Development of passenger cars in Germany

Around 60 million passenger cars, goods vehicles, buses and two-wheel motor vehicles are currently registered in Germany. They have a total mileage of about 650 billion km per year. By 2020, this annual mileage will increase by another 150 billion. The aspect of environmental compatibility therefore plays a crucial role. Energy consumption must be minimised in order to protect resources.

Today’s conventional drives, such as diesel and gasoline engines, have been through a long development process, achieving considerable improvements in respect to performance, comfort, consumption and emissions. Stringent requirements for exhaust gas emissions have led to a sufficiently good air quality despite increasing traffic levels. However, in particular in respect to energy consumption, the situation is unsatisfactory: There is a target conflict between exhaust gas optimisation and consumption optimisation. However, since road traffic still makes the highest contribution to traffic-related CO2 emissions, special measures are needed which target road transport and have a particularly strong impact: Reducing CO2 emissions from vehicles is essential.

Currently, all over Europe there is a trend towards an increasing share diesel cars and a decreasing share of gasoline passenger cars. Also in Germany, the share of diesel vehicles is increasing so that now almost 50% of the newly registered passenger cars have diesel engines. The mileage share of these vehicles will increase correspondingly in future. Other European Union member states (Austria, Belgium) have already years ago reached a share of more than 50% diesel vehicles of the passenger car new registrations. Of the total stock in Germany, currently about 22% are diesel cars, which already leads to air quality problems.

For comparison: in the USA in 2002, diesel vehicles accounted for less than one per cent of the passenger vehicles and light commercial motor vehicles sold. Now the US car manufacturers are pushing very actively for the economical and clean Diesel alternative, in particular on the boom-end market of large, high performance cars. Nevertheless, the outdated image of the loud and sooting diesel engine persists in the USA. This is counter productive in respect to CO2 emissions.

The development of CO2-Emissions of new ACEA vehicles, shows a significantly larger progress for diesel engines (- 22 g/km opposite -17 g/km with gasoline). In addition, the specific CO2 emissions of diesel vehicles are clearly lower, which to the marketing of diesel vehicles in the long run. The potential for fuel consumption reductions has been and still is larger for diesel engines than for gasoline engines.

The specific advantages of diesel vehicles, however, are accompanied by well-known disadvantages. The higher efficiency of the diesel engine faces a better exhaust behaviour of gasoline engines until today. In respect to the environment, CO2 emissions cannot be charged up against nitrogen oxide or particle emissions. Out of
this, we are active to have on the European market the clean diesel technology. Our European legislation is in progress and in a few months we will have new standards for diesel cars. Our goal is, to have them on the same level, as petrol cars. The CO\textsubscript{2} reduction targets can more easily be reached with diesel than gasoline engines. However, even if only diesel cars would be used, the goal of 140 g/km could not be achieved. At present (2004), we would be at a level of 151 g/km. In addition, such a high Diesel portion of the vehicle fleet would be not desirable. Additional efforts are therefore necessary.

The development of the average CO\textsubscript{2} emissions of all vehicles (diesel and gasoline) shows, on the one hand, a continuous decline in CO\textsubscript{2} emissions. On the other hand, this decline is not sufficient to achieve the target of 120 g/km in 2010 (original target of the Commission). According to the current trend it will not be possible to achieve the goal of 140 g CO\textsubscript{2}/km in 2008 either without further measures: This goal cannot be reached without intensified efforts.

**Alternatives to oil based fuels**

Oil is currently the main resource base for the transport sector, the heating market and the chemical industry. The global oil production is currently at a level of roughly 3.8 billion tons per year as of 2004. The primary energy production - that means including also other resources than oil – is currently at around 10.7 billion tons oil equivalent per year and – according to estimates of the International Energy Agency - is assumed to rise to 16.3 billion tons oil equivalent per year.

The term Peak Oil refers to a singular event in history: the peak of the earth’s oil production. After Peak Oil, according to the Hubbert Peak Theory, the rate of oil production on Earth will enter a decline. A global decline in oil production will have serious social and economic consequences if we are not prepared for it. Brief oil interruptions in the seventies caused sharp declines in world GDP growth rate. These sharp declines show, that world growth does much better with steady oil supply than without.

Initially a peak in oil production would manifest itself in rapidly escalating prices and a worldwide oil shortage. This shortage would differ from shortages of the past since the cause would be geological, not political. While past shortages stemmed from a temporary insufficiency of supply, crossing Peak Oil means that the production of oil continues to decline. If there are no alternatives, many products and services produced from oil become scarcer, leading to lower living standards. After peak oil, in the medium term we have two main alternatives available: coal liquefaction and biomass liquefaction.

Biomass is a form of stored solar energy that is captured through the process of photosynthesis in growing plants. Biomass-to-liquids (BTL) is a process to produce liquid fuels out of biomass: It mainly aims at using the whole plant to improve the CO\textsubscript{2} balance and costs. A Fischer-Tropsch process is used to produce synthetic fuels out of gasified biomass. While first generation biofuels, as for example biodiesel and conventional bio-ethanol so far only use parts of a plant, i.e. oil, sugar or starch, BTL production uses the whole plant which is gasified by gasification. The result is that with BTL production, less land area is required per unit of energy produced compared to biodiesel or bio-ethanol.

Liquid hydrocarbon mixtures can also be produced from solid coal via a gasification process and subsequent Fischer-Tropsch synthesis. Thus gasoline, diesel or heating oil can be produced. Unfortunately CTL fuel is very unfavourable from an environmental perspective. A study commissioned by the German Environmental Agency shows that about
60% of the primary energy of the raw material is lost during processing. CO₂ emissions per litre of gasoline fuel would increase by 5.5 kg or by roughly a factor of three.

**Promotion of biofuels in Germany**

From January 1st, 2007, any party that places fuels on the market will be obliged to ensure that biofuels make up a statutorily determined minimum proportion (quota) of the fuel they sell on the German market. It is intended that the quota system should be introduced in a simple, unbureaucratic way and at the lowest possible cost to consumers and the mineral oil industry. The quota will relate to the energetic content of the fuels. Separate quotas will be set for petrol and diesel as of 2007 and rising overall quotas for 2009 to 2015.

The quota will relate to the total sales of the parties liable to comply with the quota and may be achieved by blending or through the sale of pure biofuel. The parties liable to comply with the quota will be free to decide which biofuels they place on the market. The refining of biogenic oils (e.g. hydrotreatment) will not count towards the quota. The reference period will be the calendar year in question. If the quote is exceeded, it will be possible for the surplus to be carried over to the following year. From January 1st, 2007, biofuels that count towards the quota will be subject to the full rates of mineral oil tax/energy tax.

In order to protect investments that were made in the expectation that, as provided for up until now, the favourable tax treatment of biofuels outside the quota would continue until 2011 with a decreasing tax incentive. The tax incentive can be adjusted to take into account the annual overcompensation review. Besides that, the favourable tax treatment of E-85, BTL and bioethanol from enzymatic processing of lignocelluloses will be tax exempt until the end of 2015. Pure biofuels for use in agriculture will also continue to be tax exempt.

Technologies to produce biomass-to-liquids (BTL) include Fischer-Tropsch biodiesel and bio-DME (dimethyl ether). Demonstration plants are in operation in Germany and Sweden. One of the most promising second-generation biofuel technologies – lignocellulosic processing – is already well advanced. Pilot plants have been established in Sweden, Spain and Denmark.

As already mentioned, second-generation biofuels will be favourably taxed until 2015. Since this will be subject to approval by the European Commission in accordance with the provisions applying to state aid, with consideration being given to the arrangements made for overcompensation, the rates applicable will be degressive. The main advantages of second generation biofuels, also from an environmental perspective, are their broader resource base, a strongly improved CO₂ balance and a higher energy yield per unit area.

With the biofuels quota regulation we achieve a substantial contribution to climate protection: solely in the period from 2007 to 2009 we will save about 5 million tons of CO₂ per year whereas these numbers already take into account the well-to-wheel balances for the different biofuels. If we would only allow the use second generation biofuels by our legislation with the same quotas, the CO₂ savings would double to 10 million tons of CO₂ annually. Besides that, the security of supply is increased through the diversification of the resource base of fuels.

**European outlook**

In the upcoming years the European Biofuels Directive will be subject to review and revision. The German
government supports a strong increase in bio fuels use. The review of the bio fuels directive will play a key role in this. The 2015 target should be at least 8% based on energy content. Moreover Germany suggests that the Commission in its review of the bio fuels directive examines a target of 12.5% for 2020.

Furthermore, the question of mandatory targets has to be discussed. There are many arguments in favour of mandatory targets: Market distortions in the EU are best avoided by using mandatory targets. A general Community approach would minimize differences in fuel quality. Security of supply in the very important transport sector will be much more efficient if we have a single EU policy.

Generally the approach with setting targets is a good way forward to give the industry the necessary investment security. In addition to setting future targets, the achievement of existing targets is of equal importance. To this end, mandatory targets will lead to a more coherent implementation of national policies as well as additional measures or minimum criteria to be respected by Member States for the promotion of bio fuels.

From the perspective of the German government a certification system, that the EU is planning to implement, should include the GHG impact and minimum sustainability criteria for crop cultivation (including the impact on natural forests). A first draft of the biofuels directive is expected by the end of 2006.

Also in the upcoming years, the European Fuel Quality Directive will be subject to review and revision. The German government supports increased blending limits from 5 to 10 vol % in order to give companies that have to fulfil the quota obligation a greater flexibility. The current state is as follows: the German institute for standardisation has implemented a task force that is looking at possible ways to increase the blending limits. It is of great importance for us that the fuel standards are changed in a way that all cars (that means including older cars) can drive with fuel that has higher blending limits.

**Conclusion**

Medium term there are no alternatives to the combustion engines available and therefore we have to find ways to reduce CO\(_2\) while using these combustion engine. The large-scale use of coal-to-liquid processes is, from an environmental point of view, the least favourable scenario since we have an increase of CO\(_2\) emissions by roughly a factor of three relative to the CO\(_2\) emissions from petrol. Therefore we should try to increase the biofuels share. Since we are limited in the quantities of biofuels that we can cultivate domestically, we need to import biomass from the global market where we have currently a sufficient amount of biomass available.