International Road Federation
Fédération Routière Internationale
Federación Internacional de Caminos

Down to Contents

IRF white paper

Roads and the Greenhouse Effect

Contents

Tables and figures

Note:

The following text was researched and drafted by Christian Mory, Christopher Simpson and José Papí on behalf of Working Group I of the IRF Geneva Programme Centre

About the International Road Federation

The International Road Federation is a non-governmental, not-for-profit organisation with over 650 members worldwide from both the public and private sector. It was founded in 1948.

The mission of the IRF is to encourage and promote the development and maintenance of better and safer roads and road transport systems worldwide. The IRF:

- Promotes education and understanding of the social and economic benefits to be derived from developing modern road networks, transport systems and traffic control;
- Encourages and supports the planning and execution of economically and environmentally sound programmes to improve and extend road networks and allied systems;
- Provides education and training programmes;
- Co-operates with, advises and exchanges experiences with international, national and local organisations with goals similar to those of the IRF;
- Advises on, assists and promotes the creation of national and regional road federations;
- Collects, collates and distributes statistical, technical, economic, educational and other road-related material;
- Stimulates and supports regional and global harmonisation of standards;
- Supports road research;
- Encourages and promotes improvements in road safety.

The IRF also publishes *World Road Statistics*, the only global compilation of road and vehicle statistics. It is based on data from official sources within national statistics offices and national road administrations in more than 200 countries. It also benefits from increased IRF cooperation with major international institutions such as Eurostat and Afristat, and the UN Economic Commissions for Europe and for Africa.

Since it first appeared in 1958, World Road Statistics has been an indispensable reference tool for road professionals, statisticians, economists, journalists and development specialists around the world.

It is used by such agencies as the United Nations Development Programme, the World Bank, the European Commission and the CIA for their own publications: for example, the World Bank uses World Road Statistics to prepare a part of its own publication *World Development Indicators*.

Back to contents

Foreword

The strange and little remarked phenomenon surrounding the "greenhouse effect" is that the solution to the problem appears to reside in giving money to the government through eco-taxes – as if eco-taxes were somehow to eradicate environmental problems. True, these eco-taxes are said to be used to enact ecologically sound policies. If this is the case, the positive impact of public policy on, say, congestion, is yet to be felt.

That does not deter governments from continuing to pursue the same policies. And, in a sense this is understandable. If road users continue to give money to the government with little or no effect on congestion problems, it means they haven't given enough: time to pile on more taxes, which governments can spend on balancing budgets and giving the kind of hand-outs likely to get them re-elected.

In our view, the independence of a government-commissioned environmental report which concludes that the problem can be solved by giving money to government is suspect. Ditto for "independent" and frequently headline-grabbing reports from environmental pressure groups, claiming absolutism in what is, after all, an inexact science.

Need we remind readers that 25 years ago, environmental orthodoxy claimed that the earth was entering a new ice age, and that human activity, industrialisation and its associated air pollution, i.e. the causes cited today in global warming, was to blame for accelerating the process of global cooling. To assert that the "majority of scientists agree on the phenomenon of the greenhouse effect" seems strangely unscientific when not supported by a poll taken showing the proportion of top scientists who *do* agree.

This brief report claims no such independence. It is written by specialists from a sector of the economy, the road, which has made an enormous contribution to prosperity, individual mobility and delivery of goods and services. No other form of transport rivals the road as a means of getting people where they want when they want or of getting goods transported from producer to wholesaler and from wholesaler to retailer. In fact, no matter what form of transport is used – ship, train, aircraft – the final journey, taking people or goods from A to B, will *always* be by road.

The negative impact of the road has to be set against these undeniable benefits. In this report, the IRF focuses on one negative impact: environmental. It places the proportional contribution of human activity to concentrations of "greenhouse" gases in the earth's atmosphere in perspective: only 3% of all greenhouse emissions come from human activity; 97% is emitted through natural processes. However, the IRF recognises that, while the *proportion* is slight, the environmental *impact* of human activity may be enough to tip the balance.

It also recognises that road traffic accounts for a significant proportion of all greenhouse gases from human acitivity, about 10% and growing. It therefore looks at what the road sector has already done to reduce its environmental impact and what measures it can and should take. Note, for example, that the road sector has implemented all government legislation and targets often well in advance of implementation dates.

The report also makes a critical appraisal of public policy to date and suggests what kind of policies may succeed in the future.

Back to contents

Préambule

Un phénomène curieux et qui passe inaperçu touche l' "effet de serre" : la solution à ce problème semble en effet résider dans la levée d'impôts par le biais des eco-taxes, comme si les eco-taxes allaient en quelque sorte éradiquer les problèmes environnementaux. Il est souvent répété que ces eco-taxes ont été créées pour permettre une politique environnementale vigoureuse. Or, si cela avait été le cas, le bénéfice des politiques publiques se serait déjà fait sentir, par exemple sur la congestion.

Cette constatation n'empêche pas pour autant les gouvernements de poursuivre la même politique. On peut aisément comprendre un tel phénomène. En effet, si les utilisateurs des routes continuent de payer des taxes avec peu, ou pas, d'effet sur le problème de congestion routière, on peut conclure que ces utilisateurs n'ont pas assez donné. Ainsi, c'est en accumulant toujours plus de taxes que les différents gouvernements peuvent dépenser plus, pour financer les dépenses publiques, et assurer leur réélection.

Pour l'IRF, l'indépendance d'un rapport émanant d'une commission gouvernementale sur l'environnement et qui conclut que les problèmes seront résolus par plus de taxes est suspecte. Même chose pour les rapports très médiatisés des groupes environnementalistes revendiquant l'absolutisme dans ce qui est encore, après tout, une science inexacte.

Ainsi, il est intéressant de rappeler que, il y a 25 ans, l'orthodoxie environnementaliste prétendait que la terre entrait dans une nouvelle ère de glaciation, et que l'activité humaine, l'industrialisation et la pollution de l'air qui en découlait (c'est à dire les causes mises en avant aujourd'hui pour le réchauffement

de la planète) étaient responsables de l'accélération de ce phénomène de refroidissement. Affirmer que «la majorité des scientifiques reconnaissent le phénomène de l'effet de serre» apparaît plutôt non-scientifique. En effet, ce résultat ne s'appuie sur aucun sondage d'opinion effectué au sein de la communauté scientifique montrant quelle proportion de scientifiques est vraiment d'accord là dessus.

Ce bref rapport ne prétend pas non plus être indépendant. Il a été rédigé par des spécialistes d'un secteur de l'économie, la route, secteur qui a très largement contribué à la prospérité, à la mobilité individuelle et à la livraison de biens et de services. Aucun autre mode de transport ne rivalise avec le secteur routier en tant que moyen d'amener les gens là où ils veulent, quand ils le veulent, ou encore, comme moyen de transporter les marchandises des producteurs aux distributeurs, puis des distributeurs aux vendeurs. Ainsi, quelque soit le moyen de transport utilisé - bateau, train, avion - la partie finale d'un trajet menant des personnes ou des biens d'un point A à un point B se fera *toujours* par la route.

L'impact négatif des routes doit être mis en balance avec les bénéfices indéniables que ces dernières apportent. Dans ce rapport, l'IRF se concentre sur l'un des impacts négatifs de la route : l'effet sur l'environnement. Ce rapport met en perspective la contribution de l'activité humaine aux concentrations de gaz à «effet de serre» dans l'atmosphère terrestre : seulement 3% de toutes les émissions à effet de serre proviennent de l'activité humaine, 97% des émissions sont émises via des processus naturels. Or, l'IRF reconnaît que, bien que cette proportion soit faible, son impact environnemental peut être suffisant pour fragiliser l'équilibre.

L'IRF reconnaît aussi que le trafic routier compte pour une proportion significative des émissions de gaz produites par l'activité humaine, environ 10%, et que ces émissions sont en croissance. De ce fait, l'IRF se penche sur les actions que le secteur routier à déjà menées pour réduire ses effets sur l'environnement et quelles mesures il pourrait et devrait prendre. A noter, par exemple, que le secteur routier a mis en place toutes les législations et rempli les objectifs fixés par les gouvernements, et ce, souvent bien avant les dates requises.

Ce rapport mène ainsi une analyse critique des politiques publiques suivies jusqu' à présent et suggère celles qui pourraient réussir à l'avenir.

Back to contents

Vorwort

Einer der weniger beachteten Aspekte der Bekämpfung des "Treibhauseffektes" ist die Tatsache das Lösungsansätze fast immer auf weitere "Öko-steuern" hinauslaufen, als ob "Öko-steuern" alleine Umweltprobleme lösen könnten. Es wird gerne argumentiert, dass "Öko-steuern" für die Finanzierung umweltfördernder Massnahmen verwendet würden. Sollte dem so sein, ist hiervon, wie zum Beispiel die Staus auf den Strassen zeigen, wenig zu spüren.

Das hält Regierungen nicht davon ab ihre Besteuerungspolitik fortzusetzen. Bessern sich Verkehrsprobleme trotz Steuererhöhungen nicht, so wird das lediglich als ein Zeichen von "Unterbesteuerung" angesehen und es werden die nächsten Steuererhöhungen gefordert. Die Gelder werden dann wieder nicht zur Verbesserung der Verkehrslage, sondern für andere Zwecke verwendet.

Unserer Meinung nach sind von Regierungen in Auftrag gegebene "unabhängige Expertenberichte", die weitere Steuerhöhungen vorschlagen, zweifelhaft. Gleiches gilt für "unabhängige" Berichte diverser Umweltgruppen, die einen Absolutheitsanspruch auf Umweltthemen anmelden.

Gerade was Klimaveränderung betrifft sollte nicht vergessen werden dass noch vor 25 Jahren eben die Faktoren, von denen heute vermutet wird, sie würden eine Erderwärmung verursachen, für eine Erdabkühlung verantwortlich gemacht wurden. Die Aussage, dass "eine Mehrheit von Wissenschaftlern sich über den Treibhauseffekt einig sind" klingt seltsam unwissenschaftlich angesichts der Tatsache das es keine Umfragen gibt in denen sich führende Wissenschaftler zu dem Treibhauseffekt bekennen.

Dieser IRF-Bericht nimmt nicht für sich in Anspruch, unabhängig zu sein. Er wurde von führenden Experten geschrieben, die aus einem der wirtschaftlich wichtigsten Sektoren kommen, einem Sektor der unseren Wohlstand, die Mobilität von Gütern und unsere eigene Mobilität garantiert - dem Strassensektor. Keine andere Transportform hat eine so umfassende Infrastruktur, keine andere Transportform bietet Individuen und der Wirtschaft flexibeleren Transport. Welches Transportmittel man auch benutzt, ob Eisenbahn, Schiff oder Flugzeug, am Ende wird *immer* eine Fahrt über Strassen stehen.

Dass der Strassenverkehr die Umwelt belastet steht ausser Frage. Solche Kosten müssen jedoch mit dem weit höheren Nutzen des Strassenverkehrs verglichen werden. Dieser IRF-Bericht konzentriert sich auf eine der negativen Auswirkungen, die der Strassenverkehr erzeugt – die Auswirkung auf die Umwelt. Auch wenn nur rund 3% aller "Treibhausgase" in der Erdatmosphäre auf menschliche Aktivitäten zurückzuführen sind und die restlichen 97% aus natürlichen chemischen Prozessen stammen, könnten es gerade diese 3% sein, die das Fass zum überlaufen bringen.

10% der menschlich erzeugten Treibhausgase werden durch Strassenverkehr erzeugt, wobei die

Tendenz steigend ist. Der bericht präsentiert die Massnahmen, die der Strassensektor schon ergriffen hat, um seinen Treibhausgasausstoss zu verringern und welche Schritte in der Zukunft getan werden sollten. Es sollte angemerkt werden, dass der Strassensektor immer sehr gut mit Regierungen kooperiert hat, um Vorschriften, häufig früher als vorgeschrieben, umzusetzen.

In diesem IRF-Bericht werden derzeitige Politikansätze kritisch analysiert und vielversprechende Ansätze für eine zukunftsorientierte, den Umweltanforderungen entsprechende moderne Verkehrspolitik präsentiert.

Back to contents

Prefacio

El curioso -y pocas veces examinado con atención- debate que rodea al denominado “efecto invernadero” suele centrarse en la propuesta de soluciones al problema sobre la base de proporcionar ingresos adicionales a los Gobiernos a través de las llamadas “ecotasas” –siempre bajo la suposición de que las ecotasas van, de alguna manera, a erradicar los problemas medioambientales-. En este sentido, se afirma que las ecotasas contribuyen a reforzar políticas medioambientales sólidas. Sin embargo, y aunque así fuera, el impacto de las intervenciones del sector público sobre el problema de la congestión todavía no ha sido analizado con detalle.

Sin embargo, este hecho no ha detenido a los Gobiernos en sus intentos por implantar este tipo de políticas. De algún modo, esta actitud es comprensible. Si los usuarios de la carretera siguen financiando las arcas del Estado sin que se produzca un efecto claro sobre los problemas de congestión, aún se les podrá exigir más: será el momento de implantar nuevos impuestos, los cuales podrán ser usados por los Gobiernos para el ajuste de sus balanzas presupuestarias y la introducción de partidas extraordinarias con fines electoralistas.

En nuestra opinión, la independencia de los informes medioambientales encargados por los propios Gobiernos y que concluyen que los problemas deben ser resueltos a través de la introducción de nuevos impuestos queda, cuanto menos, bajo sospecha. Lo mismo cabe señalar con relación a los informes elaborados por los distintos grupos ecologistas, usualmente aceptados como neutrales y objeto de numerosos titulares en los medios de comunicación, los cuales suelen reclamar soluciones absolutas en un campo que es, ante todo, una ciencia inexacta.

Debemos recordar al lector que hace 25 años, la ortodoxia medioambientalista aducía que la Tierra se adentraba en una nueva era de glaciaciones y que las actividades humana e industrial, así como la contaminación que acarreaban (las mismas causas citadas esgrimidas hoy en día respecto al calentamiento global del planeta), eran las culpables de acelerar el proceso de enfriamiento a escala planetaria. La afirmación de que “la mayoría de los científicos están de acuerdo con relación al fenómeno del efecto invernadero” no parece entonces, pues, demasiado rigurosa, salvo en el caso que se acompañe de una encuesta de opinión que refleje qué proporción de científicos de alto nivel comparten realmente dicha aseveración.

Este breve informe no se postula a sí mismo como “independiente”. Por contra, está escrito por expertos de un sector de la economía, la carretera, que efectúa una gran contribución a nuestra riqueza, a nuestra movilidad individual y al intercambio de bienes y servicios. Ningún otro modo de transporte rivaliza con la carretera como el medio más eficaz de transportar personas donde quieren y cuando lo desean, así como de desplazar bienes desde los fabricantes a los distribuidores y de éstos a los puntos de venta finales. De hecho, se utilice la forma de transporte que se utilice – barco, tren o avión –, el trayecto final en el desplazamiento de personas o bienes de un punto A a un punto B *siempre* se efectuará por carretera.

Sin embargo, los impactos negativos de la carretera también deben contemplarse, a pesar de todos estos beneficios innegables. En este informe, la IRF se centra en el análisis del impacto medioambiental. Así, sitúa en la perspectiva correcta la contribución proporcional de la actividad humana en la emisión de gases a la atmósfera: sólo un 3% de las emisiones que contribuyen al efecto invernadero tiene su origen en el hombre; el 97% restante se produce a causa de procesos naturales. De todos modos, la IRF reconoce que, aunque esta proporción sea pequeña, el impacto medioambiental de las actividades humanas podría ser suficiente para romper el equilibrio climático.

Asimismo, la IRF admite que el transporte por carretera representa una proporción muy significativa de las emisiones humanas que contribuyen al efecto invernadero: un 10% y en ascenso. En consecuencia, el informe analiza qué ha hecho el sector hasta ahora para combatir este impacto medioambiental y qué medidas puede y debe tomar en el futuro. Baste resaltar, por ejemplo, que el sector de la carretera ha cumplido, a menudo anticipadamente, con las legislaciones y objetivos medioambientales a que ha sido enfrentado.

En definitiva, el presente Libro Blanco presenta recoge una valoración crítica de las políticas públicas desarrolladas hasta la fecha, al tiempo que sugiere qué tipo de medidas podría tener éxito en el futuro.

Back to contents

I. What is the “greenhouse” effect?

The greenhouse effect is a natural phenomenon. The sun’s energy heats the earth’s surface, and some of that heat is in turn radiated back. Certain gases in the earth’s atmosphere prevent this radiation from escaping into space. Thus the heat becomes trapped inside the atmosphere which, in essence, is like the glass cover of a greenhouse, hence the term “greenhouse effect”.

This “greenhouse effect” maintains the earth’s average surface temperature at +15°C, and is therefore a precondition for life on the planet – without the “greenhouse effect”, the average temperature would be –18°C.

This natural “greenhouse” effect derives mostly from water vapour present in the atmosphere. It is generally agreed that the quantity of water vapour in the atmosphere does not vary, so calculations take no account of its contribution to the “greenhouse” effect. Clouds, moreover, have a cooling effect by reflecting the sun’s rays.

Most CO_2 emitted into the earth’s atmosphere results from natural processes. Today, however, concentrations of “greenhouse” gas are rapidly increasing and a proportion of the scientific community believes that humankind’s contribution, small though it is, could easily tip the balance and contribute to global warming.

This study, therefore, focuses on the additional impact of other gases in the earth’s atmosphere on the “greenhouse” effect.

Back to contents

II. Greenhouse gases

Over the last century, while the quantity of water vapour has remained constant, emissions of other gases into the earth’s atmosphere have substantially increased, particularly carbon dioxide. This is largely due to vast quantities of CO_2 escaping into the atmosphere as a result of burning fossilised carbon to produce energy. Table 1 gives the contribution of each gas to the “greenhouse” effect, with column 3 showing the additional effect of each gas once water vapour has been discounted. The contribution of gases to the “greenhouse” effect varies.

Table I: Greenhouse gases

Gas	Contribution to the “greenhouse effect”	Additional contribution to the “greenhouse effect”
Water vapour	62.0%	0%
Carbon dioxide	22.0%	57.9%
Ozone	7.0%	18.4%
Nitrous oxide (N_20)	4.0%	10.5%
Methane	2.5%	6.6%
Other rare gases	2.5%	6.6%

To ensure a standard form of measurement, “CO_2 equivalents” are frequently used. Thus, the CO_2 equivalent of nitrous oxide (N_2O) over a period 20 years is around 270, nitrous oxide’s effect over that period being about 270 times greater than CO_2.

What counts is the quantity of each gas present in the atmosphere, its capacity to absorb infrared rays and the length of time it remains in the atmosphere.

Back to contents

III. The “greenhouse” debate

The “greenhouse” debate began several years ago when scientists alerted governments and the general public to the dangers of global warming which, they said, could effect earth’s natural balance.

The issue was taken up by the Intergovernmental Panel on Climate Change (IPCC), a round table of world experts, set up by the United Nations at the end of the 1980s, to advise politicians and economists on scientific background to decision making.

IPCC calculations[1] on variations of the earth’s temperature over the last 150 years show:

- from 1860 to 1900, constant.
- from 1900 to 1940, a 0.4°C increase;
- from 1940 to 1975, no change;
- from 1975 to 1990, an increase of 0.2°C.

Interpretations vary: for some commentators, temperature variations are a natural phenomenon; for others, they mean that human activity is causing the temperature of the planet to rise.

The latter group believes that humankind is now going to reap the consequences of economic development, which include:

- extensive deforestation programmes, depriving the planet of the means to absorb CO_2
- energy-consuming industrial activity on the increase for over a century, fuelled initially by fossil sources (carbon, petrol, gas) which emit carbonic gases; these accumulate in the earth’s atmosphere together with other greenhouse gases, and compound the greenhouse effect, which thus leads to global warming.

[1] Intergovernmental Panel on Climate Change (1990)

Back to contents

IV. Climate change and public policy

In June 1992, the United Nations held a Conference on the Environment and Development in Rio de Janeiro, Brazil. One of its major outcomes was heightened international awareness of the “greenhouse” effect, with the signature, by 150 countries of the Draft Convention on Climate Change. Clause 2 deals with stabilising concentrations of greenhouse gases in the atmosphere to avoid dangerous disruption of the earth’s climate. The Convention calls for a commitment from industrialised countries to stabilise their greenhouse gas emissions to 1990 levels.

In December 1997, at a conference in Kyoto, Japan, 38 industrialised countries committed themselves to reducing their greenhouse gas emissions by 5.2% by 2008 to 2012. The six greenhouse gases identified during the course of the conference are: CO_2 (carbon dioxide), CH_4 (methane), N_20 (nitrous oxide), HFC, PFC and SF_6.

From 1997 on, greenhouse gas emissions began to figure high on government agendas with all sectors of the economy called upon to reduce emissions. In the absence of hard evidence, policy-making is based upon the “precautionary principle”: since we do not know if the danger is real or not, let us prepare ourselves for the worst just in case.

Back to contents

V. An inexact science?

Yet doubts remain:

First, it is unclear what relationship exists between concentrations of carbon gas in the atmosphere and rising temperatures. Climate mechanisms themselves are extremely complex and scientific understanding of interactions between water vapour, clouds and oceans is incomplete.

Second, a body of scientists strongly disagrees with the IPCC's findings.

Third, there are no standard formats for measuring gas emissions. Data on greenhouse emissions varies according to the source of information, and changes from year to year and according to units of measure, sometimes expressed in tonnes of CO_2, sometimes in tonnes of carbon. If meaningful interpretations are to be made, criteria, units and methods for quantifying emissions need to be unified, and hypotheses based on models, for example, mobility models, should be systematically monitored.

Back to contents

VI. Some data on greenhouse emissions

1995 data from the Technical University in Vienna show:

Table II: Composition of earth's atmosphere

H_20 (present in nature)	60 to 95%
Other greenhouse gases (present in nature)	5 to 40%
Greenhouse gas (from human activity)	0.5 to 1.5%

According to this data, therefore, human activity, accounts for between 0.5 and 1.5% of total greenhouse gas production. Proportions of each gas are:

Table III: Greenhouse gas proportions

Tropospheric ozone (0_3)	2 to 10%
Nitrous oxide (N_20)	2 to 10%
Stratospheric H_20	0 to 10%
CFC	5 to 25%
Methane (CH_4)	10 to 25%
Carbon dioxide ($C0_2$)	35 to 65%

Back to contents

According to a 1996 environmental report from Volkswagen, a German vehicle manufacturer, quoting IPCC sources, a total of 796 billion tonnes of CO_2 is released each year into the earth's atmosphere. Of this

- 770 billion tonnes is from natural processes,: 43% from the ocean, 23% from the earth, 28% from vegetation and 1% from the combustion of biomass.
- 26 billion tonnes is produced as a result of human activity.

Thus, 97% of all CO_2 emissions into the earth's atmosphere come from nature itself, with only 3% produced by human activity.

Proportional production of CO_2 emissions from the various sectors of the economy are given in Table IV:

Back to contents

Table IV: Emissions by sector of the economy

Power stations	25%
Households and small businesses	23%
Industry	21%
Biomass combustion	15%
Road traffic	10%
Air transport	2.7%
Other forms of transport	2.2%
Water transport	1%

Back to contents

VII. Is road traffic a special case?

Road traffic, then, according to the estimates of Table IV, accounts for 10% of all greenhouse gas produced by human activity, i.e. 0.3% of total greenhouse gas production.

Some people view road traffic as a special case because emissions from the sector will inexorably rise and eventually become difficult to control. However, as this report will later show, demand for transport is unlikely to explode.

In 1995, the OICA (International Organisation of Motor Vehicle Manufacturers) made a forecast of CO_2 emissions from road vehicles. The results are given in *Figure 1*, page 10, and show the situation is far from being the disaster some commentators suggest.

It has to be added that OICA's forecasts were made *before* supplementary measures to reduce CO_2 emissions were taken in various parts of the world such as the 1998 voluntary commitment of ACEA (European Association of Motor Vehicle Manufacturers) to reduce emissions by 2005.

OICA's forecasts are therefore on the pessimistic side.

Back to contents

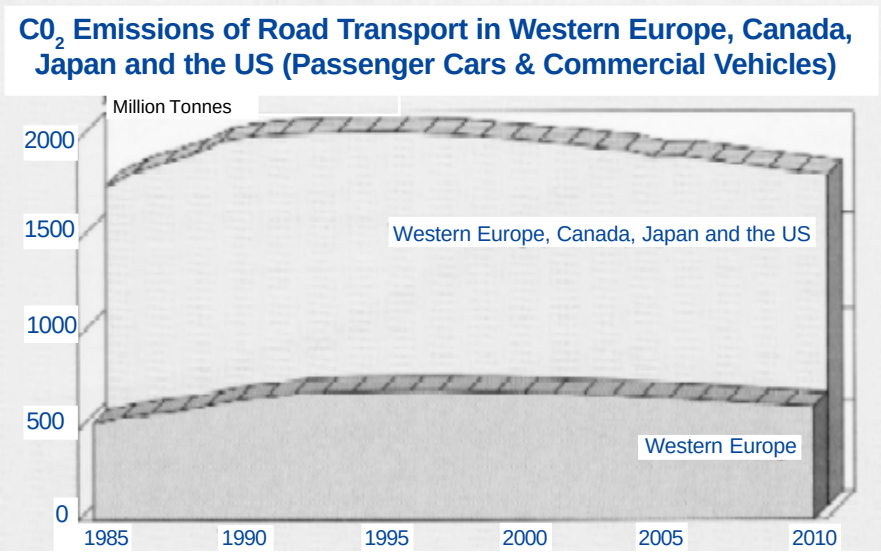

Figure 1: CO_2 emissions of road transport in Western Europe, Canada, Japan and the United States (passenger cars and commercial vehicles)

Back to contents

Even in the worst case scenario - i.e. if worldwide emissions of CO_2 from motor vehicles were to double within 20 years - total emissions of CO_2 from natural processes and from human activity would rise by only about 0.3%.

Thus, the transport sector can and indeed should make its contribution to reducing greenhouse emissions in the same proportion as other economic sectors.

Measures taken to control road traffic's contribution to CO_2 can therefore have only a minimal impact on total emissions. In the following sections, we review the origins of greenhouse emissions from the road sector, what reductions can be made and policies likely to result in reductions.

Back to contents

VIII. Greenhouse gas emissions from the road sector

Greenhouse gas from the road sector comes mainly from carbon dioxide emitted during fuel combustion in vehicle engines. Emissions are directly related to fuel consumption. Principal fuels are petrol and diesel.

Other road sector and related greenhouse emissions are: fuel refineries, road bitumen, vehicle manufacturing plants, leaks from vehicle air conditioning systems, and so on.

Back to contents

Table V: Some data on road vehicles

Vehicles in use (units)	630,000,000	of which
	480,000,000	cars
	150,000,000	commercial vehicles
Annual mileage (cars 1995)	in kilometres	
	12,000 to 15,000	EU
	10,000	Japan
	20,000	USA
CO_2 emissions (cars)	in g of CO_2 per km	
	186	EU
	191	Japan
	250	USA

Source: IRF, ACEA, JAMA, MVMA

Automobiles emit 1.7 billion tonnes of CO_2 per year and account for 6.5% of all emissions from human activity:

- total emissions: 796 billion tonnes
- emissions from natural sources: 770 billion tonnes
- emissions from human activity: 26 billion tonnes
- emissions from automobiles: 1.7 billion tonnes

Back to contents

IX. Improving fuel consumption

Fuel consumption is an important factor in choosing a motor vehicle. Motor vehicle manufacturers and their suppliers have been trying to find ways of reducing fuel consumption ever since the car was invented, and well before people began to worry about the greenhouse effect.

Today, most countries levy high taxes on fuel: fuel costs are thus a significant proportion of the running costs of a private car. Furthermore, energy savings are an integral part of road professionals' culture because fuel consumption of heavy vehicles - trucks, coaches and buses - has an impact on operating margins and competitiveness.

1. Technology

Back to contents

Motor vehicle fuel consumption can be reduced in a number of ways

- improving the performance of vehicle engines;
- improving vehicle aerodynamics;
- reducing friction between tyres and the road surface;
- manufacturing lighter vehicles; and
- by developing new methods of propulsion.

However, these need to be weighed against other vehicle improvements such as vehicle safety (which can increase vehicle weight), environmental characteristics (a catalytic converter increases fuel consumption) or comfort demanded by the customer (car air-conditioning systems consume energy).

In addition, motor vehicles are consumer products, unlike aeroplanes or high-speed trains of which only a few are manufactured and the number of people involved relatively small. Price is a major issue: will a consumer pay for a feature which he or she perceives as unnecessary?

Back to contents

2. Traffic flow

Vehicles travelling at constant speed use less fuel than vehicles caught in traffic jams, so improving traffic flow will lower fuel consumption. This can be achieved by:

- building new or upgrading existing infrastructure
- improving road markings and
- installing information systems.

Back to contents

3. Driver training

Educating and training drivers in economy driving skills can also help reduce overall fuel consumption, as can providing drivers with advance information on traffic congestion. *(See also page 18)*

Back to contents

X. Transport policy

Given public perception of road traffic's massive contribution to the "greenhouse" effect, decision-makers, backed by a number of interest groups, have come up with a variety of policies aimed at restricting the use of road vehicles.

Back to contents

1. Taxation

Policy-makers frequently view hikes in fuel taxes as the means of getting people to abandon their road vehicles.

In some countries where fuel is heavily taxed, fuel prices may influence choice of vehicle, people opting for more fuel efficient models. But in such countries, it would need a truly enormous tax hike for motorists to react.

Some countries levy taxes on motor vehicles based on fuel consumption. The tax is charged either at purchase or on-the-road. Fairness demands a constant reference tax level, with equitable distribution of tax between high paying motorists and those paying less. And, since fuel taxes are already high, the motorist is well aware of fuel consumption costs.

In addition, following the "fuel consumption" tax to its logical conclusion, should other factors such as "safety" and "pollution" also be calculated into vehicle taxation; and, if they are, how is the relative importance of each factor to be measured and reflected in tax rates?

In the end, customers define their own priorities: purchase price and running costs are just two criteria in determining choice of vehicle.

Back to contents

Conclusions

- People use cars and companies use trucks because they have qualities which, regardless of cost, other modes of transport lack: flexibility, rapidity, reliability and quality of service.
- Transport is a key factor in the efficient running of an economy and also a substantial proportion of company expenditure (about 15%). Increasing road transport costs would only result in damage to the economy.
- High motoring taxes would benefit the entire transport system only if the tax revenues are directed towards improving the road network and installing intelligent transport systems.

Back to contents

2. Regulation

The United States has already implemented the CAFE fuel consumption standard (Corporate Average Fuel Economy). CAFE has two major disadvantages. First, it exists as a rigid factor in a free market which discriminates against manufacturers specialising in luxury vehicles. Second, regulation often fails to anticipate technical development.

Conclusion

The most effective way of improving vehicle performance is through customer demand and technical progress, not through laws and regulations.

Back to contents

3. Encouraging users to switch transport modes

Some modes of transport, such as underground, suburban or long distance trail, and bus are claimed to be more energy-efficient.

In some cases this may be true. However, a bus or locomotive diesel engine running in a rural area transporting no or few passengers or buses travelling during low-peak periods consume far more energy per head than many cars.

A German parliamentary study shows that equivalent fuel consumption for a locomotive is 4.9 litres per 100 passenger/km against 4.7 litres per passenger/km for a car.

A study by the Niels Bohr Institute (Denmark, 1995) compared the fuel consumption of different transport modes in Denmark. Table VI shows the energy consumption differential of the different modes of transport, less perhaps than most people imagine. In Denmark, for instance, Table VI shows it is more cost-effective to build bridges and tunnels to ease traffic flow than to keep ferries running. In fact, the long-distance bus (coach) consumes the least energy.

Table VI: Fuel consumption of transport modes

MJ/passenger X km	
Motor car	1.4
Coach	0.5
Bus	1.5
Metro	1.2
Other rail transport	1.0
Air transport	2.2
Ferry	6.4

Policies to encourage users to switch transport modes often ignore the fact that, in most cases, a switch is not possible. In urban areas, the trips which are most on the increase are those made outside the city centre and between suburbs. For these trips, public transport, generally designed to connect suburbs to the city centre and not suburb to suburb, is not an option.

Similarly, most freight is transported over short distances. Rail, efficient only over long distances, fails to offer a credible alternative to road, especially since railway networks are less dense than road networks. Freight has to be transported by road before it is loaded on rail and after it is unloaded, which wastes times and increases costs.

Finally, road has such a massive share of the transport market that a switch to rail is not feasible due to lack of rail capacity.

Back to contents

Conclusions

- To mitigate the “greenhouse” effect, it is more cost-effective to concentrate resources on upgrading the energy performance of the entire road system.

- Policies aimed at switching transport modes would have only a minimal effect.
- The road's success is due to its quality of service and great flexibility. Using the greenhouse effect as an argument against road use is counter productive and potentially damaging to the economy.

Back to contents

4. Reducing road traffic

Other policy ideas seek to place arbitrary limits on road traffic, arguing that road traffic is always on the increase, that it is damaging to the environment and unnecessary in industrialised societies.

This kind of policy, in the IRF's view, is based on two false assumptions: first, that some journey's are unnecessary, and second, that the number of kilometres travelled is on the increase.

Transport has always played a crucial role in human development, both as a means of encouraging exchanges between peoples and promoting commerce and trade. Mass land transport of goods and people became possible in the 19th Century with the arrival of the railway. Today, transport focus has changed. It is more and more based on solutions tailored to individual person or company needs. Just-in-time delivery, a great consumer of transport, has helped raise industrial productivity.

Table VII: Average kilometres travelled per year (passenger cars)

	1970	1980	1990
United States	16,530	14,700	16,970
Germany	16,500	13,200	14,500
Japan	17,793	11,208	10,401

Source: AAMA, JAMA, VDA

On the other hand, while the number of journeys has increased over the years, the number of kilometres travelled has actually diminished *(see Table VII)*. Supply companies are now moving closer to their client companies.

It is also inaccurate to assume that journeys will go on increasing. In most industrialised countries, vehicle ownership is almost at saturation point and people have reached their satisfaction level as far as number of journeys are concerned.

Travel consumption thus follows the development pattern of other forms of consumption such as food and health products, i.e. a period of heavy consumption – the "catching up" phase – followed by a period of stable consumption.

Back to contents

Conclusions

- Policies to reduce traffic are based more on political ideology than on factual reality;
- For passenger trips, shorter working hours and more leisure time mean more visits to friends and family, cultural trips and away breaks. Can these be considered as useless trips? People are not "prisoners" of their cars. They have simply made the choice about the kind of life they want (house, garden, pleasant environment away from it all), all made possible by the car.

Back to contents

XI. Policies that work

Back to contents

1. Developing fuel efficient vehicles

Developing fuel efficient vehicles is the most effective way of reducing "greenhouse" gas emissions from road traffic. Fuel price may influence both which model customers choose and their driving behaviour. Industry should be trusted to respond to market demand for fuel-efficient vehicles.

Well-known technical and design parameters of fuel-efficient vehicles include:

- vehicle aerodynamics *(see Table VIII)*;
- weight reduction;
- improved petrol and diesel engines;
- electronics to optimise engine output;
- better gear boxes,

and so on.

Less well-known parameters are new types of engines, such as electric, hybrid (with petrol or diesel) and hydrogen engines. In the long run, a revolution in engine technology could lead to the development of fuel cell operated vehicles, although in the short to medium term engine design will continue to be based on petrol and diesel.

Back to contents

2. Better tyre technology

Tyre manufacturers have developed new generations of low-resistance tyres that reduce energy consumption without jeopardizing performance. These tyres have equal levels of adherence to the road surface, so there is no compromise on safety, and are just as durable, so lead to no increase in consumption of raw materials.

If these new tyres were fitted to all road vehicles currently in use, not just new generations of vehicles, it would help speed up the process of reducing carbon gas emissions.

Table VIII: Resistance at 100 km/h

	Car	Truck
Air	65%	50%
Internal friction (e.g. transmission)	15%	10%
Tyres	20%	40%

Source: Michelin

Tyre manufacturing is energy intensive: some 200 different raw materials go into a tyre before the vulcanization process. A single tyre's total energy content is equivalent to 27 litres of oil (21 litres in raw material, 6 litres in the manufacturing process).

In the future, economies of energy in tyre manufacture can be made by:

- simplifying the manufacturing process: over the last 20 years, technology has helped reduce energy required to manufacture a tyre by 30%;
- reducing the weight of a tyre: radial and tubeless tyre technology has already made a major contribution to reducing the weight. Manufacturers envisage further reductions in the weight of tyres for heavy trucks.

Back to contents

3. Vehicle maintenance

To achieve real environmental objectives, attention should focus on all motor vehicles, not just new vehicles. Features such as on board diagnostics systems can monitor engine output, while regular technical inspection reveals if vehicles are well-maintained and operating under optimal conditions.

Back to contents

4. Vehicle fleet renewal

It takes about ten years for the national vehicle fleet to be renewed. Providing incentives to replace old gas-guzzling vehicles with newer, fuel-efficient models, for instance payouts to scrap old vehicles, would speed up the process of fleet renewal and help reduce carbon gas emissions.

Back to contents

5. Motor fuels

Oil companies are improving their petrol and diesel products, such as lowering sulphur content, to increase fuel efficiency, comply the new environmental regulations and respond to new developments in engine technology.

Alternative fuels such as natural gas produce lower CO_2 emissions.

On the other hand, some experts thinks that plant-based fuels may not provide the answer to CO_2 emissions because of their negative overall energy and environmental performance from cultivation to final use *(but see also under item 7)*.

Back to contents

6. The road network

Motor vehicles achieve optimal performance where traffic flow is most fluid. Ways of improving traffic fluidity, reducing congestion and hence lowering fuel consumption are:

- Building new road infrastructure where necessary;
- improving current infrastructure;
- installing road signs providing both directions and information on the road network to allow motorists to choose the best route.

In the United States, for example, Intelligent Transport Systems (ITS) are being installed in 75 of the largest urban areas, an investment that should help reduce journey times by 15%.

Back to contents

7. Other action

- CO_2 concentrations in the earth's atmosphere can be reduced by creating CO_2 wells. These are areas of forest which absorb the carbon gas. For example, in 1998 PSA Peugeot Citroën, a French automobile manufacturer, announced that a CO_2 well covering 12,000 hectares had been planted in the Brazilian rain forest.
- A similar initiative, launched by Formula 1 Grand Prix organisers, involves a reforestation programme in the Chiapas region of Mexico.
- A Spanish initiative, Gasarbol, has shown that 3.1 tonnes of CO_2 might be absorbed for every hectare reforested.

Back to contents

- In 1998, Toyota, a Japanese motor vehicle manufacturer, set up a company in Australia which will plant 5,000 hectares of eucalyptus trees each year over a period of ten years. In the eleventh year, the company will harvest the trees and process them into raw materials for paper. The environmental advantage of eucalyptus trees is that they grow very quickly and are said to be at their most efficient in absorbing CO_2 during their first thirteen or fourteen years of growth. One hectare of eucalyptus can absorb and solidify five to six tonnes of CO_2 per year. 5,000 hectares should absorb between 25,000 and 30,000 tonnes annually.
- The ecosystem of rubber plantations can absorb massive quantities of carbonic gas. The tyre industry consumes about 70% of natural rubber production and using natural rubber in the manufacture of tyres, for example, would help reduce concentrations of CO_2 in the earth's atmosphere, thereby providing support to measures taken to limit "greenhouse" gas emissions.
- Plant-based materials could replace plastic or metal in some vehicle parts.
- Plant resources might be used both for absorbing CO_2 and for manufacturing fuels, and thereby contribute to reducing CO_2 concentrations. Sugar cane alcohol, for instance, is used as fuel in Brazil.

Back to contents

8. Additional information

Table IX gives estimates of the relative impact various measures have on reducing *CO_2* emissions

Table IX: Potential of different road features for reducing CO_2 emissions (in % - different percentages cannot be combined)

Enlarging the road network	40
Replacing crossroads with bridges	30
Building bypasses	25
Eliminating level crossings	13.5
Pre-selection at traffic lights	15
Traffic flow management	30
Synchronised traffic lights	40
Traffic jam reduction	22
Management of urban traffic	40
Management of extra-urban traffic	30
Management of traffic on motorways	20

Source: VDA, IW Cologne

Back to contents

XII. Other policies

While some transport policies, such as regulation or taxation, do not always achieve their stated aims, positive outcomes might be achieved by other government initiatives. Some are suggested here:

Back to contents

1. Public/private research initiatives

On the contrary, they could provide support for private-sector initiatives, such as:

- Joint research
  - to improve understanding of the greenhouse effect, its true extent, the mechanisms by which it operates, and its effects, so as to achieve a better perspective of the kind of measures to take.
  - to support industrial technical research in non-competitive areas, in particular basic research on fuels, engines, combustion phenomena, etc.
  - to encourage experiments in “intelligent” transport management.
- Encourage the development of new types of vehicles such as electric, hybrid or fuel cell propulsion.

Back to contents

2. Policy decisions

- Avoid sudden changes in taxation: in some countries, lower taxes on diesel fuel and the added advantage of greater fuel efficiency have led a significant proportion of consumers to opt for diesel-powered automobiles. Manufacturers have therefore invested heavily in reducing the environmental impact of diesel engines. Sudden changes in taxation, for example raising the taxes on diesel to the same level as those on petrol, would be counterproductive. They might have the effect of modifying market trends, leaving manufacturers uncertain where best to invest environmental research and development budgets.
- Earmark all new motor vehicle tax revenues to the underfunded road transport system to finance infrastructure development. This will not only help keep pollution down through greater traffic fluidity, but also improve road safety.
- Provide incentives to replace old gas guzzling with new more fuel-efficient vehicles with lower CO_2 emissions.
- Promote use of road traffic information systems to allow motorists to choose the best route.
- Monitor vehicle maintenance.
- Train motorists to drive economically from the moment they learn to drive, and thereafter through regular information campaigns.
- Develop and maintain the road network so that energy is no longer wasted in traffic jams.
- Renew road surfaces to diminish tyre friction.
- Encourage competition between transport modes, in particular between road and rail. This would lead to a true revolution in efficiency, customer service and management. Any partial transfer to rail would be due to rational decision-making - e.g. better service and cost efficiency, lower environmental impact - rather than political ideology. Fair competition would also spur the transport sector, including road, into making further efforts to improve performance.

Back to contents

Layout: Christopher Simpson - Cover Design: HEMISPHERE Geneva