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Measures for a sustainable energy supply in the field of mobility

Summary

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SUMMARY

The goal of this report within the framework of monitoring »sustainable energy supplies« is to analyse instruments and measures for achieving a situation in the medium and long term where the transport system makes a significant contribution towards a sustainable energy supply.

The major importance of the transport sector in this context is clear from the following figures: Currently, the transport sector accounts for 30% of final energy consumption in Germany (industry 26%, domestic and small consumers 44%). This share has steadily increased over the last few decades. In 1970 it was still only 17% in western Germany, by 1991 it was 26% in the post-reunification Germany. In terms of petroleum use, transport currently has a share of around two thirds. Besides this growing importance compared to the other energy consumers, the transport sector is the only one showing an increase in the volume of energy consumed in absolute terms since 1991.

Effective impact on transport cannot be achieved through a single instrument, or even a small number of instruments. What is needed is a coordinated package of measures from all areas of transport policy (investment policy, price policy, regulatory policy, organisational measures, public relations). This would ensure that achieving the desired goals will not be hindered by countervailing impacts. The effects of the individual measures must complement and reinforce each other. Such synergetic effects in turn make it possible to keep the intensity of individual measures – e.g. price policy – relatively low, limiting adjustment shocks.

For a quantitative analysis of the effects of such measures, a trend scenario and sustainability scenario are defined up to 2020. For the period 2020–2050 only qualitative considerations are attempted.

There is an overwhelming consensus today that sustainable development should enable the goals of ecological compatibility, economic efficiency and social equity to be achieved simultaneously. However, for reasons of practicality the analysis here focuses initially on the ecological dimension, using CO_2 emissions as the primary indicator. Economic and social aspects are analysed as consequent problems.

TRAFFIC GROWTH IN THE SCENARIOS

TREND SCENARIO

In the trend scenario growth in traffic is predicted as a function of key socio-economic and demographic data, under the assumption that current transport policy is essentially maintained unchanged at all levels involved. This is used as a benchmark for the sustainability scenario.

Passenger traffic

The assumptions for fuel prices are particularly important for traffic growth in the trend scenario. Real fuel prices for internal combustion engines rise 28% from 1997 (the base year) to 2020 to DEM 2.07 (1.06)/l. The percentage growth is significantly higher for diesel due to the lower starting level, amounting to 46% (DEM 1.81 or 0.93/l).

Total passenger mileage increases from 997 billion person/km to 1,272 billion person/km, an increase of c. 28%. By far the highest growth among the various forms of transport is air travel (origin-destination basis), which grows by more than two and a half times. Among ground-based forms of transport, motorised individual passenger transport grows fastest at 28%. Railway traffic is expected to grow 22%. Public road transport is forecast to decline slightly (7%). Non-motorised traffic (pedestrian bicycle) is also forecast to decline slightly (by 4%).

Freight

It is particularly important to note that a road charge of DEM 0.15 (0.08)/ vehicle km is assumed for heavy goods vehicles (HGV) using Federal motorways.

Overall, total traffic is expected to grow 66% in the trend scenario. Long-distance road freight grows by 93%. A lower (but still considerable) rate of growth of 50% is forecast for inland waterway cargo movements, with rail freight growing 30%. A striking feature in the case of rail is that the overall below-average growth in traffic is accompanied by enormous growth in combined freight, which more than doubles in terms of both demand and movements, outstripping road haulage.

SUSTAINABILITY SCENARIO

The sustainability scenario explores the possibilities of using a suitable range of measures to reduce the CO_2 emissions calculated for the benchmark case (trend scenario), while keeping the framework socio-demographic and socio-economic data constant.

Individual measures from various areas of policy are pulled together in efficient packages of measures which shift traffic (changing the modal split in favour of more earth-sensitive transport processes), reduce traffic (e.g. fully utilising potential for rationalisation) and improving vehicle technologies (e.g. saving energy). Greater use of alternative drive systems (fuel cells and fuels) should be achieved through strategic promotion.

The most important element in the sustainability scenario is shifting traffic. Here a fiscal and transport policy framework is defined which is an alternative to that in the trend scenario and substantially improves the competitive position of forms of transport (public road transport, railway and nonmotorised traffic in passenger transport and railway and domestic waterways in freight transport) which compete with road transport (private cars and road haulage).

Passenger traffic

The following measures are central to the evolution of transport in the sustainability scenario:

- A 3% annual increase in pump prices for petrol in the period 1997–2020, equivalent to doubling the price in real terms.
- Kerosene tax based on the average tax rates for road transport diesel fuel in the EU. By 2020 the average price per litre should be around DEM 1.00 (0.51) in real terms.
- Emission levy on CO_2 and NOx emissions in air travel (DEM 0.63 [0.32]/kg CO_2 and DEM 150.00 [76.69]/kg NOx in 2010).
- Complete abolition of the commuter allowance.
- Increased parking space management in cities and conurbations.
- Speed limit for passenger traffic: 120 km/h limit on Federal motorways, 80 km/h limit on other regional roads.
- Mandatory training for drivers in energy-saving and earth-sensitive driving styles.

The total traffic using all forms of transport decreases by 6% in the sustainability scenario compared to the trend scenario, with motorised private transport

declining 14%. Rail and public road transport each grow by around one-third, and nonmotorised traffic also grows by around one-third compared with the trend scenario. Air traffic drops by around 20% compared to the trend scenario, although this still represents an increase of around 160% on the 1997 level.

The decisive factor in achieving the desired shift in traffic is that the range of public transport and nonmotorised transport must be expanded in qualitative and quantitative terms to ensure that these systems can absorb the traffic moving from private cars and public transport and nonmotorised transport must also develop their own »pull« effect.

Freight

Central measures for freight are:

- Tax on diesel fuel is brought in line with the tax on petrol. Pump prices are DEM 3.28 (1.68) per litre (in real terms).
- A road user fee based on engine capacity is charged for the entire road system and all trucks. The fee is increased over time until by 2020 it stands at DEM 0.40 (0.20)/vehicle km for trucks with 3.5–12 t gross permitted weight, at DEM 0.60 (0.31)/vehicle km for trucks with 12–18 t gross permitted weight, and DEM 1.00 (0.51)/vehicle km for trucks with 18–40 t gross permitted weight.

In addition there are:

- More controls on existing speed limits and a ban on trucks overtaking on Federal motorways and roads.
- Closer monitoring of regulations on driving time and breaks.
- Installation of tachygraphs and speed regulators which cannot be manipulated.
- Further liberalisation of the European rail market.
- Removal of bottlenecks in rail networks and transhipment centres for combined traffic, increased capacity of routes and general reduction in transport time.

Total freight traffic decreases only slightly (by 2.6%) in the sustainability scenario compared with the trend scenario, and compared with 1997 levels this still means growth of over 60%, or an average 2.1% a year. A notable feature of this development is that even in the sustainability scenario traffic still grows faster than GDP with intensive price policy measures. The goal of decoupling

freight traffic growth from economic growth by 2020 is accordingly virtually unattainable.

The effect on long-distance road freight of transferring and reducing traffic is to reduce traffic by almost one-fifth compared with the trend scenario. The potential reduction of 83 billion tkm in long-distance road freight has the biggest impact on the railways, which can add a further 45 billion tkm to 140 billion tkm compared to the trend scenario. Compared to the base year 1997, this would mean almost doubling movements. However, unless the many deficiencies and inadequacies of DB AG's freight system in particular can be significantly reduced in the medium and long term, the volumes calculated for rail in the sustainability scenario will remain wishful thinking.

Losses to long-distance road freight result in significantly lower growth of 13 billion tkm for inland shipping, corresponding to a rise in traffic of just under 15%. In air freight, traffic falls around 27% compared to the trend scenario. However, as with passenger traffic, this still means growth of around 160% compared with 1997.

CO_2 EMISSIONS

TREND SCENARIO

In the trend scenario, total CO_2 emissions of motorised traffic in Germany, including air traffic originating in Germany, rise 13% between 1997 and 2020. This growth is almost entirely the result in growth of truck and air traffic. While road and rail traffic have virtually unchanged CO_2 emissions compared with 1997, and the rise in emissions from inland shipping is unimportant because of its minimal significance in the broad picture, air traffic emissions rise 139%. This boosts the share of air transport in total emissions of motorised transport from 9% in 1997 to 19% in 2020. The share of private road transport in total CO_2 emissions by transport declines over the same period from 60% to 45%, while the share of road freight rises from 26% to 3%.

SUSTAINABILITY SCENARIO

In the sustainability scenario total CO_2 emissions by motorised transport rises by around 20% between 1997 and 2020. Within this, higher reductions in individual sectors are partly offset by air transport.

For example, CO_2 emissions from road transport decline by just under 30% under the assumptions of the sustainability scenario, while in air transport they rise sharply (by around 50%). This boosts the share of air transport in total emissions of motorised transport from 9% in 1997 to 17% in 2020. The share of private road transport in total CO_2 emissions by transport declines over the same period from 60% to 40%, while the share of road freight rises from 26% to 36%.

For rail, CO_2 emissions decline slightly (by 6%) despite high growth in traffic (c. 60% for passengers and 90% for freight), due primarily to the assumption of a relatively high use of renewable energy (»solar long-term scenario«) in electricity generation.

ECONOMIC AND SOCIAL CONSEQUENCES

Total household spending on transport rises in the trend scenario by 21% from 1997 to 2020 to DEM 350 billion (178.9 billion). This represents annual average growth of 0.8%, well behind average growth in GDP (just under 2%). As a result, spending on transport lags behind total spending by private households.

In the sustainability scenario by 2020 spending on transport rises by 7% faster than in the trend scenario, increasing to DEM 374 billion (191.2 billion) This represents average annual growth of 1.1% from 1997. However, even with this higher growth, spending on transport still lags behind other elements in total spending by private households.

The price increases assumed for fuel are accordingly largely offset by the reduction in consumption. In this way the price policy (among other factors) drives a process of technical development which leads to improved energy utilisation which in turn limits growth in costs.

Transport costs for long-distance road freight are some 35–40% higher in the sustainability scenario by 2020 than in the trend scenario. Even so, this only increases costs to the economy by c. 0.5%. Only a few sectors of the economy are

affected by increases in transport costs to the point where there is a risk of significant economic consequences, e.g. building materials (share in costs: 13.5%), forestry and fisheries (5.5%), food (6%), paper and board (4.9%), wood processing (4.4%), glass (4.1%), chemical products (3.9%) and the transport sector itself.

There is accordingly no basis for concern that Germany could lose appeal as a location for industry as a result of transport cost increases on the scale assumed here. There is even less risk of this given that increasing the cost of road transport only makes sense if comparable (price) regimes are introduced in all EU countries. In addition, as experience has shown, it should only be possible to implement these at EU level.

TRENDS IN THE PERIOD 2020-2050

Quantitative statements about the evolution of traffic in the period 2020–2050 are extremely speculative. Even so, long-term statements about the long-term goal of »sustainable development« are desirable. We accordingly outline some qualitative considerations of possible developments up to 2050.

First, it is clear that a possible decrease in passenger traffic is unlikely to be so significant that near-approximation to the sustainability goal for 2050 (80% reduction in CO_2 emissions from 1990 levels) would follow quasi automatically. As a result, measures to influence and shape transport will be needed even after 2020.

The contribution towards a »sustainable« transport system of behavioural changes on the part of the actors in transport will probably continue to be limited after 2020. The major role in reducing CO_2 emissions will have to come from technical improvements, even in the more distant future. For this it is essential to exploit to the utmost the technical possibilities for limiting consumption of fossil fuels. Without a supporting pricing policy as an incentive to use energy-saving technology, this will be virtually impossible.

The trends towards globalisation and internationalisation of production and trade and to national and international intensification of the division of labour will continue beyond 2020. This will lead directly to an increase in the transport intensity of the economic system, with resulting further growth in traffic. No autonomous developments are apparent in freight transport markets beyond 2020 which would contribute significantly towards reducing CO_2 emissions. It remains to be seen how far technical developments (drive technologies, renewa-

ble fuels) can make a significant contribution. It accordingly seems appropriate to leave the price policy measures of the sustainability scenario in place for the freight transport markets even after 2020, possibly with enhanced intensity.

Statements for the period after 2020 are equally difficult when it comes to the technical potential for reducing energy consumption and CO_2 emissions. To achieve the emission goals, a substantial increase in efficiency is required – improved engine efficiency, downsizing vehicles and engines, energy recovery, electric motors, going without enhancements to comfort – all with the goal of the »1 litre car«. At the same time, increased use of renewable or low-carbon fuels is essential. In the short and medium term it might be helpful to replace petrol and diesel fuels with natural gas. Bioenergy fuels (biodiesel, plant oils, bioethanol or biogas) and the use of electricity generated from renewable fuels, directly and through renewable hydrogen in combination with fuel cells all have potential for reducing emission levels in transport.

COMPATIBILITY OF TRANSPORT POLICY MEASURES WITH THE CONSTITUTION AND EUROPEAN LAW

Constitutionally, the relationship between the central fiscal and price policy measures discussed in connection with the sustainability scenario and article 12 paragraph 1 of the German constitution (freedom of occupation) is particularly problematic. As far as European secondary law (and even European primary law) is concerned, the scope for use of instruments at national level is being steadily reduced.

Petroleum tax increases

A stepwise increase in petroleum tax to DEM 2.34 (1.20)/litre for petrol and diesel in real terms by 2020 can be implemented by Federal legislation without approval by the Bundesrat. The associated incursions into constitutional rights under article 12 para. 1 (freedom of occupation), article 3 para. 1 (equality before the law) and article 2 para. 1 (personal freedoms) can be justified under the conditions described above. There are no obstacles in European legislation.

Abolition of the commuter allowance

The Federal legislature has the competence to abolish the commuter allowance, subject to approval by the Bundesrat. However, abolishing the commuter allowance infringes the freedom of occupation under article 12 para. 1 of the German

Constitution. This infringement would not be justified, and would accordingly be unconstitutional.

Introduction of a road user fee for trucks

The EU Directive on charging HGV for using certain infrastructures imposes stringent requirements for a truck road user fee to be permissible. It applies to trucks from a gross permitted weight of 12 t. A road user fee for HGV may only be charged for using motorways. For safety reasons, extension of the road user fee to individual stretches of other roads is permissible as an exception.

The level of the fee must be calculated on the basis of the costs of constructing, operating and extending the motorways. External costs may not be included. On the basis of the information available, the annual cost to the Federal government of this is around DEM 9.8 billion (4.9 billion). Assuming on the basis of HGV annual kilometrage that a road user fee of DEM 0.01 (0.005)/vehicle km will generate annual revenue of around DEM 240 million (122.7 million), the annual costs of the Federal government are covered by a road user fee of DEM 0.41 (0.21)/vehicle km. Any significant increase above this, and specifically the fee for consideration of DEM 0.60 (0.31) or DEM 1.00 (0.51)/vehicle km is not permitted under European law.

There are no fundamental constitutional problems with the remaining HGV road user fee of DEM 0.41 (0.21)/vehicle km. It should, however, be noted that there are constitutional problems if the HGV road user fee is used exclusively to recover road costs. This would mean that road hauliers would have to bear the entire cost of building, operating and extending the motorways even though they are not alone in causing the costs. As a result, other goals (creating financial incentives to avoid transportation, avoiding trips without loads or transferring transportation from road to rail or inland shipping) would have to be pursued. Achieving these goals could contribute towards a sustainable energy supply, environmental protection and easing the burden on the roads. Pursuing other goals should be entirely acceptable in terms of European law provided that the level of the HGV road user fee is calculated on the basis of the costs of building, operating and extending the motorways.

Measures for steering air traffic

The introduction of a kerosene tax would be possible under national law and the Chicago Convention, but would violate numerous bilateral aviation treaties and current European law.

An emission levy could be introduced at national level, and would not involve problems with international law. Whether European law allows an emission levy is a matter of controversy: the European Court certainly argues that such a levy would violate EU law.

As a result the most promising approach appears to be to introduce both kerosene tax and an emission levy at the European level.

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