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Keeping Climate Change Solutions on Track:

The Role of Rail

A Global Position Paper

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Keeping Climate Change Solutions on Track: The Role of Rail

A Global Position Paper

"The Train to Copenhagen project is a showcase of sustainable transport solutions that will be part and parcel of a resource-efficient, low-carbon Green Economy of the 21st Century.

"By Sealing the Deal on an ambitious climate agreement in Copenhagen, governments will get into gear to propel the world to a low-carbon future so that societies may also finally embark on a journey to more sustainable transport."

UNEP Executive Director Achim Steiner

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The role of rail in climate change solutions

International efforts are focused on reducing greenhouse gas (GHG) emissions from the activities of modern society to avoid unprecedented impacts from climate change.

Transport brings enormous benefits to society through access and mobility, but it also has many external costs, including its contribution to climate change. Transport has a key role to play within solutions to climate change as current transport structures are responsible for extreme pressures on energy resources and ecosystems through a dependence on fossil fuels.

Rail presents a low carbon mode of transport, and continued energy efficiency improvements and increases in modal shift to rail from road and air are crucial to support transitions to low carbon mobility.

The technological and operational developments in rail, financial investments from international funds and governments, and the commitment of rail operators demonstrates not only the current status of rail, but more importantly the potential for rail to contribute to global emissions reductions in 2010 and beyond.

Global transport CO_2 emissions

The transport sector consumes approximately 20% of global energy demand, of which 80% is derived from fossil fuels. Correspondingly, the sector is responsible for approximately 23% of global carbon dioxide (CO_2) emissions from fuel consumption[1]. In addition, transport energy-related CO_2 emissions are predicted to increase by 1.7% a year from 2004 to 2030[2]. The significant proportion of global emissions from transport indicates that the sector can play a key role within the challenge of tackling climate change and sustainable development. The inclusion of transport within the successor to the Kyoto Protocol will be a key step to recognising and developing the role of transport, including rail, in reducing global emissions.

A strong focus is directed towards the development of road transport policies and mechanisms as this sector emits 73% of total global transport emissions by modal share; rail is responsible for 2% of CO_2 emissions in the transport sector[3]. It is important however to recognise the importance of rail within sustainable transport development, and the key role this mode can play within the challenge of achieving ambitious emissions reduction targets.

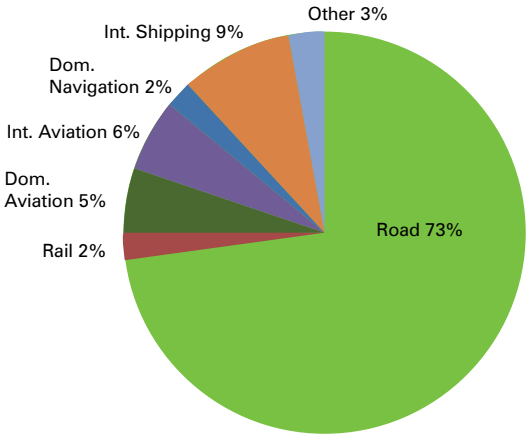


Figure 1 Global transport CO_2 emissions by modal share, 2005 [3]

The International Union of Railways (UIC) is committed to communicating the potential role of rail, and the 'Train to Copenhagen' will provide an opportunity to engage key actors in the UNFCCC negotiations. [4]

The 'Train to Copenhagen' was launched on 5 November 2009 at the UIC Asia Environment Conference in Kyoto, where the world's first global agreement ever on climate change was agreed upon in 1997. In this symbolic place, the conference participants signed the 'Message from the Rail Sector to the COP15 - from Kyoto to Copenhagen', available at the end of this document).

In the framework of this campaign, the Climate Express, the special train running from Brussels to Copenhagen for the COP15 meeting in December, will set a platform to present the potential role of rail in global climate change action to UNFCCC delegates, media/press, NGOs and intergovernmental organisations.

www.traintocopenhagen.org

1 International Energy Agency, 'CO_2 emissions from fuel combustion', 2008 Edition
2 International Energy Agency, 'World Energy Outlook 2006'.
3 International Transport Forum Transport CO_2 Emissions, www.internationaltransportforum.org
4 www.traintocopenhagen.org

Reducing the environmental impact of transport

A steep downward trajectory in total global GHG emissions reductions by 2050 will be needed to avoid adverse climate change impacts, and therefore unprecedented efforts from all sectors will be required to attain these levels. An extrapolation of European transport emissions based on recent annual growth rates alongside the path of EU-27 GHG emissions reduction targets illustrates the task at hand for the transport sector to engage with the challenge (figure2).

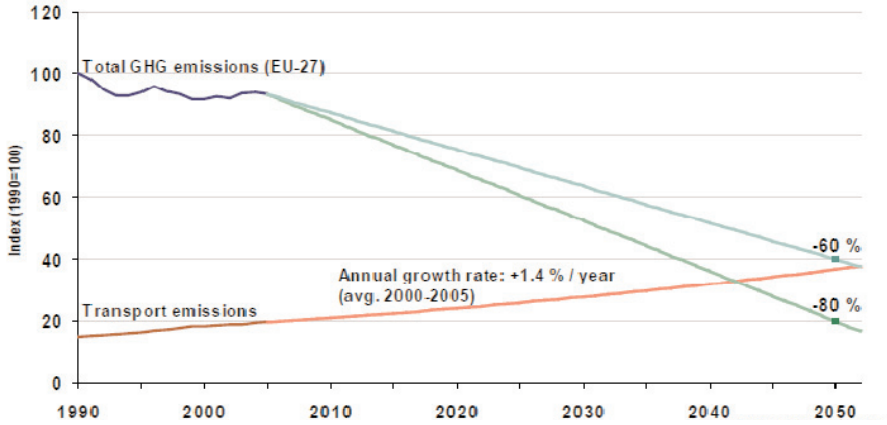


Figure 2 EU overall emissions trajectories compared with extrapolated transport emissions (indexed) [5]

There are three primary strategy responses to the challenge of reducing the environmental impact of transport. The first is 'avoid', where transport is reduced or avoided altogether; such as land-use planning and public transport integration in order to enable efficient interconnectivity, and reductions in km travelled.
The second strategy is 'shift', where journeys are made by lower CO_2 per passenger emitting modes such as public transport, walking, cycling or rail. The third strategy is to 'improve' the efficiency of current transport modes. In the context of rail the two most relevant strategies are 'shift' and 'improve', however rail does have a part to play in 'avoid' strategies within integrated land use and spatial planning.

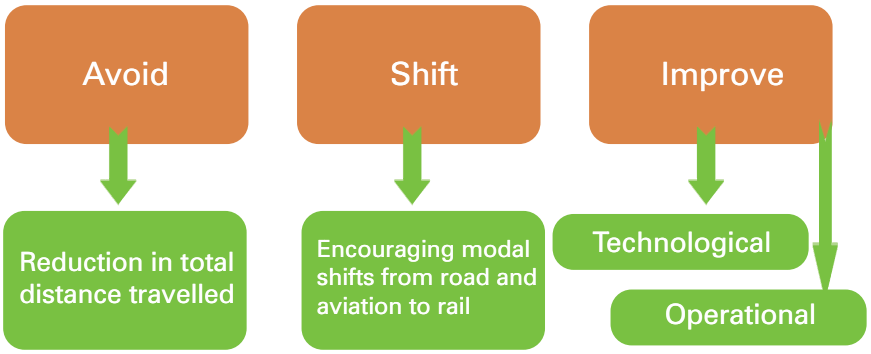


Figure 3 Potential rail strategy responses to reduce environmental impacts

5 Source: European Environment Agency 2008

Many policies aimed at reducing transport emissions focus on modal shift and increased use of mass transit modes such as rail. As more people choose to use rail over other modes, and trains are utilised closer to capacity, rail becomes more energy efficient. Rail also has the opportunity to further reduce its environmental impact through the implementation of both technological and operational improvements.

As part of a commitment to highlighting the role of rail in global emission reductions, this UIC publication provides an overview of the emission reductions potential of rail as a result of modal shifts from road and air and behaviour change measures such as managerial and operational efficiency, as well as technological development within existing and new technologies.

International investment

Developments in the transport sector typically require high levels of financial investment due to the high costs of infrastructure and research and development into new technologies. Recent years have seen increases in international investments in rail to improve service, capacity and coverage of networks.

The World Bank's active transport projects at the end of Financial Year 08 (FY08) reflected the dominance of road transport in investment. However encouraging shifts to rail are seen in the 14% increase in FY09 new commitment lending, and a decrease to 57% for road and highways. [6]

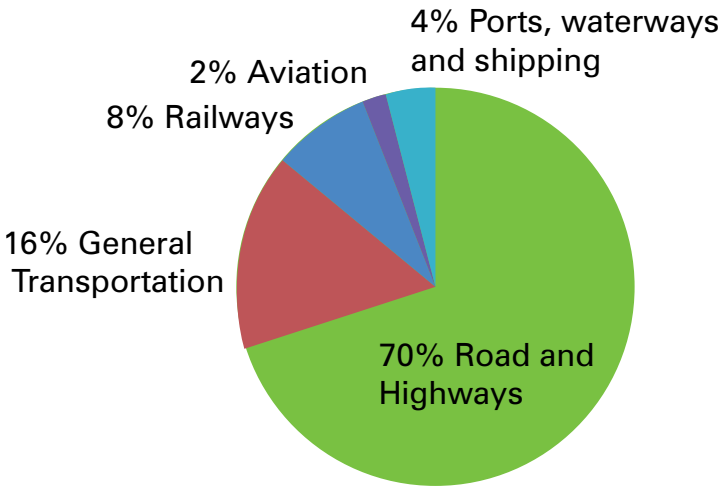


Figure 4: World Bank Transport Portfolio of Active Projects, End of FY08

In addition to international funds, national governments are committing significant financial resources within the rail sector. Commitments announced in 2009 include: in South Africa 25billion Rand is committed to upgrading passenger services in terms of infrastructure, rolling stock and operations, in Israel a government budget in June announced US$7.25billion has been allocated for new lines and double tracking, and Spain is committing a €10.2billion investment into rolling stock and infrastructure in 2010 with a focus on developing the High Speed rail network .[7]

6 World Bank, 'Transport', www.worldbank.org
7 Railway Gazette, www.railwaygazette.com

Global Strategies and Agreements

International rail strategies are being implemented with the aim to reduce CO_2 emissions through improvements in the capacity and efficiency of rail networks.

The Trans-Asian Railway Network, an Intergovernmental Agreement of the Economic and Social Commission for Asia and the Pacific (ESCAP), is made up of nearly 114,000 km of rail routes across 28 countries, and aims to offer efficient rail transport services for the movement of both goods and passengers within the region as well as between Asia and Europe. The development of this network highlights the growing awareness of governments that rail offers an important and viable alternative to road and even air transportation .[8]

In 2008, members of the Community of European Railway and Infrastructure Companies (CER) voluntarily agreed to a sector-wide target of 30% reduction in CO_2 emissions from rail traction on 1990 levels by 2020[9]. European research into rail efficiency has a focus in the project 'Innovative Integrated Energy Efficiency Solutions for Railway Rolling Stock, Rail Infrastructure and Train Operation' (Railenergy).[10]

"The objective of the 'Railenergy' project is to address energy efficiency of the integrated railway system and to investigate and validate solutions ranging from the introduction of innovative traction technologies, components and layouts to the development of rolling stock. Inter-relationship of railway sub-systems is highly complex, especially with regard to assessing their consumption of energy."

Railenergy

In Canada, the Railway Association of Canada (RAC), Environment Canada and Transport Canada signed a Memorandum of Understanding (MOU) on May 15, 2007, and is in force from 2006 to 2010. The MOU identifies specific commitments on the part of the major railway companies during this period, and the recent emissions monitoring report provides a review of the progress being made towards GHG emissions targets, Table 1.[11]

8 ESCAP, www.unescap.org
9 CER, www.cer.be
10 Railenergy, www.railenergy.org
11 Locomotive Emissions Monitoring Program, 2007, http://www.tc.gc.ca/programs/environment/ecofreight/voluntaryagreementsrail-eng.htm

Table 1 GHG intensities of Canadian rail (CO_2 eq per productivity unit)

Railway Operation	2006	2007	MOU 2010 target
Class 1 freight (kg / 1,000 RTK)	17.79	17.32	16.98
Regional and Short Lines (kg / 1,000 RTK)	15.10	15.21	15.38
Intercity Passenger (kg / 1,000 passenger-km)	0.13	0.13	0.12
Commuter Rail (kg / 1,000 passenger-km)	1.74	1.71	1.46

The 'Copenhagen' Treaty - a chance for sustainable transport

The United Nations Framework Convention on Climate Change (UNFCCC) provides an international collaboration for action on climate change mitigation andadaptation. The UNFCCC Kyoto Protocol, adopted in 1997, commits developed countries to reduce greenhouse gas (GHG) emissions under the principle of 'common but differentiated responsibilities', and provides three market-based mechanisms to support countries to meet reduction targets; the Clean Development mechanism (CDM), Joint Implementation (JI) and Emissions Trading.

One of the two registered transport CDM projects is within rail; the 'Installation of Low Green House Gases (GHG) emitting rolling stocks cars in a metro system', which was registered December 2007, and is hosted by India. The Delhi Metro Rail Corporation replaced conventional electro-dynamic rheostatic braking technology with Japanese regenerative braking technology on three lines (Figure 5), and reduces the demand for electricity by up to 33%.[12] The carbon credits produced through the offsetting of emissions from coal fired power generation are purchased by Japan Carbon Finance Ltd (JCF). The monitoring report submitted to the UNFCCC, for the period 29/12/07 to 31/01/08, calculated the project reduced emissions by 5081t CO_2 against the projected baseline emissions .[13]

12 Japan Carbon Finance Ltd, www.japanfs.org
13 UNFCCC, www.unfccc.int

Figure 5 Delhi metro train (Source: DMRC)

The project has been shown to be successful in reducing emissions, however the small level of reduction is counter balanced by high project costs in terms of time and finance. Future mechanisms within the UNFCCC framework should therefore be developed to address the balance of cost and benefits to support higher numbers of projects with higher levels of emissions reduction in the transport sector.

The successor to the Kyoto protocol, under negotiation in Copenhagen at the 15th meeting of the UNFCCC Conference of the Parties (COP15), will be a critical international treaty not only for commitments to further reductions in GHG emissions and the implications for climate change impacts, but also for successful inclusion of the transport sector and the development of sustainable mobility.

In order for future international agreements to be successful, they must include up-scaled mechanisms with appropriate financing and capacity building with recognition of the key sectors that can contribute to actions on climate change. In the case of rail, up-scaled support could provide incentive for developments in infrastructure in addition to improvements in rolling stock. The recognition of co-benefits from transport projects, such as access and safety, would also facilitate the monitoring of socio-economic indicators in addition to GHG emissions.

As a transport mode, rail presents a significantly lower CO_2 emitting travel option in terms of gCO2 per passenger km (Figure 6), and supports efforts to shift travel demand from road and air to rail in low carbon transport strategies.

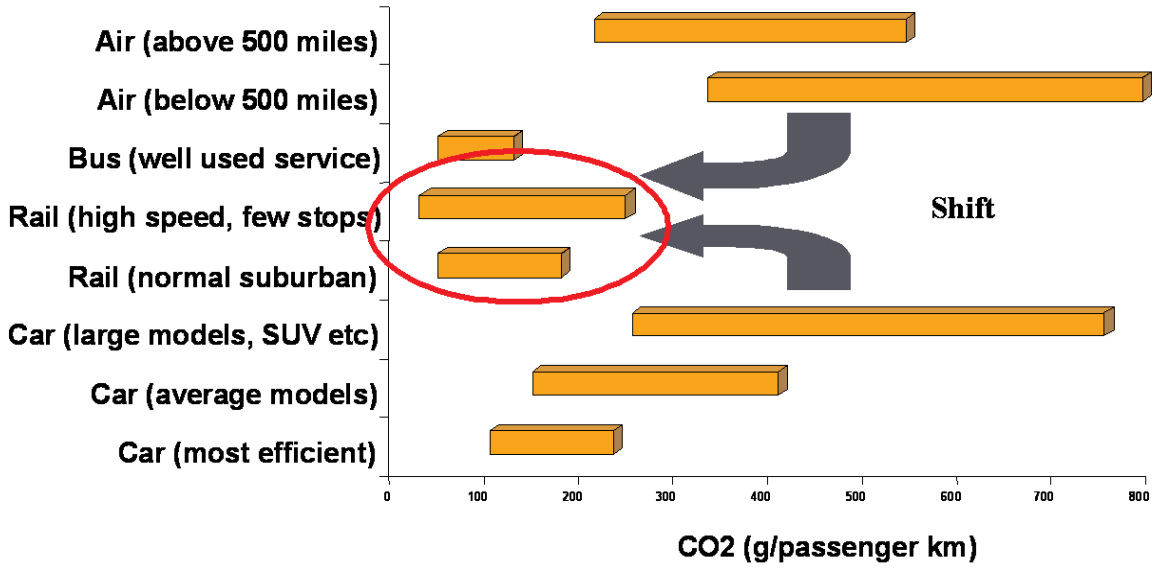


Figure 6 Ranges of CO_2 emissions across different modes of transport [14]

Demand for travel by rail varies significantly between countries, both in terms of passenger and freight movements. Within Europe, EU-27, rail accounts for 7.1% passenger travel and 17.9% freight movements by modal split,[15] however in contrast Canadian rail represents 0.8% passenger travel and 41% freight activity in tonnes-km.[16] The potential to increase the modal share of rail is dependent on the relationship of a group of factors, inter alia; population density, spatial planning, network management, regulatory instruments and costs. National level assessments are therefore needed to evaluate the degree to which the modal share can be increased for individual countries, but there are positive indications that switching to rail can result in significant benefits. The social co-benefits of increasing the role of rail in a sustainable transport system include safety, predictable journey times, congestion reduction and access to mobility. Rail also provides economic opportunities to increase GDP, reduce external costs and support 'green' jobs.

14 Adapted from 'How does air compare?' Aviation Environmental Federation, UK. www.aef.org.uk
15 Eurostats database: 2007 modal split data. epp.eurostat.ec.europa.eu
16 Transport Canada, www.tc.gc.ca and National Resources Canada

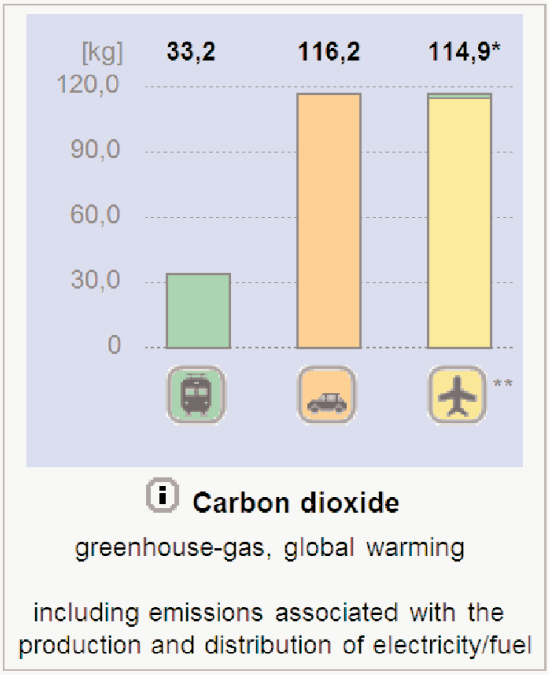
Increasing the modal share of rail

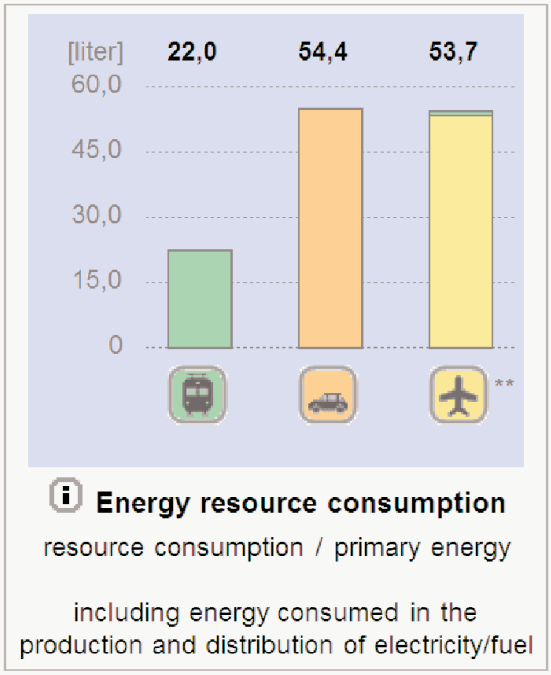
The rail sector provides strong support for a low carbon transport network, and influencing behaviour change is a key factor in promoting shifts away from road and air. Communicating the environmental benefits of rail is an important step in effecting a change in modal choice, and internet tools such as EcoPassenger and EcoTransIT assist with the delivery of clear information to potential rail passengers.

Informing the potential rail user

EcoPassenger and EcoTransIT are two user-friendly internet tools for the comparison of a number of indicators including energy consumption and CO_2 emissions for planes, cars and trains in Europe. The methodology behind the calculations are focused on a life cycle approach and supported by the European Environment Agency. The calculations include the emissions from the cumulative energy consumption, including the energy used to produce the electricity or the fuel, in a "well to wheel" perspective.

A calculation by EcoPassenger based on travel from Brussels to Copenhagen, the last leg of the 'Train to Copenhagen', shows clearly how rail is by some margin the most efficient travel option in terms of CO_2 emissions and energy resource consumption per passenger.





Websites: EcoPassenger (http://www.ecopassenger.org/), EcoTransIT (http://www.ecotransit.org/)

However, providing information regarding the environmental benefits of rail alone will not stimulate modal shift, and needs to be supported by policy and financial measures that address;

- Fair pricing through taxes and levies across the whole transport sector,
- Internalisation of external costs,
- Investments in infrastructure, and
- Developments in technologies

Modal shift to rail can also be tackled within three transport demand areas; urban transport, High Speed passenger rail and freight movement over long distances.

Urban transport – shifting transport demand from car to rail

Transport within agglomerations and city centres presents a number of issues when a high proportion of travel is made by private vehicles; including low air quality, safety, access and reliability of travel times. A shift from cars to public transport has been the focus of Transport for London who has made a series of investments and implemented policy measures to influence this shift. Promotion of sustainable transport in London has incorporated the extension and upgrading of Underground infrastructure, creation of London Overground, and the introduction of a congestion charge and low emission zones. The efforts have achieved a decrease in car modal share of 5% and an increase in Underground and Dockland Light Railways travel of 7%.[17]

High speed passenger rail – shifting transport demand from air to rail

High Speed Rail has been shown to draw travel demand from other modes, such as short haul aviation and road. In Spain, the new high speed line between Madrid and Seville increased the market share of rail on the route to 84% (Figure 7)[18]; private car share reduced by 50%. Studies into the Madrid to Seville AVE line have revealed without the AVE an additional 48,000 tonnes of CO2 would be produced on this route every year[19]. The new high-speed service between Madrid and Valencia due to open in 2010 will add savings of 80,000 tonnes of CO2, a saving equivalent to the domestic electricity consumption of a city with 250,000 inhabitants.[20]

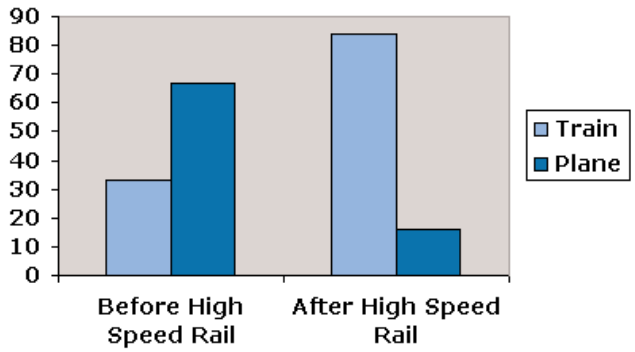


Figure 7 Modal shift to rail on the Madrid to Seville route (%)

17 Moving London towards lower carbon – TfL's role', 2008
18 How to achieve sustainable development in the transport sector', UNIFE
19 Spanish Railways Foundation 2008
20 Renfe 2009

In Italy, in the first 50 days of the Rome to Milan high speed line operation, the airlines connecting Milan and Rome experienced a reduction of 91,000 passengers (approaching 2,000 per day), whilst the new High Speed rail service gained 1,600 new passengers per day. Rail held 48% of the market share during these first 50 days, compared to 39% for air transport and 13% for road. The modal shift to rail translates to savings of 30,000 CO_2 tons per year. In 2010 the new line Florence to Bologna will open reducing the Rome to Milan route by an additional 30 minutes, and it is estimated that the 46 high speed trains connecting Rome and Milan on a daily basis will shift 60% of the transport demand from air.[21]

In Korea, the economic benefits of modal shift to High Speed rail have been illustrated by the President of Korail; "For example, the electricity bill for a KTX high-speed train travelling the 400km from Seoul to Busan with 935 people on board is Won 1.08 million. If these 935 people travel by car instead, with four people per car, it would cost a total of Won 21 million in petrol and tolls. That means using a car is 20 times more expensive than travelling by train. With only a 1% increase in passenger traffic, rail can reduce energy and CO_2 emission costs by Won 600 billion a year. This is why rail transport is now at the heart of so-called green growth worldwide."[22]

Intermodal logistic chains- shifting freight transport from road to rail

The impact on emissions reductions through shifts in freight transport demand from road to rail is highlighted by the Association of American Railroads (AAR),[23] "If just 10 percent of long-haul freight now moving by truck moved by rail instead, annual greenhouse gas emissions would fall by more than 12 million tons. Cumulative reductions through 2020 would be around 200 million tons".

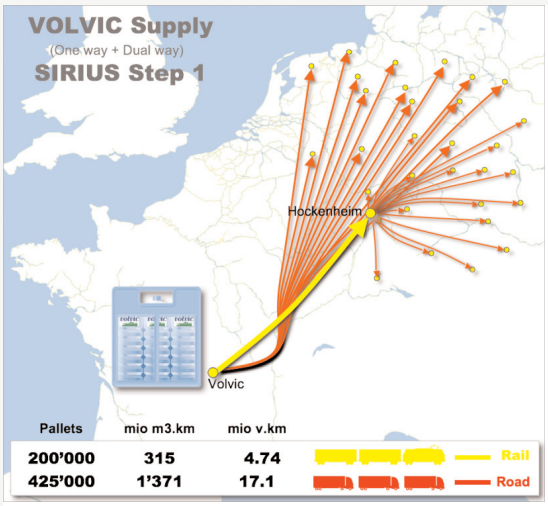
In the last 12 years Germany, Netherlands, UK and Sweden have increased the modal share of freight railways at a pace that is more than doubling the increase of total transport volumes. The reorganisation of the export of Volvic water by Danone provides an example of the level of reductions in emissions and energy consumption that can be achieved with a change in modal choice for freight movements.

21 UNIFE. www.unife.org
22 International Railway Journal, www.railjournal.com
23 Freight Railroads Offer a Smart, Effective Way to Reduce Greenhouse Gas Emissions'. www.aar.org

Modal shift in Volvic beverage flows

The Sirius 1 Project is aiming to study the modal shift from road to rail for the export flows of Volvic water from France to Germany. On a yearly basis, 625,000 pallets holding 454 millions of litres of water were sent 100% by truck, and additionally 445,000 pallets of empty bottles were returning for recycling.

The project studied the removal of 10,000 trucks by replacing the road transport of 200,000 pallets for supply and 100,000 pallets for return, with rail between Volvic and Hockenheim.



Source:SIRIUS 1 Project (EU funded) and ESTIA-Switzerland

Using the Estia-VIA®1 method, the study estimated the modal shift saved;

- 11,818 tons of CO2 eq. per year
(equivalent to the carbon quantity absorbed by 807 ha forest during one year)
- 55,636,000 kWh of non renewable energy per year
(equivalent to the amount of energy needed for domestic lighting needs of 320,000 inhabitants during one year)

The addition of rail also introduces an efficient method of transport within an industry that demands fast consumer goods exportation.

Increasing the energy efficiency of rail

In addition to influencing behaviour change, improving the energy efficiency of the rail sector is needed to maintain the position of rail as a low carbon transport option. The rail industry is pushing forward with managerial improvements and technological innovations to further develop the performance of trains, and reductions in rail emissions. Areas of rail development include; Energy Efficiency Management, Innovative Energy Efficiency Operation and Trackside, Energy Saving Onboard and Innovative Traction systems. Examples of innovations and developments are highlighted here to demonstrate the level of energy efficiency and emissions reductions that has been achieved.

High Speed Rail

High speed rail is a mode of transport that operates on dedicated fast lines in the region of 250km/h. The key features of High Speed Rail HSR include state-of-the-art development of train design, operations and high capacity railways. In France, the double-deck, double-unit TGV Duplex train offers 1090 seats in twenty vehicles compared to the 439 seats in the 9-cars of a Pendolino train .[24]

24 'Energy consumption and CO_2 impacts of High Speed Rail: ATOC analysis for Greengauge 21'. www.greengauge21.net

The improvements in the design of Japanese Shinkansen trains, especially optimizing the length and shape of the lead nose, have both increased energy efficiency and lowered CO_2 emissions. Above all, the significant reduction of weight has greatly contributed to them. The total reduction of energy consumption on the basis of equivalent estimate was 40% despite the considerable increase of maximum speed. Although a 40% increase in speed normally results in a doubling of energy demand, Japanese Shinkansen has successfully achieved higher top speeds while at the same time reducing energy consumption.

The Swedish "Gröna Tåget" (the Green Train) research shows further potential for reductions in energy consumption per seat km by 32% on the existing Stockholm to Gothenburg line by using the GT-250 instead of the X-2000 reference High Speed train. The reduction in energy consumption is reflective of increased seating capacity and an increase in regenerative energy capacity.[25]

Regenerative Braking

Regenerative braking refers to a braking system used by trains fitted with electric traction motors whereby the motors become generators, converting the energy of the train brake into usable power. The power generated as a braking current can then be fed back to the third rail, overhead line or returned to an electricity supplier. In the United States, Amtrak introduced Acela Express high speed trains and other new and remanufactured electric locomotives in 2006. These trains use regenerative braking systems and have allowed Amtrak to reduce energy consumption by 8% .[26]

In the UK, Pendolino trains return 17% of the energy they use to the grid when they brake.

(Source: Virgin Trains)

In Sweden, the "Gröna Tåget!" research estimated using regenerative braking results in more than 20% energy regeneration on existing lines and in the order of 30% on the planned high-speed lines.[25]

25 www.gronataget.se
26 Amtrak, www.amtrak.com

Hybrid Technology

A hybrid train uses an onboard rechargeable energy storage system, placed between the power source and the traction transmission system connected to wheels. Surplus energy from the power source generated from regenerative braking, charges the storage system. Diesel hybrid technology has been demonstrated in Japan within the Kiha E200 train, which has shown 9% energy efficiency improvement compared to the previous diesel railcars, and in Canada in the Evolution Hybrid Locomotive.

JR East (East Japan Railway Company) forged ahead within their research and development into Environmentally Friendly Cars with the demonstration of the world first fuel-cell hybrid railcar.[27]

Fuel cell hybrid technology

Fuel cells are electricity-generation technology with low environmental impact. They feature high electricity-generation efficiency, and the only byproduct generated through their reaction is water.

JR East is proceeding with research on railway systems using fuel cells. Completing the world's first fuel-cell hybrid railcar in 2006, JR East confirmed its basic performance in test runs at up to 100 km/h and identified issues yet to be resolved. Currently, it is engaged in research on improving the efficiency of the fuel cells and producing and refueling with hydrogen.

Copyright: JR East

ne@train
new energy train

Energy efficient driving

In the US, an Amtrak revised operating policy to reduce the amount of time that a powered locomotive sits idling and installation of a new automatic shut-off system in its diesel locomotive fleet contributed to a 10% reduction in diesel use, FY04-06.[26]

27 JR East, www.jreast.co.jp/e/index.html

The TRAINER (TRAining programmes to INcrease Energy-efficiency by Railways) project carried out in a number of EU countries is aimed at improving the energy-efficiency of railways. The objectives of TRAINER are to encourage train drivers to drive trains more energy-efficiently, safely and more comfortably. Field tests in Germany show that for both electric trains and diesel trains average energy savings of 5-10% can be achieved.

(Source: www.iee-trainer.eu).

TRAINER

In Australia, the Freightmiser system is an in-cab advice system that assists long-haul train drivers to stay on time and minimise fuel consumption. The on-board advice system advises the optimum speed profile for drivers, automatically adjusting to take into account changing or unexpected conditions. Industry trials of the technology have found fuel savings of between 5% and 20%, with no increase to journey times. [28]

Electrification

The emissions performance of rail has a strong link to the source of fuel supply, and the energy split of coal, diesel and electricity for rail traction varies significantly across the world (Figure 8).

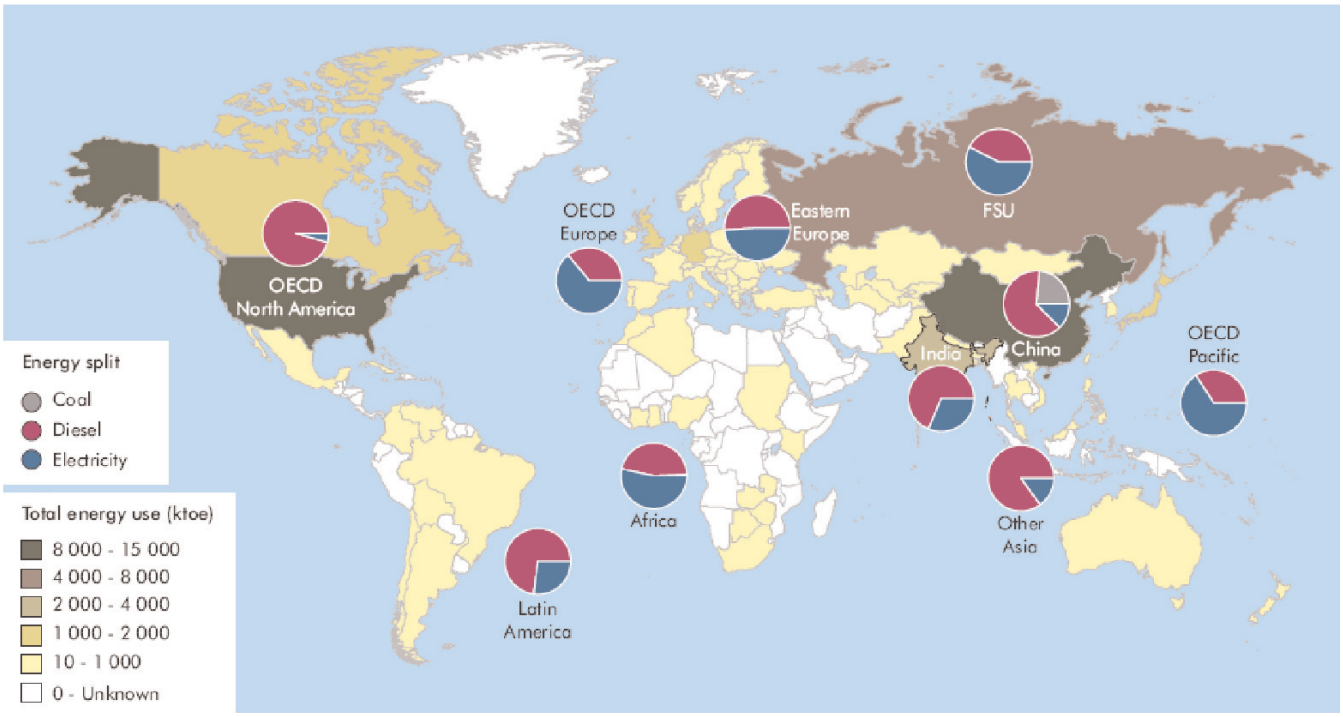
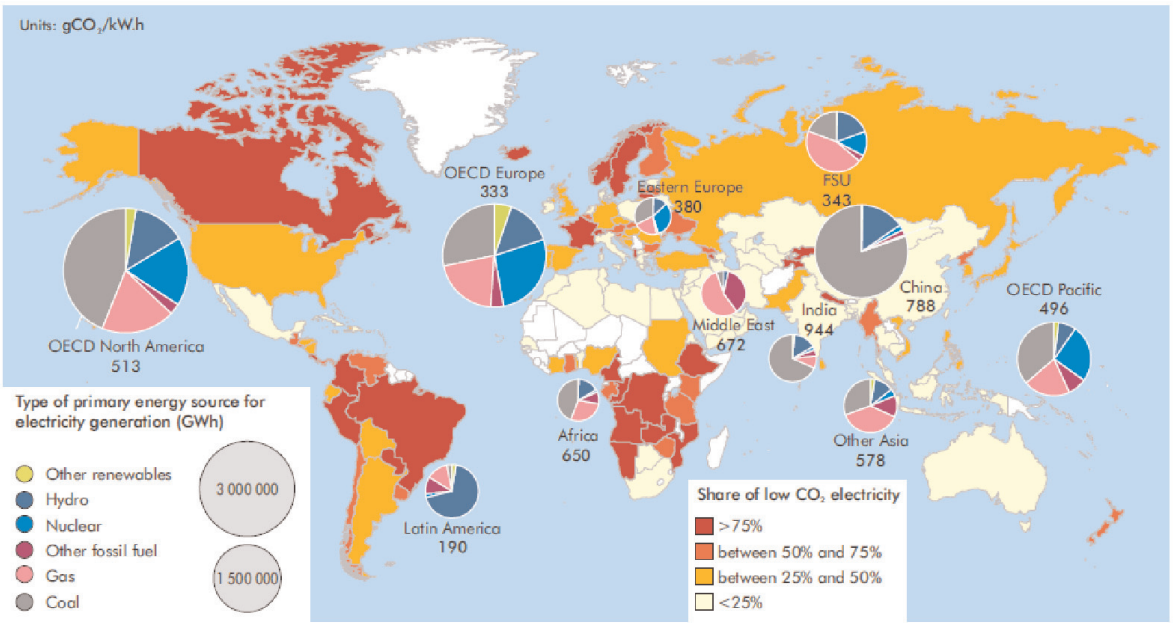


Figure 8 Global energy splits for rail traction [29]

28 Rail Innovation Australia Pty. www.railinnovation.co.au
29 International Energy Agency, IEA

Electrification offers reductions in emissions over diesel-powered trains when the electricity is sourced from sustainable energy supplies, globally however there are significant differences in moves to renewable energy supply (Figure 9). The impact of increasing renewable energy sources in electricity generation on rail emissions can be clearly shown.

Swedish Rail, Statens Järnvägars (SJ), which operates only electrically powered trains have taken the step to purchase 100% renewable energy from hydroelectric and wind-powered sources. The positive impact on emissions reductions is illustrated by the journey between Stockholm and Gothenburg, on which an SJ train can carry up to 300 passengers and emits only 400g of CO_2, compared to an average car which would emit on average 44.5kg.[30]



Source: IEA

Figure 9 Primary energy sources for electricity generation [29]

In Spain, the rail operator Renfe is the biggest consumer of electricity, and increasing the percentage of renewable energy in the national energy mix from 18% to 31% (Figure 10) contributed to a 43% reduction in CO_2 emissions per Kwh in the operation of the rail sector. [20]

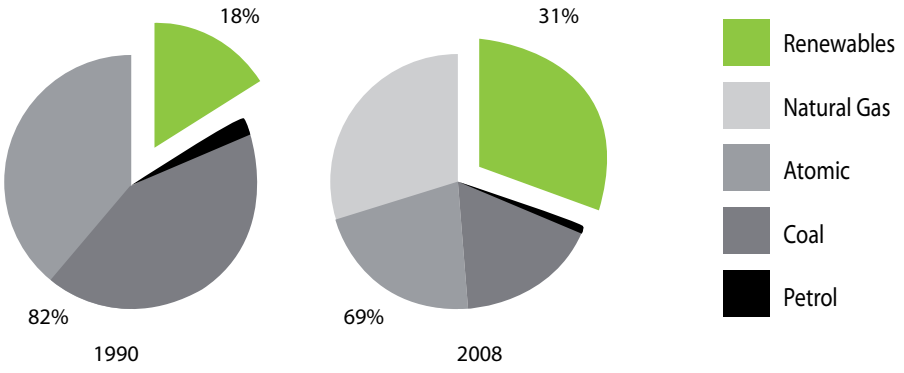


Figure 10 Increase in renewable energy in Spanish electricity production [20]

30 www.sj.se

During the period 1990-2008 Renfe reduced its total CO_2 emissions by 33% and estimates it will decrease emissions further, 57% by 2020 based on 1990. Alongside the reductions in CO_2 emissions, Renfe increased the amount of rail traffic by 19%, illustrating that greater mobility can be attained with less CO_2 emissions (Figure 11).

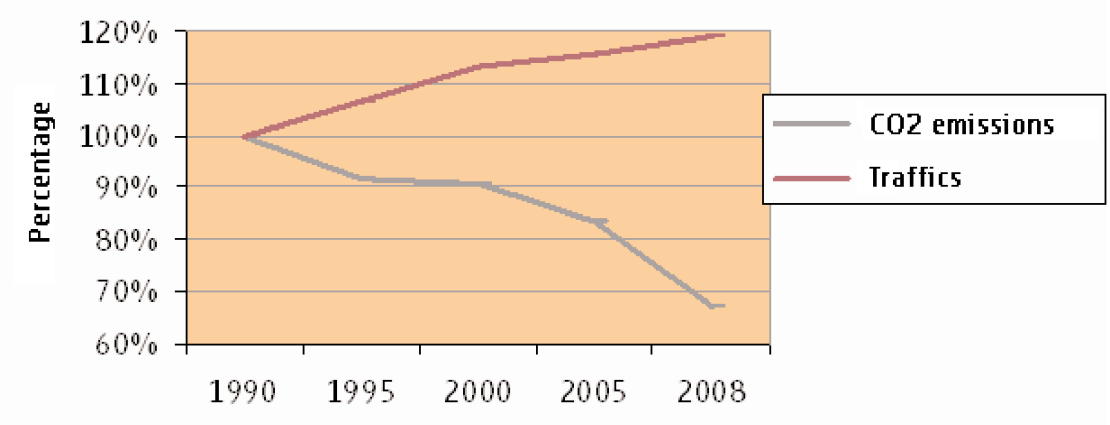


Figure 11 Decoupling mobility and CO_2 emissions at Spanish rail operator Renfe [20]

Managing the energy performance of rail

UIC is supporting its members in managing energy performance by facilitating international cooperation and best practice exchange. UIC has developed the necessary tools, including a rail energy indicator set and a UIC Energy and CO_2 emissions data base, which enables the rail sector to monitor and manage its emissions efficiently under the motto “if you can’t measure, you can’t manage”.

System boundaries

The environmental impacts within the rail energy management system boundary are those linked to the operation of rolling stock and fuel production (Figure 12). Excluded from consideration are the production and maintenance of vehicles, the construction and maintenance of transport infrastructure and additional resource consumption, for example, administration buildings and stations.

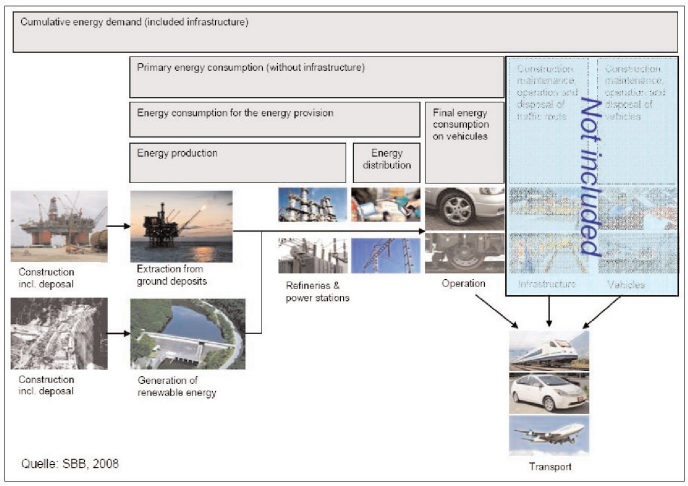


Figure 12 Rail energy management system boundary [31]

Several studies have been conducted on rail energy management, and the main findings are that the carbon footprint of the rail infrastructure is determined by the track system. The most important factors influencing the carbon footprint of the construction of infrastructure is the share of bridges and tunnels, the load factor of the transport, the average usage of the tracks, and of course, the source of the energy supply. From preliminary studies it is estimated infrastructure represents 10-20% of the life cycle emissions of rail - even for high speed lines.

In addition to managing energy performance, strong actions and commitment from railways are needed beyond environmental concerns. The rail sector's focus is also on maintaining the highest level of safety, and continuously improves its reliability, quality of service and many other factors to improve the level of customer satisfaction.

31 Methodology report www.ecopassenger.org

The importance of decisions currently being made at international and national levels regarding carbon emissions reductions cannot be underestimated. There is consensus on the need for action in terms of reducing the impact of modern society on the environment, and this understanding must be matched with commitments within all sectors to assess the ability to reduce carbon emissions through technological and infrastructure developments, along with behavioural changes in customer demand.

The rail sector is demonstrating its commitment to global carbon reduction targets with improvements in technology and operations, and through voluntary agreements such as the European commitment to reduce CO_2 emissions from rail traction by 30% from 1990 to 2020. The commitment will need to be matched with financial support from National governments, Official Development Assistance (ODA) and carbon finance markets to strengthen and incentivise public and private capital investments.

At the international level, the UNFCCC climate negotiations will be crucial in setting an agreement that works for land transport. The discussions on requirements for finance, technology transfer and capacity building are particularly important for creating a support framework for energy efficiency developments and infrastructure investments in both developed and developing countries. The rail sector would benefit from up-scaled mechanisms that have the potential to provide support for investments in infrastructure and technology development. UIC is engaged with the UNFCCC negotiations through partnership and cooperation with the 'Bridging the Gap' initiative[32] which is communicating the role that transport should play in a post-Kyoto Protocol regime. The 'Train to Copenhagen' will provide an opportunity to deliver the potential role of rail in future climate change solutions.

The continued success in energy efficiency, technological and operational developments across national rail networks, in combination with strong policy measures, can influence modal shifts of transport demand from road and air to rail and will support transitions to low carbon mobility.

32 www.sutp.org/bridging_the_gap

Message from the Rail Sector to the COP 15

- From Kyoto to Copenhagen -

Signed by the participants of the UIC Asia Environment Conference in Kyoto on 5th November 2009

Transport brings enormous benefits and development to society; however it has also adverse effects, including its impact on climate change.

The transport sector accounts for 23% of total CO_2-emissions and it is the sector with the fastest growing trends. Today the sector depends 95% on fossil fuel and is responsible for 60% of the global oil consumption.Transport energy use is predicted to be about 80% higher in 2030 than current levels.

The transport sector has a special responsibility to reduce its emissions worldwide. UIC encourages stakeholders dialogue and actions in order to create sustainable transport systems!

Rail offers a resource efficient low carbon mass public transportation system and takes its responsibility as part of the solution.

On average rail emits three times less CO_2 emissions than a car and five times less than an airplane per transport unit. Now that establishing a society with low carbon emission and energy conservation has become one of the very high priorities for every country around the world, a transportation policy with railways as its core mode of transportation is actively being developed worldwide. The creation of smart sustainable transport systems can be seen as the way ahead through two measures, one being the voluntary change of customer behaviour toward the choice of railways as the preferred mode of transportation, even when they have other choices available, and the other being the clear technological improvement to sustain the environmental advantage of rail. In order to further influence a change in modal choice, toward less CO_2 intensive transport modes, affirmative action from railways will be required in addition to strong policy and economic measures. In addition to their environmental advantage, railways must demonstrate higher level of safety, reliability, cleanliness and customer satisfaction.

Positioning railways as the preferred mode of choice of our society is the main approach to reduce CO_2 emissions of the transport sector.

The rail sector is continuously aiming at even higher performance.

The base of railways is technology, and the growth of railways has been brought about by technological innovation. Further strengthening railways' environmental advantage is the rail sector's responsibility to society as a whole, and the only way to realise it is technological development. A continuous and persevering technological development will further increase railways' environmental advantage. Furthermore, many railways all over the world have voluntarily agreed to emission reduction targets. Many of the UIC Asian and European Member railways, for example, have committed to a reduction target of 30% specific emissions between 1990 and 2020. UIC, as the global platform for rail technology, is supporting its members in this approach by facilitating international cooperation and best practice exchange. UIC has developed the necessary tools that enable the rail sector to monitor and manage its emissions efficiently under the motto "if you can't measure, you can't manage". What's more, in order to actually raise the effectiveness of these actions and to mutually enlighten each other, UIC will hold a Global Environment & Sustainability Conference once every two years. The UIC Asia Environment Conference in Kyoto, which is one of the birthplaces of the awareness of the issue of global environment, marks a milestone in this respect.

UIC will give full support to its members to raise the level of customer satisfaction, with safe, reliable, dependable, and punctual transportation as the fundamental base, while making maximum use of their various experiences and know-how to raise the level of the railways' environmental advantage..

A paradigm shift towards low carbon transport is required with solutions scaled to the size of the challenge.
A steep downward trajectory in total global Green House Gas emissions by 2050 will be needed to avoid adverse climate change impacts. Unprecedented efforts from all sectors will be required to attain these levels. Transport needs to be focussed upon in the new climate change regime, as the Kyoto protocol excluded international aviation and shipping in the CO_2 reductions targets. Explicitly including transport within the shared vision of long-term co-operative action of the UNFCCC Parties negotiations at the COP 15 in Copenhagen is vital for the development of sustainable transport systems, with rail playing a fundamental role. Financial schemes for infrastructure as well as for technology transfer and capacity building should be enabled through a new agreement.

The next generation climate regime needs to support the development of smart sustainable transport systems, with the rail sector playing a fundamental role.

The UIC is strongly committed to conveying the important role of rail in tackling climate change. The global rail community sends this message to COP15, to encourage to 'Keep Kyoto on Track' and 'Seal the Deal' in Copenhagen.

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