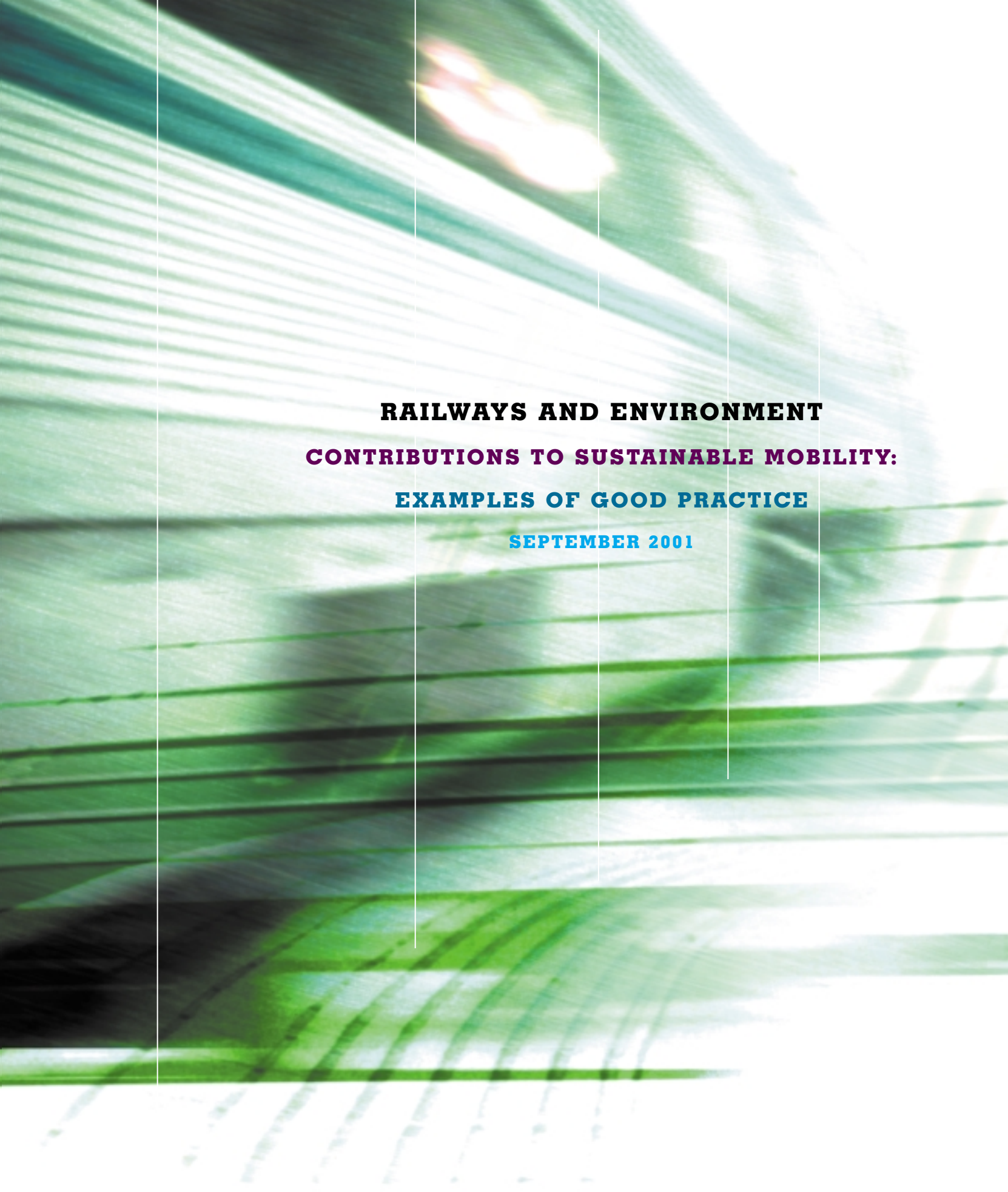


RAILWAYS AND ENVIRONMENT

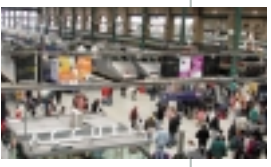
CONTRIBUTIONS TO SUSTAINABLE MOBILITY:

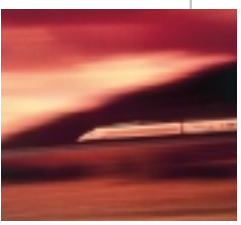
EXAMPLES OF GOOD PRACTICE

SEPTEMBER 2001

INTRODUCTION

This brochure presents a number of specific examples of ways in which the railways are helping to protect the environment. These examples refer to particular initiatives in developing new products – new types of service, new commercial concepts, new types of equipment. They show that, even though rail is in most respects the transport mode with the best environmental performance, the railways are not resting on their laurels.





> *Rail is an essential ingredient in any programme to address the problem of climate change and global warming.* >

Some of these initiatives (such as the Alpine piggyback services) have been developed in response to public policy demands. But most are simply the result of the railways seeking new customers and trying to enlarge their share of the market. In the process, they are building on their advantages in **energy efficiency, low emissions, safety** and **use of space**, making mobility easier and more sustainable.

It should not be thought that the needs of the market are always in conflict with those of the environment. Environmental performance is something which customers are increasingly demanding and willing to pay for. When they do, they often look first to rail.

Transport is a vital part of economic prosperity. The examples which follow illustrate an important message: that the railways are well-placed to respond both to the demands of their immediate customers and to those of the public at large for a reduction in the environmental damage for which transport is responsible.

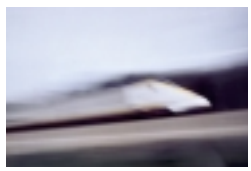
In particular rail is an essential ingredient in any programme to address the problem of climate change and global warming. These examples are something on which the public authorities can build and which they can support with appropriate policies at national and international level if they wish to make full use of the advantages rail has to offer.

THE ENVIRONMENTAL ADVANTAGES OF RAIL

While rail cannot claim to suit every kind of demand for transport, it does have a number of crucial advantages when it comes to making transport compatible with the need to protect the environment. In relation to traffic carried, it has a high energy efficiency. Steel wheels running on steel rails have a low rolling resistance and lose less energy through friction than other modes. Taking into account passenger and freight traffic together, rail is on average more than three times as energy efficient as road. Rail technology also allows high speeds to be achieved with safety.

Centralised control and the ability to carry large numbers of passengers and large quantities of freight in trains makes for a highly efficient use of space and greater capacity than alternative modes. Flexibility in the sources of energy which rail can use means that emissions of CO_2 and other greenhouse gases are less than from other transport modes – for example, road freight emits on average 190 g CO_2 per ton-kilometre and rail only 30 g per ton-kilometre – and there is scope for considerable further reductions. And because of its greater capacity and lower use of space in relation to the amount of traffic which can be carried, rail is more compatible with preservation of the countryside. Per passenger-kilometre travelled, railways require less than a third of the land taken by passenger cars.

> Rail does have a number of crucial advantages when it comes to making transport compatible with the need to protect the environment. >



THE EXTERNAL EFFECTS OF TRANSPORT

Transport use gives rise to **effects on other people than the users themselves**. Since they are spread across society at large, and are not paid for by the users, they do not enter into their calculations when they decide to travel or to make use of transport services.

Examples are air pollution, accidents, noise, climate change, and congestion. These effects cause real costs to society in terms of ill-health, premature deaths, reductions in food production, spread of diseases and loss of time.

Transport is not the only activity which creates external costs, but it is by far the most significant cause.

There are various ways of putting a value on these costs. Where possible, the amount people would be willing to pay to avoid them is often considered to be the most appropriate basis. The main categories of external costs caused by transport in the European Union countries, Norway and Switzerland in 1995 have been evaluated (INFRAS / IWW, 2000) at some € 530 billion per year, or about 7.8% of the GDP of the countries concerned.

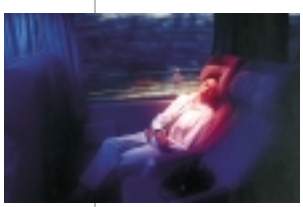
The **largest single categories of cost relate to accidents** (€ 156 billion per year), **air pollution** (€ 134 billion per year), and **climate change** (€ 122 billion per year). The value put on climate change effects here is compatible with the IPCC's recommendations for greenhouse gas reductions.

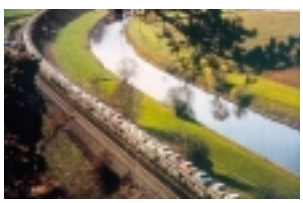
This total does not include congestion, as this can be measured in a number of very different ways. A moderate estimate of the costs of congestion, based on the value of time lost, and from the same INFRAS/IWW study, puts it at over € 128 billion per year in 1995. If, as a yardstick, the revenues produced by a charge which optimised the level of congestion were considered, the amount would be twice as high. By any measure, **congestion is a major element of external costs**. And, of course, congestion contributes to a number of them, as it increases air pollution and emissions of CO_2, particularly in cities.

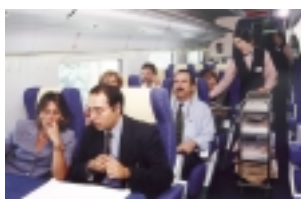
Road is responsible for some 93% of the total external costs of transport, while rail is responsible for around 1.6%. Aviation has a particularly high impact on climate change, as high-altitude emissions of greenhouse gases are particularly problematic. Air is also a very fast-growing sector.

What is at stake is not only environmental quality but also economic efficiency. The urgency and scale of the actions required to address one of these effects, global warming, has been brought out by reports of the IPCC (Intergovernmental Panel on Climate Change, a United Nations body) and underscored by the political commitments inherent in the Kyoto protocol. Against this background, it is hard to overstate the importance of rapid action to reduce the massive and increasing negative social impacts of transport.

> *What is at stake is not only environmental quality but also economic efficiency.* >



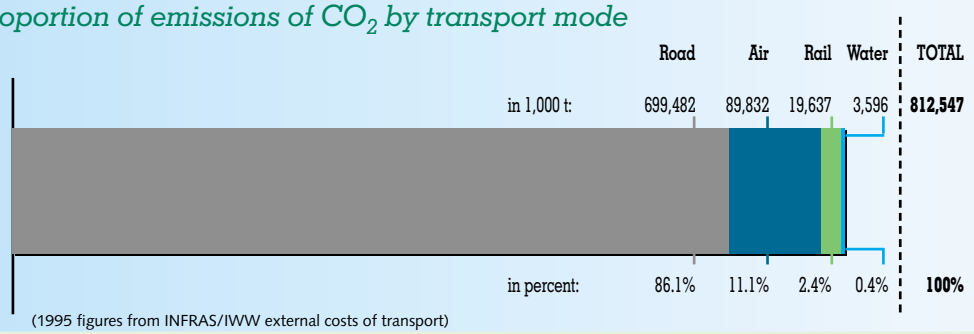




CLIMATE CHANGE AND GLOBAL WARMING

Undoubtedly the most serious challenge facing policy-makers at the present time is how to deal with the problem of the greenhouse effect. This effect, the build-up of heat within the earth's atmosphere, is caused by the emission of certain gases, mainly carbon dioxide (CO_2), into the atmosphere. It is **directly linked to man's use of fossil fuels** such as coal and oil. Transport, energy, and industry are the main sectors responsible. Road traffic accounts for some 77% of greenhouse gas emissions caused by transport, while aviation is responsible for just under 20%, but has an even greater growth rate.

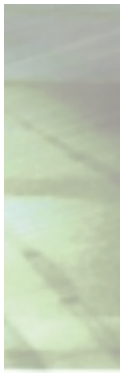
Proportion of emissions of CO_2 by transport mode



(1995 figures from INFRAS/IWW external costs of transport)

The main indicator of the greenhouse effect, the cause of climate change, is global mean temperature. The increase in temperature in the 20th century is likely to be the largest of any during the past 1000 years. The 1990s were the warmest decade since records began. According to a report by the Intergovernmental Panel on Climate Change (IPCC) at the beginning of 2001, a further rise in temperature of between 1.4 and 5.8° C can be expected by the end of this century. Although these changes appear minor, they could lead to dramatic and irreversible climatic changes, with disastrous storms and droughts, rise in sea level, and loss of important natural habitats.

IPCC researchers are of the opinion that **changes in the world's climate are already impossible to prevent, and can only be contained**. The targets for reductions in greenhouse gas emissions set by the Kyoto protocol are even less ambitious than the IPCC's recommendations. The Kyoto protocol commits the European Union countries to reduce their emissions by 8% in 2008-2012 as compared with 1990 levels.



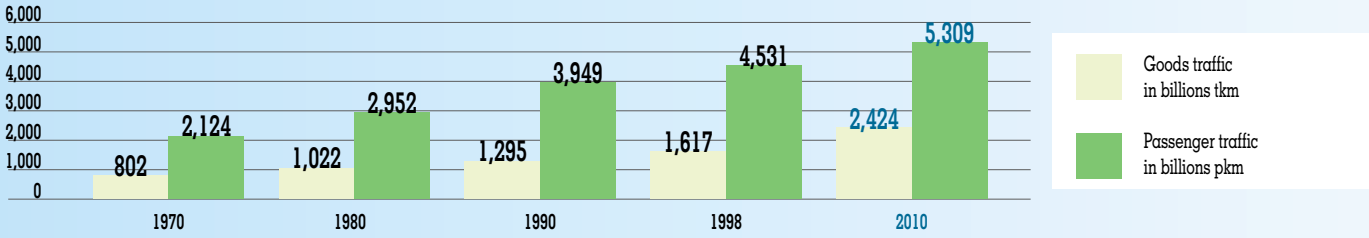
TRANSPORT TRENDS AND POLICY IMPLICATIONS

There is a strong and longstanding, but not well-understood, relationship between the growth in the volume of transport and growth in the economy. Most forecasts for the next decade show significant growth in demand for transport.

> *External costs of transport are estimated to rise by some 42% until 2010.* >

What is more, external costs of transport are rising as transport volumes rise. By the year 2010, for instance, road traffic, which already constitutes over 80% of total passenger-km and ton-km, is forecast to increase by some 30% over 1995 levels, if no measures are taken to counter this. Overall, external costs of transport are estimated to rise by some 42% until 2010, mostly involving road and air.

Growth in transport 1970-1998, forecast for 2010



From EU transport in figures 2000, European Commission and Prognos European Transport Report 2000

Transport is the fastest-growing consumer of energy in the European Union. Energy use since 1985 has increased by 47%, compared with 4.4% for the other sectors. More than 30% of final energy in the European Union is used by transport, especially by road and air. This trend is due to growing traffic volumes which far outweigh any improvement in the energy efficiency of cars.

According to an estimate by the European Commission, **greenhouse gas emissions from transport are forecast to increase by 45.8% between 1990 and 2010**.

Since rail is more energy-efficient and gives rise to lower emissions of greenhouse gases than other modes, achieving a shift in traffic from these modes to rail is at least part of the answer to making transport more sustainable.

Addressing the problem of CO_2 emissions from transport is linked to the question of how to deal with other external costs. The **most efficient solution** from an economic point of view would be to **"internalise" these costs through charging them to transport users**. This would mean that users would realise the costs which their decisions cause to the rest of society and would weigh up their actions accordingly.

> A shift of traffic to rail is at least part of the answer to making transport more sustainable. >

The CER and its member railways have consistently argued that measures to achieve a shift to more environmentally-compatible modes are essential. Such measures should include removing the regulatory disadvantages which rail suffers as compared with other modes, particularly road, as well as charging transport users according to the costs they cause. This is in line with the policy of the European Commission (White paper on "Fair payment for infrastructure use", July 1998) and with that of the European Council (conclusions of the Council of Gothenburg, 15 June 2001).

> Measures to achieve a shift to more environmentally-compatible modes are essential. >

The examples which follow give an idea of how the railways are building on their advantages.

THALYS REPLACES AIRPLANE BETWEEN BRUXELLES AND PARIS-AÉROPORT CHARLES DE GAULLE

Thalys is the brand-name of high speed services jointly operated by the Belgian (SNCB / NMBS), French (SNCF), German (DB) and Dutch (NS) railways. In operation since June 1996, Thalys services link Paris, Brussels, Cologne and Amsterdam.

The 300 km/h high speed line between Paris and Brussels was opened on 14 December 1997, cutting journey times from the original 2 h 43 to 1 h 25. Besides the short journey time Thalys offers a high-quality service. Thalys was a hit from its first day of operation. The market share of rail increased from 24% in 1996 to 60% in 2000, attracting customers mainly from air transport.

This development will continue and indeed improve with the agreement concluded between Air France and Thalys in March of 2001. As early as November 1999, Thalys began cooperating with Aéroports de Paris (ADP, the Paris airport authority), to provide a direct and daily connection between Brussels and the stations of Paris-Aéroport Charles de Gaulle as well as Marne la Vallée (Disneyland® Paris), with travelling times of 1 h 15 and 1 h 30 respectively. For Thalys this was a first "natural" step in the field of intermodal air-rail transport. By shifting part of the short-distance air transport segment towards high-speed train traffic, ADP has found an answer to the challenge of freeing up air potential on long distance flights.

examples

At the same time a first agreement was reached between Air France and Thalys. This gave the possibility to customers of Air France to choose between the alternative of five flights to Brussels National Airport and four daily high-speed connections to the Brussels-Midi station.

As the Air France customers convincingly opted for the use of Thalys, a new agreement was concluded in March 2001. Air France cancelled its Brussels-Paris flights and charters one or two carriages every day in Comfort 1 class on each Thalys train between Paris-Aéroport Charles de Gaulle and Brussels-Midi.

The implementation of this new contract also involved the opening of an Air France office in Brussels-Midi allowing Air France passengers to check in directly.

The product is a success and Air France is thinking of increasing the number of chartered coaches.

> Cancelling ten flights a day means on a yearly basis a saving of 6,700 tons of CO_2 emissions. >

Just the cancelling of the ten flights a day means on a yearly basis a saving of 6,700 tons of CO_2 emissions. Additionally, if one takes into account that the Thalys generally leads to an impressive shift to environmentally friendly rail, the total saving in CO_2 emissions are of course much greater.

PARCEL INTERCITY (PIC): THE FASTEST CONNECTION BETWEEN ECONOMY AND ECOLOGY

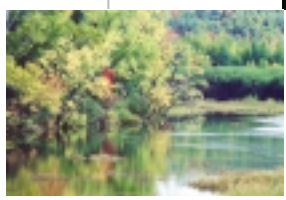
A goods train faster than any lorry? This need not be a futuristic vision, as demonstrated by Deutsche Bahn's Parcel InterCity (PIC) train, which has been transporting containers on Germany's north-south axis since spring 2000. The PIC carries parcels along the 800 km route in the record time of eight hours.

The PIC travels overnight, taking up to 20 containers daily from Munich to Hamburg-Billwerder via Heilbronn, Würzburg, Kassel, Göttingen and Hanover. An additional service from Stuttgart-Kornwestheim that travels without stopping all the way to Hamburg was introduced in November 2000. The trains reach a top speed of 160 km/h. This and the strict observance of loading and shunting times enable the PIC to achieve 96% punctuality.

> 11,500 tons less of the greenhouse gas carbon dioxide will be produced each year. >

The PIC has a load factor of over 80%. This now tried and tested system is notable for its excellent quality and a high degree of standardisation. The PIC's main client is Deutsche Post, which uses it to connect its parcel centres. The PIC's spare capacity is available to other clients who need to transport their goods rapidly.

Deutsche Post is not the only mail company going back to rail, the same development is now taking place in Denmark and Sweden as well.



At the moment DB Cargo is working with Danzas Euronet on plans for further PIC routes. Once these services are up and running, nearly 80,000 containers a year will travel by rail, making at least 40,000 long-distance lorry journeys superfluous.

For DB AG, getting high quality postal traffic back on rail is of great importance. DB Netz AG, the infrastructure subsidiary of DB AG, supports this by special continuous operational supervision of the trains.

The results of a detailed study of energy consumption and emissions along the Munich – Hamburg-Billwerder route show that the PIC trains with their, even with its high transport speed, not only free up motorways jammed with traffic, but are also good for the environment as a whole.

If the carbon dioxide emissions per ton released on this route are extrapolated to the new PIC services that are being planned, taking account of the distances traveled and transport volumes carried, it is found that over 11,500 tons less of the greenhouse gas carbon dioxide will be produced each year, a reduction equivalent to the amount of emissions for which about 1,200 "average" Europeans are responsible each year.

> 80,000 containers a year will travel by rail, making at least 40,000 long-distance lorry journeys superfluous. >

IMPROVED COMMUTING POSSIBILITIES WITH THE SVEALAND-LINK

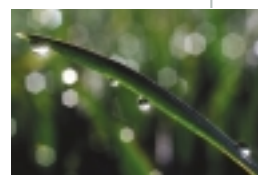
The Svealand-Link is a new railway connecting Stockholm and Eskilstuna – a distance of 115 km of which 80 km is new. The new line is operated by the Swedish passenger operator SJ and replaces an old line, making possible a radically improved service between the two cities. Travelling time has been reduced from 1 h 42 to one hour and the frequency increased from eight to eighteen services in both directions. In practice this means that it is possible to use the line for long-distance commuting.

> CO_2 emissions were reduced by 5,600 tons in 1998. >

The passenger traffic on the new line increased from 230,000 to 1,300,000 trips per year (465%!) during the period 1993 – 1998. At the same time passenger car traffic decreased by 6% on the corresponding road between both cities. This should be compared with the development on similar roads in the region, where train transport was not so dramatically improved – in those cases road transport increased by 10-11%. On certain parts of the new line the effect on road transport has been even larger. Bus transport – which in 1993 had a larger market share than the railway – has almost disappeared.

Based on average occupancy in cars and buses, it was possible to make a preliminary calculation of the railway's effect on CO_2 emissions, in comparison with an assumed traffic level if the rail service had not been improved. Emissions were, according to this calculation, reduced by 5,600 tons in 1998 on the newly built 80 km part of the line.

The new rail service does not in itself increase CO_2 emissions in Sweden. This can be explained by the fact that all rail transport by SJ since 1999 uses only environmentally labelled electricity with no CO_2 emissions.



examples

ENVIRONMENTALLY LABELLED ELECTRICITY

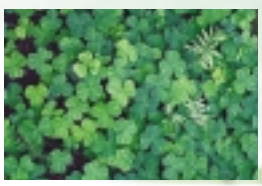
One of the big advantages with the use of electricity for energy supply is that it gives the railway freedom in choosing the source of energy. In Sweden, SJ used the new possibilities in the open electricity market to purchase electricity labelled with "Bra Miljöval" – "Good Environmental Choice". This label is an eco-label decided by the Swedish Society for Nature Conservation. Electricity produced from renewable energy sources such as wind, biofuels or existing hydropower plants meets the criteria for eco-labelling.

Choosing eco-labelled electricity was one way for SJ to contribute to a sustainable energy system. In this way emissions of CO_2 from the source of electricity was reduced from 42,000 tons (based on Swedish electricity mix) annually to almost zero. While there is no difference in the electrons running through the wires – no one can know which energy supplier any particular electrons come from – as Good Environmental Choice customer, SJ makes sure that the quantity of electricity needed to power its trains is produced in a sustainable manner.

> SJ created a fund into which the extra payment for the labelled electricity is put. This fund is used for projects to improve the environment or for technical development of environmentally improved energy production. >

SJ was at the time one of Sweden's biggest electricity consumers, and by far the biggest single purchaser of eco-labelled electricity. To increase the environmental effect upon the energy production system, SJ created a fund together with the electricity supplier Birka Energy into which the extra payment for the labelled electricity is put. This fund is used only for projects to improve the environment or for technical development of environmentally improved energy production.

The new train operators that have since been created by the division of the "old SJ" – SJ (passenger transport) and GreenCargo (freight transport) – maintain the same philosophy concerning eco-labelled electricity.



RAIL FREIGHT TRAFFIC IN SWITZERLAND, AN INNOVATIVE AND GROUNDBREAKING EXAMPLE THAT SHOULD HELP TO CURB CLIMATE CHANGE

Sustainable development in transport and co-ordinated mobility constitute the key elements of the Swiss transport policy. By the end of 1998, the Swiss population had voted in favour of allotting CHF 30.5 billion (€ 20.10 billion) for financing public transport. Thanks to these resources, the Swiss authorities can develop a sustainable transport system, placing the emphasis on rail. Numerous projects such as Alp Transit and Rail 2000 (for passenger traffic) are now under way.

Following the railway reform that became effective on 1 January 1999, freight and passenger transport will become increasingly more competitive, efficient and attractive. This will strongly contribute to saving energy and spatial resources, while meeting the economic and social requirements of Switzerland.

Railway freight transport can cross the Swiss Alps using one of the two piggyback corridors: the Gotthard, and the Lötschberg-Simplon. The present summit tunnels already allow the transit of a large quantity of freight. The New Trans-Alpine Railway Routes (NTAR) through the Lötschberg and the Gotthard will allow, as from 2006 and 2012 respectively, to considerably increase the capacity for freight transport through the Alps. Two methods are available for trans-Alpine transport: unaccompanied combined transport (containers), and the "rolling highway" (rail transport of whole trucks).

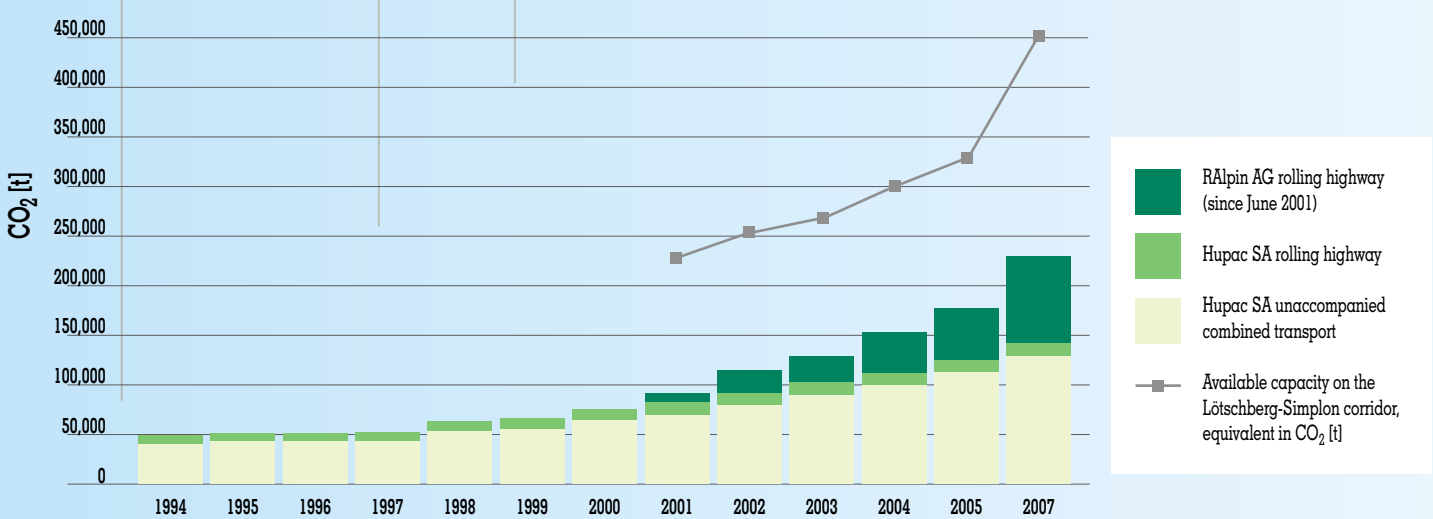
The main Swiss railway network with the two piggyback corridors (the Gotthard and the Lötschberg-Simplon) and the Rail 2000 projects.

examples

The attractiveness of rail transit through the Alps is based on the following advantages:

- transport at night and on Sundays is allowed
- road traffic jams can be avoided, fuel consumption and emission of pollutants can be reduced
- better safety, better route planning, reduction of the negative effects on man and environment.

Unaccompanied intermodal freight transport, and the "rolling highway", operated by the companies Hupac SA and RAlpin AG are two projects showing how the Swiss railways can contribute to a reduction of the quantity of CO_2 emitted by the transit of goods through the Alps today. RAlpin AG is a new company jointly owned by BLS Cargo AG, the freight arm of BLS (The "Lötschberg Railway"), SBB-CFF (The Swiss Federal Railways) and Hupac SA (a combined transport operator). The two projects divert nearly 370,000 consignments from road to rail each year.



Amount of CO_2 emissions that could be avoided in transalpine railfreight traffic thanks to the modernisation of the Swiss railway infrastructure and to the companies Hupac SA and RAlpin AG. A large amount of spare capacity is still available for further services (grey curve).

Today these services avoid the emission of 91,000 tons of CO_2. By the year 2007, this quantity is to be increased to 230,000 tons of CO_2 thanks to, on the one hand, the opening of the Lötschberg base tunnel, and on the other to the continual improvement of Hupac SA's and RAlpin AG's services. To absorb this amount of CO_2 by a forest (young beech trees) instead of using railway transport, 26,000 hectares of beech forest would be necessary today, and 65,500 hectares in 2007.

The capacity of the combined transport corridors are by far not yet exhausted. They will considerably increase further with the opening of the base tunnels.

The Swiss railways operate a network that is 100% electrified. Since the Swiss electricity production uses no fossil fuels there are no CO_2 emissions at all from rail operation.

> These services avoid the emission of 91,000 tons of CO_2. By the year 2007, this quantity is to be increased to 230,000 tons of CO_2. >

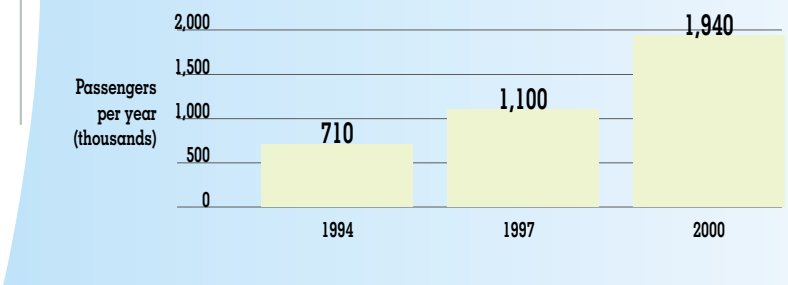
FROM CLOSURE TO MODEL PROJECT: THE USEDOMER BÄDERBAHN SET FOR SUCCESS

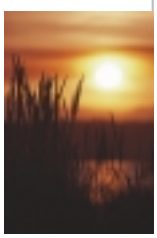
With its famous seaside resorts, the Baltic Sea island of Usedom has a long tradition as a holiday destination. The island's recreational value for the numerous holidaymakers and its ecological balance depend to a great extent on whether the problems associated with increases in road traffic can be solved. In this respect, Usedomer Bäderbahn (UBB) is playing an important role by providing environmentally friendly mobility for commuters, schoolchildren and tourists.

> The environment is spared more than 2,000 tons per year of carbon dioxide. >

It must be difficult for the visitors who glide through the German Baltic island of Usedom in modern diesels to imagine that its railway was on the brink of closure just a few years ago. Since then a wide variety of measures have made this transport provider a great deal more attractive. Tracks and stations have been completely modernised, the trains timetabled much more frequently and journey times reduced. The air-conditioned light railcar sets offer plenty of space for baggage and passengers' bicycles.

Increase in passenger traffic 1994-2000





UBB was founded in 1994 as a fully owned subsidiary of Deutsche Bahn AG (DB AG). The objective of this pilot project was to establish whether a locally based rail company would be able to create efficient rail services with good customer relations on secondary lines. The success of the reorganisation programme that was introduced speaks for itself. In 1992, 260,000 passengers chose to travel on the railway, but in 2000 it carried more than 1.9 million – with a continuing strong upward trend. All in all, good reason for DB AG to also improve further regional rail networks in the same manner.

If the railway had been closed, as was planned at one point, the island would now be having to cope with an extra 1.3 million cars each year. As a result, the environment is spared more than 2,000 tons per year of carbon dioxide.

examples

FOCUS ON CUSTOMER INFORMATION: ENVIRONMENTALLY-BASED COMPARISONS BETWEEN TRANSPORT SOLUTIONS

Information about the environmental impact of various transport modes is becoming more important, not just for environmentally conscious travellers but increasingly for responsible companies as well. In view of the significance of emissions from transport activities, the revised version of the European Union's environmental auditing regulation (EMAS II) adopted in March 2001 makes it compulsory for transport processes to be accounted for among the indirect environmental impacts of an enterprise.

In order to meet the growing need for information among their customers, railway companies have developed appropriate tools that can provide assistance when selecting the most environmentally acceptable mode of transport. In this context it is important to ensure that it is always possible for different modes to be compared using an objective, generally accepted method.

The pioneer in this field has been the SJ (Swedish railways) Miljödata project in Sweden. SJ Miljödata (called SJ/GreenCargo Miljödata since the division of SJ in several operators) can be used to compare information about the environmental impact of various modes of transport for any journey in Sweden. Today the internet-based Miljödata allows anyone to make their own environmental analysis of shipments or journeys, both on a small (individual) or on a large (industrial) scale.

> Comparing information about the environmental impact of various modes of transport for any journey. >

Miljödata consists of databases covering distances between towns and cities for all transport means, emission data for most commercial types of vehicles, and gives the user total freedom in varying load factors, number of passengers, amount of goods etc.

The analysis presents total emissions of CO_2, NO_x, HC and SO_2 together with a socio-economic evaluation of the external costs of those emissions. Results from such analyses have in many cases been used by Swedish transport customers in their environmental communication. The calculations are based on values defined by the Swedish organisation NTM (Network for Transport and the Environment) that are accepted by all transport modes.

The same approach is taken in the mobility audit published by WWF Germany and Deutsche Bahn AG. Selected comparisons between different types of passenger and freight transport are used to highlight the strengths and weaknesses of the various transport systems. A computer programme also makes it possible to plan individual journeys along over 1,600 routes according to environmental criteria. The environmentally relevant base data and factors are derived from up-to-date information provided by the German Federal Environment Agency.

Miljödata and the Deutsche Bahn mobility audit are the bases for further development of a European analysis programme – Ecotransit.

"MOBILITY AUDIT": PASSENGER TRANSPORT – COMMUTING BETWEEN AUGSBURG AND MUNICH

The mobility audit comes to the following conclusions for a person who regularly commutes between Augsburg and Munich for professional reasons:

If they use the railway, the journey takes a total of about 80 minutes, of which 42 minutes are spent on the StadtExpress and about 20 minutes changing and travelling by tram in Augsburg and Munich.

The journey takes about 70 minutes by car.

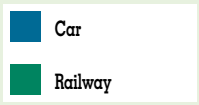
When **travelling by rail, a commuter uses about six times less energy than when making the same journey by road**. The railways do even better when it comes to carbon dioxide and other emissions as sulphur dioxide, nitrogen oxide or non-methane-hydrocarbons.

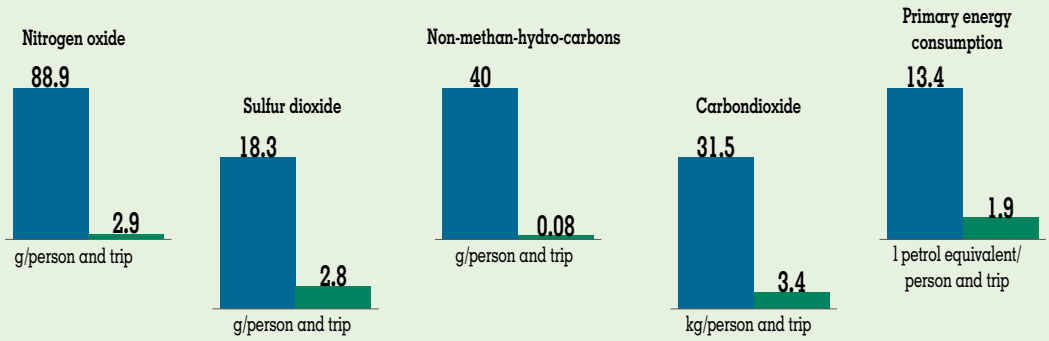
In addition to the health aspect, this makes it possible to reduce effects such as environmental acidification and the damage to forests and buildings caused by acidic erosion (sulphur dioxide and nitrogen oxide), the overfertilisation of water and soil (nitrogen oxides), the formation of the ground-level ozone that causes summer smog (nitrogen oxides and non-methane hydrocarbons) and additional heating of the Earth's atmosphere (carbon dioxide).

The reason for this big difference in emission levels can be found in the high load factor of the commuter train and its electric drive, which is more environmentally friendly than an average car.

Augsburg-München

All figures referring to a return trip.





ENVIRONMENTAL ANALYSIS BY GREENCARGO MILJÖDATA

Transport of 50,000 tons of steel from Luleå to Borlänge (Sweden)

- Distances Road: 829 km
  Rail: 1,035 km
- Comparison between heavy lorries (60 tons, Euro II) and electric train.
- Best available diesel fuel was used for road transport, environmentally labelled electricity for train transport.
- Swedish official socio-economical evaluations were used for cost comparison.

Emissions (kg)

	Road	Rail
HC	1,782	0.52
NO_x	17,409	0.52
CO_2	1,989,600	207
SO_2	414	0.31

Social costs (€)

Road	Rail
431,200	37

AVE MADRID-SEVILLE: HIGH SPEED RAIL DEVELOPMENT IN SPAIN

In 1987, Spain constructed a high speed international gauge line between Madrid and Seville over a distance of 471 km. The infrastructure works were completed in a record time as the line had to be operational for the opening of world exhibition Expo 92 in Seville in April 1992.

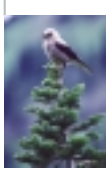
This high speed line has revolutionised the Spanish transport system and has ended Andalusia's isolation from the rest of the country. Almost ten years later the AVE (Alta Velocidad Española) venture has surpassed expectations in all areas: commercial, technical, economic and, most importantly, in quality and customer satisfaction.

> *Modal shift on this corridor has caused a reduction in external costs of around 30%.* >

The gain in time is considerable, the journey Madrid-Seville is now 2 h 15, where before the high speed line it took six hours. The Spanish Railways (RENFE) have turned AVE's excellent punctuality into a top selling point with accompanying quality commitments to support it. Since 1994, on AVE trains, the ticket price is fully refunded if the train arrives over five minutes late. AVE won a European Quality Award in 1998. In surveys 98% of customers state that the AVE service is very good or good.

The modal split before inauguration of the line was 60% for private car, 15% for coach, 14% for conventional train and 11% for air. After 2 years in service AVE became the market leader accounting for over 50% of the modal split. Today 54% of all travellers decide to go by train and only 34% take the car. Only 4% take a plane and 8% travel by coach.

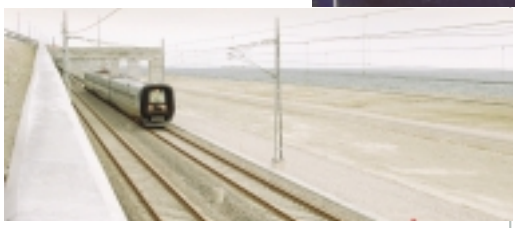
In environmental terms the modal shift on this corridor has caused a reduction in external costs of around 30%.



RAIL IS THE WINNING LINK

The Øresund Bridge – opened in July 2000 – is the world's longest single bridge carrying both road and railway traffic. The high bridge with its record-breaking cable-stayed span of 490 m is designed to harmonise both structurally and aesthetically with the approach bridges.

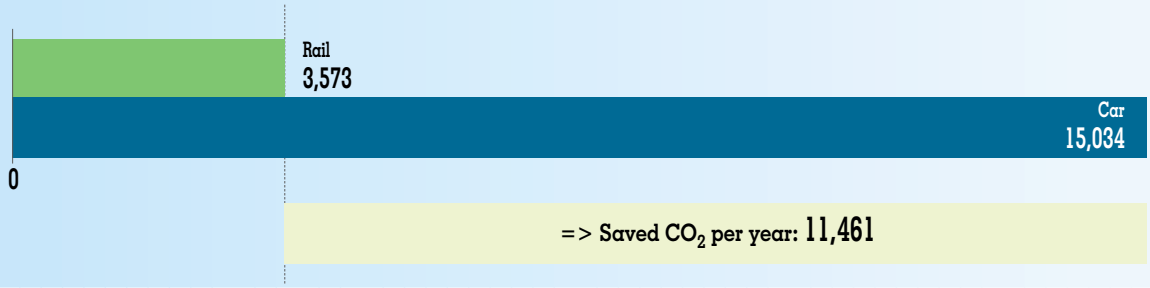
The specially made Øresund trains which are a joint project of Danish Railways (DSB), Swedish Railways (SJ) and rolling stock manufacturer Bombardier Transportation link the heart of Copenhagen with the heart of Malmö with dual-voltage electrical train sets making it possible to use both Danish and Swedish electricity supplies.



The trains serve not only the Copenhagen-Malmö main line, but form a regional service for the entire Øresund region covering a population of more than two million inhabitants. The Øresund trains mainly serve commuters, tourists and travellers to and from Copenhagen Airport.

> The Øresund trains have saved 11,500 tons of CO_2 in the first year through rail replacing car trips. >

Øresund Link – Rail CO_2 savings (Tons)

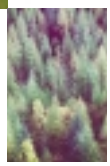


The rail link was very popular from the beginning, due to frequent departures, short journey times, high comfort with direct level unobstructed entrance to the train, easy use for families, handicapped and elderly. Furthermore, the tickets are valid for buses and other trains in the Øresund Area.

In its first year of operation, 4.3 million passengers used Øresund trains between Copenhagen and Malmö. If all these had travelled by car instead, it would have added at least 1.6 million car trips to the current 2.7 million car trips across the sound (using the official measure of 2.54 persons per car on the bridge).

On the basis of the average energy mix for DSB and SJ, the Øresund trains have saved 11,500 tons of CO_2 in the first year through rail replacing car trips.

And that is only the passenger side. The bridge was the final link establishing international Freight Freeways connecting the North of Scandinavia to southern Mediterranean countries, making it possible to offer new energy saving rail-based freight products with low CO_2 emissions.



SUCCESSFUL CO-OPERATION BETWEEN RAILWAY AND STEEL PRODUCER

SIDMAR, a Belgian steel producer wanted to maintain its competitiveness by offering high quality products and a high quality service to its customers. This objective was endorsed by Belgian Railways (SNCB-NMBS) being already an important carrier of SIDMAR products.

A working group was set up to focus on solutions to specific problems. This lead to a new improved design for the "Shimmns" freight wagons to guarantee product quality during the transport of cold rolled steel. The design was worked out with a view to productivity optimisation, conditioning of the goods, environmental friendliness and ergonomic and work safety.

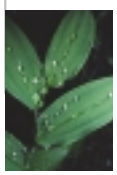
Additional improvements concerned:

- respecting, monitoring and optimising journey times
- making the necessary information and transport documents available for the transport services delivered
- setting up a consultative committee between SNCB and SIDMAR to discuss the objectives and to adapt them to the demands of SIDMAR's customers.

These objectives were specified in a quality charter between SIDMAR and SNCB in 1993.

> The fact rail has been able to improve its market share means 26,500 less lorries on the roads and a reduction of 25,400 tons of CO_2 emissions for the year 2000. >

Following the implementation of this charter, the railways' market share has shown a spectacular increase from 39% in 1993 to 48% in 2000. If this market share had stayed the same as in 1993, rail would have carried 530,000 tons less of rolled plate steel in 2000, which would mainly have been transported by road. The fact rail has been able to improve its market share means 26,500 less lorries on the roads and a reduction of 25,400 tons of CO_2 emissions for the year 2000.



examples

RAILWAY PROGRAMMES FOR ENERGY SAVING

All railway companies are undertaking efforts to enhance the efficiency of their use of energy. Here are a few examples of the relevant programmes.

Netherlands Railways (NS) have signed a voluntary environmental agreement with the Dutch government. Part of this agreement concerns the saving of energy in running trains. NS aims to improve the efficiency of its use of energy by 10% in the year 2010 as compared with 1997. Energy consumption over the year 2000 accounted for more than 1,300 million kWh, of which 75 million (approximately 5%) is generated from renewable sources.

> NS aims to improve the efficiency of its use of energy by 10% in the year 2010 as compared with 1997. >

The main result of this energy saving policy, based on experience over the past two years, is that energy efficiency went up by 9%. This result derives from the following main actions and initiatives:

- some 50 new traction units designed for double deck coaches were put into operation, while at the same time old locomotives were phased out
- a pilot project was conducted with the use of chopper installations on two train sets
- improvements have been made to the timetable (first introduced during 1998 / 1999) with longer trains and more flexibility for "coasting" (a driving technique to save energy)
- air conditioning has been improved on board double-deck trains.

Without energy saving policies, the use of energy would have been 125 million kWh higher.

Deutsche Bahn launched in 1994 its "2005 Energy Saving Programme" which already now shows results. Compared with 1990, **goods services today are using 18.8% less primary energy** per ton-kilometre whereas **consumption** per passenger kilometre has been **reduced by 2.1% for passenger services as a whole and by 15% for local services.**

Danish Railways (DSB) are currently renewing their fleet of suburban trains for the Copenhagen area network. The new rolling stock with its wide car bodies and single axled bogies is especially designed for increased comfort, reduced travelling times, low weight and high capacity. Energywise this has led to a significant decrease in the energy consumption of 50% per seat / kilometre. In terms of CO_2 this is equivalent to a **total saving of 17,300 tons of CO_2 per year for the entire network.**

> A total saving of 17,300 tons of CO_2 per year for the entire network. >

Spanish operator RENFE has been successful with energy saving activities for its AVE high speed service between Madrid and Seville. In 2000 a **reduction of 19% in energy consumption over 1993 was achieved.**

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