CHAPTER 2  CZECH REPUBLIC

POLICIES AND MEASURES TO MITIGATE GREENHOUSE GAS EMISSIONS
IN THE TRANSPORT SECTOR IN THE CZECH REPUBLIC

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Ales Kutak, Stephanos Anastasiadis, Jan Zeman
2.1 INTRODUCTION

The aim of this report is to identify the possibilities for reducing the emission of carbon monoxide (CO$_2$) by the transport sector in the Czech Republic, which accounts for 8.27% of total national CO$_2$ emissions. The two case studies presented are based on the measures that were outlined in the chapter "Provisions Leading to Emission Reduction" in the Second Communication of the Czech Republic to the United Nations Framework Convention on Climate Change.

Specifically, this report reviews a few measures including: first, the development of combined transport and second, the production and utilisation of biodiesel fuel. Our criteria for assessment concentrate on quantitative environmental benefits, especially energy saved, CO$_2$ emissions reductions, and reductions of other pollutants. Nevertheless, economic and social dimensions of the measures (namely project costs and employment benefits) are also considered.

After presenting these two case studies of good practices, we discuss briefly the findings of an analysis of other emission reduction provisions contained within the Second Communication. They include optimisation of traffic on certain major roads and modernisation of bypasses, supporting the development of urban public passenger transport, and internalisation of the external costs of transport.

To understand the implications of the policies and measures discussed below, it is necessary to review briefly the present situation of the Czech transport sector. By comparison to most other Central and Eastern Europe countries (CEEC), the Czech Republic exited socialism with a dense road and rail network. As in other Economies in Transition countries (EITs), the modal share of private automobile transportation and road freight was small compared to the countries of Western Europe. Since 1989, however, transportation patterns have tended to converge with those typical of the West. For instance, the share of total freight transport by road almost tripled between 1990 and 1997, reaching approximately 60% by 1997; whereas over the same period freight transport by railway shrunk to almost one half of its original share in 1990. A similar shift took place in passenger transport. Between 1990 and 1998, the total demand for public passenger transport in the Czech Republic fell by 50%, while the number of passenger cars grew by 50%. As a result of these trends, CO$_2$ emissions from the entire transport sector (i.e., freight and passenger) rose by 20% from 1994 to 1999.

Since 2000, the State Infrastructure Fund (SFDI) has financed most transport infrastructure development. This fund is relatively independent from the state budget. For 2001, the fund has a budget of over 30 billion Czech crowns (CZK), equalling roughly USD 815 million. Some of the larger infrastructure projects, which the fund cannot finance due to its statute, continue to be financed by the state budget (e.g., underground construction in Prague). State-guaranteed credits from the European Investment Bank and certain commercial banks are an important source of finance. European Union (EU) funds and programs are convenient side sources. Examples are the
Poland and Hungary Assistance for Restructuring of their Economies (better known as PHARE), and the Instrument for Structural Policies for Pre-Accession (ISPA).

The operational loss of public transport operators is covered by the state budget, while repairs and construction of small roads are funded or co-funded by municipality budgets. There is no aggregate data available on the total amount of finance flowing into the transport sector. However, expenditures on infrastructure investments are known and show a clear preference for road development over that of rail: in 2001, road infrastructure investment surpassed that in railways by more than CZK 7 billion\(^5\).

Given this situation, it appears that barring a major shift in national policies and priorities, the Czech Republic is doomed to repeat the mistakes of Western Europe and North America, by allowing private road transport to develop at the expense of public and non-road transport, with all the environmental and human costs such a direction entails. The aim of this report is to examine the alternatives to such a policy.

### 2.2 COMBINED TRANSPORT

**Introduction**

Combined transport is defined as transportation of freight using two or more modes of transport. In the Czech Republic, the most common variant is the combination of road and railway transport. Present conditions do not allow for road-and-water and rail-and-water combined transport to reach a significant share of the total.

The road and rail combined transport in the Czech Republic uses three systems: International Standard Organisation (ISO) containers, “RoLa system” (Rollende Landstrasse, Rolling road), and piggyback transport with swap bodies. Road-railer bimodal systems, piggyback transport with semi-trailers, and direct transhipping of containers are not yet used in the Czech Republic.

The container transport system was brought into operation during the 1970s and was used for both transport within the then Czechoslovakia and for trade with the Soviet Union (USSR). Most transport was in 1C-size ISO containers. After 1989, the movement of containers shifted. Transport to and from European harbors now plays a significant role. The RoLa system—the transport of entire road trucks on special low-floor railway carriages—was first introduced in 1994 on the Lovosice - Decin – Dresden (Germany) line. This line is still in operation. From 1993 to 1998 another line, which the Austrian government had subsidised, was operated between Ceske Budejovice - Linz - Villach (Austria). Transport within the Czech Republic was operated by the Czech Railways Company and Bohemiakombi\(^6\) on both lines.
**Impact on CO₂ emissions**

In this section, we look at how significant a role combined transport can play in reducing greenhouse gas (GHG) emissions. First, we illustrate how two already functioning systems perform, and then we calculate a projection for an “optimum-use” scenario.

Following is a review of the existing conservation, which in turn is followed by calculation of potential further emissions savings.

**The RoLa system**

The two RoLa systems in the Czech Republic have already led to a significant decrease in total energy consumption and CO₂ emissions. The average annual energy conservation and emissions reduction potential for 1994-2000 of the Lovosice-Decin–Schöna route (still in operation) and the Ceske Budejovice-Horní Dvorište-Summerau route (cancelled) are presented.

According to the general management of Czech Railways Co., the RoLa system conserved 7,620 Megajoules (MJ) of energy in 1997 and 19,007 MJ in 2000. Also, the RoLa system has led to a reduction of total air emissions of dust, sulphur dioxide (SO₂), (nitrogen oxides) NOₓ, and carbon oxide (CO) by 148 to 192 tonnes each year (see Tables 2.1 and 2.2).

**Table 2.1 RoLa - Energy conservation (MJ)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Conserved (MJ)</td>
<td>475.946</td>
<td>9,949.912</td>
<td>14,208.86</td>
<td>7,620.356</td>
</tr>
<tr>
<td>Year</td>
<td>1998</td>
<td>1999</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Energy Conserved (MJ)</td>
<td>19,007.59</td>
<td>18,885.35</td>
<td>19,007.00</td>
<td></td>
</tr>
</tbody>
</table>

* starting year, with minimal usage

*Source: General Management of Czech Railways, 2001.*

**Table 2.2 RoLa - Air emissions reduction (tons)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Dust particles</th>
<th>SO₂*</th>
<th>NOₓ</th>
<th>CO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5.335</td>
<td>-44.145</td>
<td>135.239</td>
<td>82.480</td>
<td>178.909</td>
</tr>
<tr>
<td>1999</td>
<td>5.697</td>
<td>-46.111</td>
<td>143.835</td>
<td>87.589</td>
<td>191.009</td>
</tr>
<tr>
<td>1998</td>
<td>5.724</td>
<td>-46.298</td>
<td>144.516</td>
<td>87.998</td>
<td>191.940</td>
</tr>
<tr>
<td>1997</td>
<td>4.400</td>
<td>-44.153</td>
<td>115.852</td>
<td>71.667</td>
<td>147.766</td>
</tr>
<tr>
<td>1996</td>
<td>5.231</td>
<td>-46.176</td>
<td>134.206</td>
<td>82.228</td>
<td>175.490</td>
</tr>
<tr>
<td>1995</td>
<td>4.624</td>
<td>-44.014</td>
<td>120.414</td>
<td>74.190</td>
<td>155.214</td>
</tr>
<tr>
<td>1994</td>
<td>0.909</td>
<td>-11.626</td>
<td>25.321</td>
<td>15.979</td>
<td>30.582</td>
</tr>
</tbody>
</table>

* Electric railway traction plots the average emissions for a unit of electricity produced.

*Source: General Management of Czech Railways, 2001.*
The container system

The conservation of energy and reduction in the four most significant types of emissions will be calculated for the container transport system for 1999. The calculated values are estimates, because exact input data, both quantitative and qualitative, are unavailable.

The amount of transport by railway instead of road was the main calculation criterion. The performance of container transport was calculated and the energy consumption and emissions of road freight transport and combined container transport were compared. The result suggests that the combined container transport conserves large amounts of energy and significantly reduces emissions. The results are summarised in Table 2.3 below. The whole process can be viewed in Appendix B.

Table 2.3 Container system - Emissions reduction (tonnes) and energy conservation in gigajoule (GJ): 1999

<table>
<thead>
<tr>
<th>CO₂ reduction</th>
<th>CO reduction</th>
<th>NOₓ reduction</th>
<th>CₓHᵧ reduction</th>
<th>Energy conserved</th>
</tr>
</thead>
<tbody>
<tr>
<td>61,000</td>
<td>860</td>
<td>1,240</td>
<td>370</td>
<td>760,000</td>
</tr>
</tbody>
</table>

Projected impact of optimum utilisation of combined transport

This section quantifies the benefits of combined transport for a hypothetical case, which incorporates the “optimum” use of this transportation mode. This optimum presents a case in which combined transport accounted for roughly 25% of the total freight transport in the country. If international trucks are considered, a significantly larger proportion could be achieved.

Since the number of trucks that could be transported on the RoLa system cannot be estimated objectively, it is impossible to make a trustworthy estimate of energy conservation and emissions reduction for this mode of combined transport. Therefore, our calculation will confine itself to the case of container transport.

Again, the calculated values are approximate only, since exact input data, both quantitative and qualitative, are unavailable. The amount of freight transported on railways instead of road is again the focal calculation criterion. Let us again assume the average loads of 1,100 tonnes for a train and 30 tonnes for a truck.

Since the combined transport could constitute approximately 25% of total transport, and since the total freight transport is 60,000 million tonne km, it would carry 15,000 million tonne km. Therefore, container transport, being 33% of the total combined transport, would carry 5,000 million tonne km (per year).

Based on the average energy consumption of road and rail freight transport, the calculation results in the following data:
- The emissions for railway container transport would be 300,000 tonnes of CO₂, 300 tonnes of CO, 1,500 tonnes of NOₓ, and 500 tonnes of hydrocarbons (CₓHᵧ). The railway container transport would consume 2,000 TJ of energy.
• Road truck transport, on the other hand, would emit 1,400,000 tonnes of CO₂, 16,000 tonnes of CO, 24,000 tonnes of NOx and 7,500 tonnes of CₓHy, consuming 16,000 TJ of energy, for the same amount of freight.
• Therefore, in the optimum-usage scenario, the railway container transport saves 1,100,000 tonnes of CO₂, 15,700 tonnes of CO, 22,500 tonnes of NOx, 7,000 tonnes of CₓHy, and 14,000 TJ of energy.

<table>
<thead>
<tr>
<th>CO₂ reduction</th>
<th>CO reduction</th>
<th>NOₓ reduction</th>
<th>CₓHy reduction</th>
<th>Energy conserved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,100,000</td>
<td>15,700</td>
<td>22,500</td>
<td>7,000</td>
<td>14,000,000</td>
</tr>
</tbody>
</table>

**Economic benefits**

In the absence of harmonized transport prices (i.e., internalisation of external costs – see Chapter 2.4), it is possible to identify the likely economic benefits but not to quantify them.

The creation of a combined transport system can bring the following economic benefits:

• production and development of railway carriages for the combined transport;
• construction of transhipment terminals;
• production and development of transhipment terminal equipment (e.g., special cranes and container transhipment equipment);
• employment growth in the industries related to combined transport; and
• the net benefit to the state budget created by the offsetting financial subsidies against the external costs saved (which can be used to eliminate the negative economic consequences).

On the other hand, it can have the following negative economic consequences:

• a drop in production and sales of freight vehicles;
• a drop in need for new roads and motorways;
• a drop in fuel production and sales; and
• a decrease of the number of jobs in the above mentioned areas.

**State support of combined transport**

The 1998 ‘Transport Policy of the Czech Republic’ states that combined transport is not directly addressed in legislation. The necessary changes in legislation are recommended, based on standards of the European Union. It mentions the need to support development of the vehicle fleet and special equipment for combined transport and to monitor the optimal utilisation of transhipment terminals and logistic centres. A government report\(^9\) expresses similar concerns.
Financial instruments

The state financial instruments for the support of combined transport are:

- subsidies for the purchase of low-floor container carriages for the Czech Railways Co.;
- partial support of enterprises for establishing new combined transport systems and vehicles, such as swap bodies;
- support of modernisation of transhipment mechanisms and reconstruction of logistic terminals;
- support to purchase new technology, especially for manipulation with swap bodies; and
- operational subsidies for the Lovosice - Decin - Schöna - (Dresden) RoLa line.

Czech Railways Co. has been receiving steadily increasing subsidies for the purchase of container carriages since 1996; since 1998 purchases by private enterprises have also been subsidised. The proposal for 2000 foresees the same level of subsidy. A detailed overview of the subsidies follows.

Investment subsidies

Since 1996, Czech Railways Co. has been receiving investment subsidy for the purchase of container carriages. In 1998, the Ministry of Transport began subsidising private businesses for purchase of transhipment mechanisms, swap bodies, road container carriages, etc. The proposal for 2000 included a subsidy of CZK 5 million for governmental installations in the transhipment terminals. Investment support for new terminals and the reconstruction of the existing terminals has not taken place due to their sufficient capacity.

<table>
<thead>
<tr>
<th>Table 2.5: Investment subsidy overview 1996-1999 (in million CZK)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td><strong>Czech Railways</strong></td>
</tr>
<tr>
<td><strong>Private entities</strong></td>
</tr>
<tr>
<td><strong>Governmental</strong></td>
</tr>
</tbody>
</table>

*proposed

The investment subsidies for the Lovosivice-Schöna RoLa line (see table 2.6) are planned to cover the construction of new transhipment terminals and reconstruction of the existing facilities.

Table 2.6: Investment and operation subsidy for the Lovosice - Schöna RoLa line, received and proposed. The Czech share only (in million CZK)

<table>
<thead>
<tr>
<th></th>
<th>Subsidy received</th>
<th>Subsidy proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>investment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>85</td>
</tr>
<tr>
<td><strong>operation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>205</td>
</tr>
</tbody>
</table>


The only existing RoLa line between Lovosice and Schöna has been receiving an operation subsidy, with the Czech share constituting between CZK 85 and 102 million. There are proposals to raise the subsidy substantially (to CZK 235 million in 2005), but there is a serious threat that the subsidy may be cancelled altogether. The government plans to cancel this subsidy in 2005 at the latest, when the D8 motorway across the border is opened.

**Legislation**

Besides several amendments of existing laws (Trade Act, Enterprise Act, etc.), a new Integrated and Intermodal Transport Bill was proposed in compliance with international agreements and conventions that bind the Czech Republic (e.g., The European Agreement on Important International Combined Transport Lines and Related Installations - AGTC). Unfortunately, this document has not yet left the Ministry of Transport, whose individual departments disagree on the need for such a law.

**Barriers to the Development of Combined Transport**

The principal factor limiting a significant expansion of the combined transport system is that transport prices are not harmonised. This then creates other barriers. These secondary barriers (not taking into account price factors) include inflexibility among railway haulers, little customer knowledge of the combined transport system, and the relative difficulty of route planning in a situation where a surplus exists of truck haulers, who offer convenient door-to-door service.

In present conditions, direct road transport has a competitive advantage (i.e., lower costs) over combined transport because the railway tariff is higher for combined transport than.
for regular freight. Another factor is the cost of road transport to and from the transhipment terminals as well as loading and offloading (a costly affair - each container costs CZK 1,000). The operation costs of the terminal and the costs of the operator affect the competitiveness of combined transport vis-à-vis direct road transport.

The efforts of the Czech state to subsidise certain combined transport projects are in fact only a complicated attempt at remedying the negative consequences of the current irrational price regime (see chapter 2.4). The attitude of the Czech government is demonstrated best by their unwillingness to significantly support accompanied transport (the RoLa system). This position is expressed, among others places, in the Governmental Proposal for Transport Networks Development to 2010.

Furthermore, enterprises are very unlikely to start any combined transport projects demanding long-term investment now that the governmental support may end at any time.

Conclusion
Combined transport represents a potentially significant way to reduce greenhouse gas emissions. However, the current tariff conditions do not support any significant expansion of combined transport and are not sufficient to compensate for the disadvantages it suffers from in comparison to road truck transport.

2.3 BIODIESEL

Introduction
The object of this section is to evaluate the possible benefit of a biodiesel fuel production support program as defined in the joint material on the reduction of greenhouse gas emissions of the Czech Ministries of Agriculture and Environment from June 22, 2000 8. Furthermore, the study serves other functions too such as evaluating other environmental benefits, considering the social and economic context, estimating the likely limitations to the use of biodiesel as well as summing up the principal obstacles and risks that impede full utilisation and the realisation of potential benefits.

The Present Situation
In the Czech Republic, the term biodiesel is used for a mixture of diesel oil and “fatty acid rape oil methylester” (FARME) in which the share of FARME exceeds 30% of weight. The rest of the fuel consists of crude oil products chosen to maintain the 90% biodegradability of the final product within 21 days. This mixed fuel has certain technical advantages against pure FARME. First, the fuel does not dilute the engine lubricant oil, which thus need not be changed so often. Second, the mixed fuel does not cause problems when starting the engine at low temperatures and is comparatively less damaging to rubber pipes and paint.
The Czech support program for the production of FARME and mixed fuel, the Oleoprogram, was initiated in 1992. Its aim was primarily to support the utilisation of agricultural land for non-food production and the implementation of new technologies for renewable energy generation. Lately, policymakers have recognised that this program may help solve environmental problems related to transport has been recognised.

The support provided by this program so far can be divided into the following three areas:

- support for the construction of FARME and mixed fuel production facilities through loans;
- indirect support in the form of zero excise duty on the FARME produced and partial return of the excise duty to the end users of the mixed fuel (according to the content share of FARME); and
- direct support for the production of FARME and mixed fuel (see below).

There is no direct subsidy in the Czech Republic for setting aside from agricultural use similar to that used by farmers in the European Union growing rape seed for energy and fuel purposes.

On April 1, 2000, the excise duty relief for mixed fuel was cancelled, although FARME is still free from the excise duty. At the same time, direct support to the producers of FARME and mixed fuel was increased. It is expected that another form of support will be introduced in the future. This will include the purchase of rape seed from Czech farmers and its subsequent sale to the producers of biofuels in order to maintain the price of biofuel at 90% of conventional diesel. The present FARME production capacity is roughly 60,000 tonnes per year.

**Impact on CO₂ emissions**

For the sake of simplicity, this chapter will discuss figures for FARME. The total benefit of the use of mixed fuel in the Czech Republic will be deduced from the total production of FARME as a component of the mixed fuel.

**Energy balance**

The calculation of input energy for the production of FARME is influenced by a variety of factors. It depends on expected yields, energy consumption during the production of the applied fertilisers, pesticides, as well as on farming methods, production technologies, etc. Another condition influencing the total energy balance is the fact that by-products of the processing of rape (such as grouts, glycerine or straw) are also used in energy production.

All sources state a very positive energy balance for FARME (i.e., the outputs outweigh the inputs). Table 2.7 summarises this balance.
Table 2.7 Energy balance of FARME production

<table>
<thead>
<tr>
<th>Source</th>
<th>Balance (output : input)</th>
<th>Output includes by-products</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Petroleum Industry Association (EUROPIE)</td>
<td>1.49:1 1.9:1</td>
<td>No Grouts</td>
</tr>
<tr>
<td>Union für Förderung von Vel- und Proteinflanzen e.v., Germany (UFOP)</td>
<td>3:1</td>
<td>No</td>
</tr>
<tr>
<td>Institut für Energie und Umweltforschung, Germany (IFEU)</td>
<td>1.47:1 3.42:1</td>
<td>No Grouts, glycerine, straw</td>
</tr>
</tbody>
</table>


Greenhouse gas balance

The balance of greenhouse gases is even more difficult to quantify from a methodological point of view. It cannot be defined on the sole basis of the energy balance, since other greenhouse gases also influence it. These gases, namely methane (CH₄) and nitrous oxide (N₂O), are produced in the course of the production and application of artificial fertilisers, for instance during the processing of rape seed.

The differences between the individual sources are significant. Therefore the quantification of the likely benefit of the Oleoprogram for greenhouse gas emissions reduction is likely to be very inaccurate. The following calculation is only a rough estimate. The real reduction of emissions will probably be higher - up to three times, according to some sources ¹⁰.

Considering that the CO₂ equivalent emissions produced during the extraction, production, transportation and burning of conventional diesel oil is 3.4kg per 1kg of oil, and considering the balance calculated by the German Institute for Energy and Environment Conservation (IFEU), the reduction of greenhouse gas emissions for 1kg of FARME is approximately 1.2 kg of CO₂. If the Oleoprogram assumes an increase in FARME production by about 40,000 tonnes a year (from 1999 levels), there would be a reduction of CO₂ equivalent by some 48,000 tonnes a year.

Table 2.8 GHG balance conventional diesel : FARME

<table>
<thead>
<tr>
<th>Source</th>
<th>Balance (conventional diesel : FARME)</th>
<th>Output includes by-products</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUROPIE</td>
<td>1.14:1</td>
<td>No</td>
</tr>
<tr>
<td>UFOP</td>
<td>3:1 – 4.4:1</td>
<td>No</td>
</tr>
<tr>
<td>IFEU</td>
<td>1.54:1</td>
<td>No</td>
</tr>
</tbody>
</table>

Sources: Navrh reseni Oleoprogramu pro obdobi roku 2001 a dalsi roky (c.j. 1987/300/2100/320/00).
Impact on emissions of other pollutants

The use of mixed fuel also eliminates SO₂ emissions. FARME contains no sulphuric compounds at all and emits considerably less carbon monoxide and hydrocarbons than conventional diesel oil. FARME emits 0.77 g of CO per kWh and 0.19 g of hydrocarbons per kWh, whereas conventional diesel oil emits 0.92 g and 0.23 g per kWh respectively. On the other hand, it emits slightly more nitrogen oxides (approximately 3-5%)¹¹. FARME offers environmental benefits beyond air pollution such as 98% biodegradability within 21 days and no health risk when it comes in contact with skin¹².

Economic and social context

Support for production

Between 1992 and 1995, the Czech Ministry of Agriculture granted loans for the construction of FARME and mixed fuel production facilities. The loans, totalling CZK 721.5 million, were divided among 16 enterprises with total production capacity of approximately 60,000 tonnes of FARME a year.

Before April 1, 2000, mixed fuel production was supported indirectly by means of zero excise duty on produced FARME and the return of part of the excise duty to final consumers of the mixed fuel (depending on the percentage of FARME). Furthermore, in 1999 and the first quarter of 2000, direct support was granted, amounting to CZK 3.0 per kg of produced FARME.

Since April 1, 2000, the mixed fuel has been subject to excise duty identical to that of conventional diesel (i.e., CZK 8.15 per litre), whereas the zero duty on pure FARME has been preserved. Therefore, a new form of direct support was introduced, amounting to up to CZK 13,000 per tonne to the producers of FARME, and up to CZK 16,000 per tonne of processed FARME to the producers of the mixed fuel¹³.

The form and financial demand of the Oleoprogram for 2001 and future years

In order to simplify the form of support and to harmonise it with common practice in EU countries, a change in the system of financial support for the production of biofuel has proposed by the Ministry of Agriculture. The aim of the support is to keep the price of mixed fuel at 90% of the price of the conventional diesel oil. The reason is that mixed fuel has a slightly lower efficiency than traditional diesel (5-7% lower).

The support is based on the principle of intervention purchase of rape seed from Czech producers and its subsequent sale to FARME producers at a calculated price, which is significantly lower than the purchase price. Since the price is calculated so that the mixed fuel is 90% of the price of conventional diesel oil, it is dependent on the price of crude oil. Should the price of crude oil drop so much that a zero price for rape seed would be needed to maintain the necessary final price of mixed fuel, an auxiliary support system is
proposed. This eventuality, however, is unlikely since the price of conventional diesel oil would have to drop below CZK 17.50 per litre (i.e., approx. 0.5 Euro per litre). Intervention purchases will be managed by a state-appointed organisation. The existing State Market Regulation Fund or the State Agriculture Intervention Fund now being established, are both considered appropriate for this function. The state budget would cover the losses for this regulatory body. The total financial demand of the Oleoprogram (in 2000 prices and costs) is estimated to be between CZK 0.6 and 1.6 billion, or between Euro 17 and 46 million.

Employment
The influence of the use of biofuels on employment is definitely positive. The growing of rape and producing of rape seed oil creates new job opportunities and helps to preserve existing jobs, especially in agricultural sector. Moreover, it concerns not only producers and distributors, but also farmers, for whom rape seed is a significant complementary crop. However, any estimate of the number of employees dependent on rape seed farming and mixed fuel production is bound to be approximate. From the size of the crop area, the production (150,000 tonnes of rape seed for the production of FARME, 22,282 tonnes of produced FARME in 1999) and the number of fuel stations that sell mixed fuel (274), it can be estimated that the production of rape seed and the production and distribution of mixed fuel employs, directly or indirectly, about 2-5,000 people. Jobs in rural areas are preserved, which helps slow down the exodus to cities.

Limitations and barriers
The production of biofuel is limited by the size of crop areas available for growing rape seed while maintaining crop procedures and agricultural diversity. It is estimated that the production of FARME can utilise a maximum of about 400,000 tonnes of rape seed every year, which is about three times as much as current use.

The present production capacity of FARME in the Czech Republic is about 65,000 tonnes a year. This will be fully used in 2000/2001 according to the Ministry of Agriculture. A further increase in the production capacity will be dependent on economic conditions. The present subsidy programs do not include significant support for it.

The quality of the biofuel does not present any problem at the moment, as the Czech standard CSN 656507 complies (except in phosphorus content) with the German standard DIN E 51606 and guarantees high quality. The use of mixed fuel eliminates certain technical problems caused by pure FARME and the slight uncertainties caused by the fact that it is a new type of fuel are compensated by the lower price.

Conclusions
The use of mixed fuel as an alternative fuel for combustion engines is undoubtedly one of the measures capable of reducing greenhouse gas emissions in the Czech Republic. Production capacity, possibilities of financial support from the state budget, and the amount of production of rape seed as the basic raw material determine the present volume of production which is 60,000 tonnes of FARME a year. This represents a reduction in CO₂ equivalent emissions of roughly 100,000 tonnes. Considering the financial demand
of the biofuel production support program, the costs of reducing CO₂ emissions are quite high (between 6,000 and 12,000 CZK per tonne). However, the reduction of greenhouse emissions constitutes only a minor part of the benefit of the use of mixed fuel. Other benefits include a reduction of emissions of sulphuric oxides, solid pollutants, and hydrocarbons. Furthermore, the social benefits must be taken into account, such as the fact that growing energy crops represents one of the principal substitution programs for Czech agriculture, which is currently experiencing a deep crisis.

It is evident that the use of mixed fuel is one measure that can reduce greenhouse gas emissions. Nevertheless, it is definitely far less significant than shifts in the usage of various modes of transport and the growth rate of individual automobile transport.

2.4 OTHER PROVISIONS OF THE SECOND COMMUNICATION

Introduction

In this section we focus on three other ‘Provisions Leading to Emission Reduction’ that are discussed in the Second National Communication. These are:

- optimisation of traffic on certain major roads and modernisation of bypasses;
- supporting the development of urban public passenger transport; and
- internalisation of the external costs of transport.

A detailed analysis of the CO₂ emission impact potentials of these three provisions was made and the following conclusions were drawn.

Optimisation and Construction of Roads

We calculated changes in energy consumption and CO₂ emissions by road category and transport mode. The overall result of the calculation is that the total energy consumption by road transport will drop by 21% by 2010. All of the road categories show a drop in energy use, except motorways, whose energy use will actually increase by 16%. Further, we have evaluated the difference in energy consumption and CO₂ emissions between a "do-nothing" scenario and the government road building scenario, ignoring all other influences on traffic volume. This comparison shows a difference of 9% in favor of the do-nothing option if the entire road network is looked at. Looking at motorways only, the difference is 46%.

In order to minimise the increase in energy consumption and CO₂ emissions, it is necessary not to increase the total length of the international, national, regional, local and major municipal roads. From a climate protection point of view, the only allowance that can be made is for bypasses that will: 1) increase the flow of traffic without increasing its speed above approximately 90 kph and 2) shorten route lengths significantly. This presumes that the original roads that have been substituted will be closed to long-distance through-traffic and will only serve local traffic. City ring roads must be built with the least possible number of lanes, and on condition that through-traffic reduction measures
will be undertaken inside the ring to balance the increase in road capacity on the ring. Such measures are also desirable along the outer edge of the ring.

Supporting the Development of Public Passenger Transport

Since the 1990s motorization has represented the fastest growing sector in the Czech economy. Along with this motorization, the country has been experiencing a decline in public passenger transport. During the past five years, the modal share of public transport has decreased along with the total number of public transport vehicles used. The public transport infrastructure is now shorter and increasingly in disrepair; without remedial measures, these trends are likely to persist in the immediate future.

Passenger transport has been almost entirely privatised on road, air and inland waterways. The state-owned Czech Railway Company is being transformed, as yet without success. A partial privatisation of services on regional railways has taken place. The infrastructure is still owned by the state, but the trains are run by private companies. Since 1989, fares have risen many times over and significant commuter discounts were cancelled both in bus and railway transport. Furthermore, budgetary subsidies have been declining, especially in bus transport. Fare regulation was ended in January 2001 (railways were the last mode of transport in which fares remained regulated).

We compared the environmental impacts of three scenarios of the Czech public transport system, working with 2010 and 2025 as time horizons and covering all important groups of emissions as well as energy consumption. The results of the individual scenarios indicate clearly that it is not enough to develop public transport. Without a concurrent decrease in individual transport, the development of public transport itself leads to an increase in energy consumption and CO₂ emissions. The emissions related to the distance travelled and to a single passenger are, however, significantly lower for public transport than for individual transport.

Therefore, only if measures are taken to reduce the volume of individual transport, and part of its passenger share is shifted towards public transport, will the total amount of energy consumed and CO₂ emitted decrease. Further public transport development is desirable from both the social and environmental points of view.

Internalisation of External Costs

Creating a system for full payment of the external costs in transport in the Czech Republic depends on the future developments within the European Union in this field. The future of EU internalisation policy is not clear. Although the ‘White Paper on Infrastructure Charging’ for internalising external costs provides a timeline, adherence to its provisions and dates are uncertain. According to the European Commission, there must be gradual and phased harmonisation of the charging principles applied in all the main forms of commercial transport. There is no intention to penalise any one mode of transport, since the Commission favours maximum flexibility in the rates that the user will pay within each mode, depending on the circumstances of the transport operation.
In the Czech Republic, technical obstacles can be easily overcome. However, other obstacles will be difficult to deal with, such as the largely technophile thinking of decision-makers and strong lobbying by the automobile industry. There is also a need to further educate the public, since it too often tends to believe that road construction is the best remedy to transport problems, it perceives the automobile as a status symbol, and has fears about rising unemployment as a result of internalisation.

The internalisation of external costs will certainly lead to a reduction of vehicle emissions. Higher fuel prices will stimulate customers to buy more fuel-efficient, thus more cost-efficient, vehicles. At the same time, long-term production conditions will be secured for manufacturers. Internalisation will also lead to the use of more socially and environmentally acceptable modes of transport, as they will be cheaper than other modes, and to a decreased demand for transport, as people will be likely to reduce the number of trips by such means as car pooling, multiple errands, telecommuting, etc. The extent to which this will happen will depend on the level transport pricing reaches and on other factors, such as the accessibility of alternatives.

The European Conference of Ministers of Transport estimates the financial loss caused by CO₂ emissions to amount to 1-2% of gross domestic product (GDP). In the Czech Republic, transport represents an 8.27% share of the total CO₂ emissions, yielding a financial loss of 2.728 billion CZK for 1997. Since the amount of CO₂ emissions is in direct proportion to the amount of fuel consumed, it is easy to identify an appropriate level for carbon taxation.

According to the internalisation model by the European Federation for Transport and Environment, the fuel tax should rise two to four times within ten years in different countries, according to the difference in their emissions. It does not mean a large increase in fuel prices, unless crude oil becomes much more expensive. If the fuel tax increases by approximately 65%, the demand for fuel will decrease by some 33% (assuming price elasticity of -0.8). With an income elasticity of 1.1 and annual income increase of 2%, the demand for fuel will decrease by 17%. Since diesel oil is currently subject to less taxation than gasoline, the implementation of this model will cause a steeper increase in the price of diesel oil, and thus a steeper decrease in demand, than that it will for gasoline.

Although the exact effects of internalisation of external costs on the decrease in production of CO₂ emissions and other noxious substances are not known, there is no doubt that the effect would be positive. It is impossible to quantify the scale of the effect since cases of its implementation have been so rare. Still, a rapid practical implementation of internalisation of external costs of transport can only be recommended. Further hesitation means a further increase of the environmental debt of transport, and further growth of the costs that will have to be covered at the end of the day.
Conclusions

Although the Czech Republic is currently experiencing rapid motorization and the general shift of modal split from public transport to individual car transport, these trends are also working against national and local efforts to reduce the impacts of the transport sector on climate. If the emissions of CO₂ from transport are to be reduced, it is desirable not to implement the country's Motorway and Road Construction Programme to its full extent, but rather to invest in maintenance of existing infrastructure and to upgrade it carefully, so as not to induce additional energy consumption.

A reduction in the volume of individual car transport will also help improve public transport so that it meets people's expectations and needs. Also, it was found that without a decrease in individual transport, the development of public transport cannot lead to a net reduction in energy consumption and CO₂ emissions.

The market in which the transport system operates is distorted and unjustly favors individual transport. Only when equal market conditions are restored in the transport sector, through the full internalization of external costs, will public transport will be able to fully compete with individual transport. Until then it will seem expensive compared to individual transport.

2.5 CONCLUSIONS AND RECOMMENDATIONS

The evaluation of the benefits, in the form of a reduction in emissions of CO₂, of the measures in the transport sector that included in the Second Communication of the Czech Republic to the UN Framework Convention on Climate Change, yields the following major findings:

The Biodiesel and Combined Transport measures are examples of a desirable policies and measures with strong potential for CO₂ emission reductions. The support of biodiesel production is a relatively successful government program, while the government’s support for combined transport could be much stronger. If greater support is given to the development of combined transport facilities and networks in the near future, the impact on reducing the CO₂ emissions will be far more significant.

There is one provision in the Second Communication whose impact on the CO₂ emissions could be devastating if it were to be fully implemented. The inclusion of the provision entitled "Optimisation of traffic on certain trunk roads and construction and modernisation of bypasses and their feeder roads" in the Second Communication appears to be erroneous. On the contrary, this provision leads to an increase in the volume of CO₂ emissions. There are two principle reasons for this. First, new road infrastructure tends to lead to growth in road traffic, and second, an increase in the speed of the traffic on new high capacity roads leads to a significant increase of energy consumption and thus CO₂ emissions. Expected technological advances in automobile fuel efficiency only partially
compensate for the influence of these two factors. Therefore, we recommend to omit this provision from the Third Communication.

The two other provisions, "Support to Development of Public Transport" and "Internalisation of External Costs," could make essential contributions to reducing the volume of CO₂ emissions. Their degrees of practical implementation differ greatly. The success of the former policy depends vitally on implementation of the latter. This measure is able to stop the growth of the largest source of CO₂ emissions within the transport sector, automobile transport. Nevertheless, because this is a highly unpopular topic among politicians, and the prevailing opinion is that cost internalisation should take place within the context of pan-European measures; there has been almost no progress in this area. It is vital, therefore, that concrete measures toward the full internalisation of the external costs of transport be taken as soon as possible.
2.6 FURTHER READING

Combined Transport
Moznosti dopravy v CR z hlediska trvale udrzitelneho rozvoje. CSDK, Brno 2000.

Biodiesel

Internalisation of External Costs
Fair and efficient pricing in transport: The commission’s proposals.
http://europa.eu.int/comm/transport/themes/mobility/english/sm_0_en.html
The Economic Cost of Road Accidents. COST 313 (pro European Commission), Brussels 1990.

Generated Traffic


Hansen, M. et Huang, Y.: Road Supply and Traffic in California Urban Areas. Institute of Transportation Studies, Department of Civil and Environmental Engineering, University of California, Berkeley, June 1996.


Energy in Fossil Fuels


Other


REFERENCES TO CHAPTER 2


NOTES TO CHAPTER 2

1 This report is a condensed version of a longer report by the same authors, which contains more extended discussion of the policies presented in the Second Communication, along with more detailed data and calculations. The full report is available from the Centre for Transport and Energy.

2 Doprava a zivotni prostredi v CR. Ministerstvo dopravy a spoju CR, Praha 1999.


6 An enterprise providing services in combined transport, founded in 1992 as a subsidiary of Kombiverkehr Frankfurt/Main, Germany. In 1995 new partners joined in: Czech Railways, Czech Associations of International Automobile Hauliers, Czech Logistics Association, and ÖKOMBI – an Austrian society for combined transport. Since 1996 Bohemikombi is a member of UIRR – International Union of Rail-Road Combined Transport Companies

7 To estimate the volume of the transit flows, however, is difficult if not impossible, since it depends on the distance between border crossings the hauler chooses (the minimum distance suitable for combined transport is currently about 500 km) and on the amount of transiting transport. The Czech Republic is currently, due to truck transit reduction measures in neighbouring countries, exposed to an overload of truck transport. If such restrictive measures were also applied in the Czech Republic, the volume of truck transit could be reduced significantly.
