterification, there are no product disadvantages from that.

4.2 Demand Scenario

The increasing proportion of diesels in the vehicle fleet has a significant impact on the relationship of diesel fuel to gasoline. For an average vehicle life of 15 years, even a partial trend towards gasoline powered cars would still leave a significant increase in diesel demand in 2020. This result is particularly important, because the increasing imbalance between diesel and gasoline demand is a major challenge for the refineries, **Figure 3**.

4.3 Development of CO_2 Emissions

Delay in timing for achievement of the efficiency goals means that the WTW CO_2 emissions can no longer be kept constant, due to increasing mobility. Despite this, in 2020 a reduction of nearly 20 % could be achieved by complete implementation of the efficiency goals. Thus the contribution of the automotive industry is the baseline. The burden for consumers remains within reasonable limits, because a large proportion of the efficiency increase can be achieved at negative cost. But moving into biofuels blending costs money from the very first litre of biofuel blended, to the tune of about 132 to 322 € / t CO_2 avoidance. Fuel decarbonisation of 10 % reduces total CO_2 emissions by a further 12 %. In total, a reduction of CO_2 emissions can be achieved compared with the starting situation 2005, **Figure 4**.

The framework conditions for fuel decarbonisation have been defined on an open-technology basis. Theoretically, the goal could also be achieved by avoidance of CO_2 emissions of fossil fuels from Well to Tank. By continuous efficiency improvements, the refineries

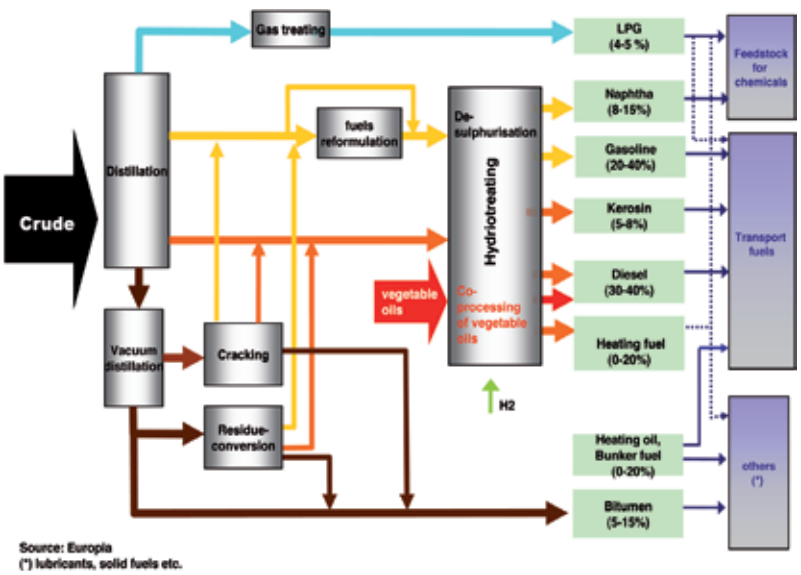

Bild 6: Product pattern of a typical European refinery

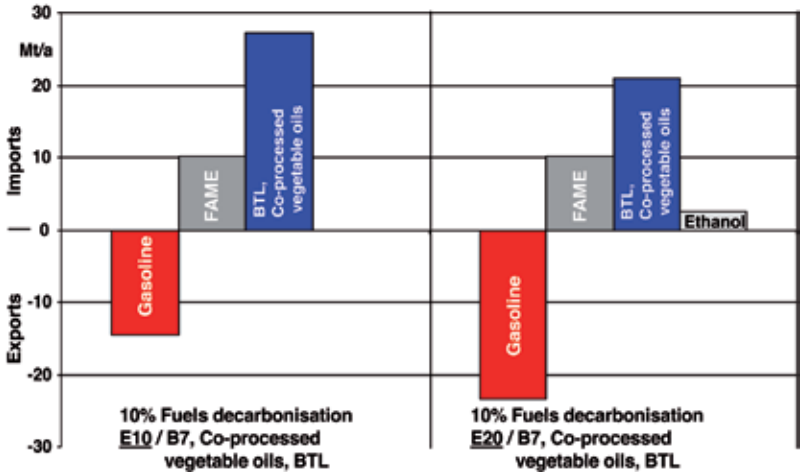

Figure 7: Gasoline exports and biofuel imports in 2020 according to Scenarios to keep the refinery production ratio below 2

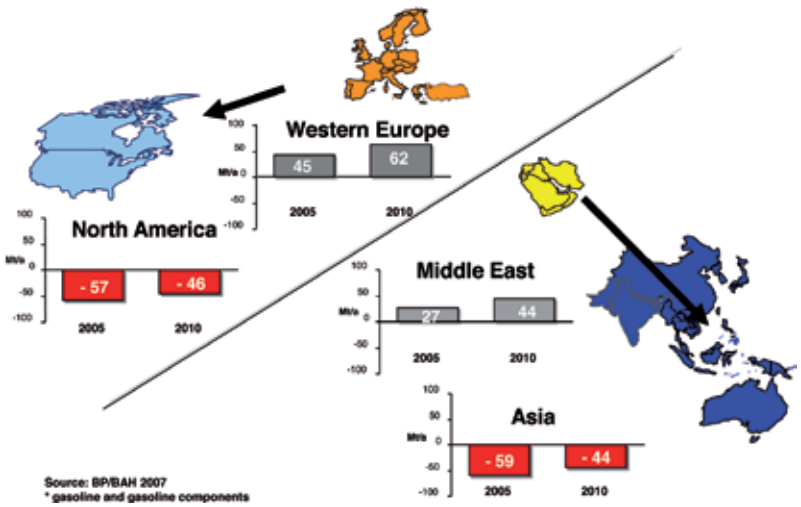

Figure 8: Global gasoline* supply and demand balance (Mt/a)

have in fact contributed to significantly reducing CO_2 emissions in processing. But the proportion is low in life-cycle consideration, at an average of 6.5 % today. Efficiency increases are also cancelled out by ever higher requirements for fuel properties, since these normally require energy-intensive processes. In the present state of the art, the only way to achieve fuel decarbonisation is in fact via biofuels.

4.4 Biomass Availability and Demonstration of Sustainability

To achieve half of the decarbonisation target 72 % of the EU15 arable land would need to be dedicated to bioenergy production. Consequently massiv imports from outside of Europe are the only way to increase the share of biofuels in the market. Today independent biodiesel producers already rely on imported soy and palm oils.

The petroleum industry is actively supporting the introduction of a certification system which gives legal certainty, minimises red tape and is harmonised throughout Europe.

The extension of arable land cannot keep pace with the worldwide rapidly increasing demand for food – with the consequence of exploding food prices. In this context the decarbonisation target deems unrealistic. A moratorium is inevitable until a certification system is in place which is supported by all relevant stakeholders and until the availability of sustainable biomass is secured.

Under these conditions the solution model below is merely theoretical. However, the approach describes ways and means to responsivlely achieve realistic targets minimising market distortions for the benefit of the consumer.

4.5 The Solution Approach of the Fuel Pool

The split of biofuels to the gasoline and diesel segments is defined by the technical limits for the engines, that is 10 % for ethanol and 7 % for FAME. The only practicable way to fill the gap between this and the target is by means of Co-processed vegetable oils or BTL. Even if the ethanol share were to be doubled to 20 %, that would only make a minor change in the ratio, since gasoline will only account for a quarter of the total market in 2020, **Figure 5**.

The necessary volumes of second-generation biofuels cannot be produced in the time horizon envisaged. Individual demonstration and pilot plants for advanced biofuels have been implemented or will be realized in the near future. Full-scale plants will then be built using the experience with the pilot plants.

Co-processing of vegetable oils would be a possible technological bridge. To put it in simple terms, vegetable oil would additionally be used together with the conventional feedstock gasoil. Diesel components obtained in this way meet the high quality requirements for existing and future engine technology. The automotive industry supports the blending of Co-processed vegetable oils. It is possible to use them in large quantities and with a positive impact on engine combustion and on exhaust emissions.

4.6 Impact on Refinery Structure

Even if the decarbonisation goal is achieved in 2020, most of the fuel supply will still be fossil-based. A responsible policy must therefore permit framework conditions which ensure the continued existence of the refinery structure which operates within a largely fixed input / output ratio, **Figure 6**. Even if there is substantial use of biofuels to substitute for diesel, not only the current gasoline-to-diesel ratio of 1.6 but also the assumed maximum of 2 will be

exceeded. That means there is a need for significant capital expenditure in the refinery infrastructure, to reflect the future demand pattern but at the same time to expand exports of surplus gasoline, **Figure 7**. These exports are possible at the present time only because the gasoline deficit in the United States means there is a sales market there. The gasoline deficit of the USA will be reduced by efficiency improvements in vehicles, by the intended biofuels blending, and by structural changes, and that will mean major challenges for the refinery structure in Europe in the medium term. Forecasts of the Supply-Demand balance of the growing Asian market offer little hope of an alternative sales market for surplus gasoline, **Figure 8**.

5 Key Elements of a Consistent Biofuels Strategy

Biofuels are an important component in the fuels mix. They have to be included in a meaningful way in the existing supply structures, and to meet the requirements set by rapid developments in engine technology.

Biomass can be cultivated infinitely, but the arable land is limited at short term, and it is in potential competition with food crops. The goals of the German government have to take account of the availability of biomass, which takes time to develop.

The biofuel blends make gasoline and diesel more expensive. The fuel economy of vehicles first has to be improved substantially, to justify the mandatory consumption of a scarce and expensive resource, and not the other way round.

The framework conditions have to be kept open to all technologies – that is an essential condition for competition to achieve the most cost-efficient production methods.

The primary goal for biofuels must be climate protection, and thus avoidance of CO_2 – creating competition for biofuels that give the maximum CO_2 avoidance.

Sustainable cultivation of the biomass must be ensured, regardless of whether biofuels are grown domestically or are imported. ■

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