





Climate change as a result of human activity is probably the greatest challenge facing society in the twenty-first century and we, the worldwide motor vehicle manufacturers want to be part of the solution.

This paper describes our current and potential contributions and puts them into context. It is very important to have a clear picture of what can be done, by whom and with what impact on society as a whole, in order to take informed decisions and develop the best strategy for all.

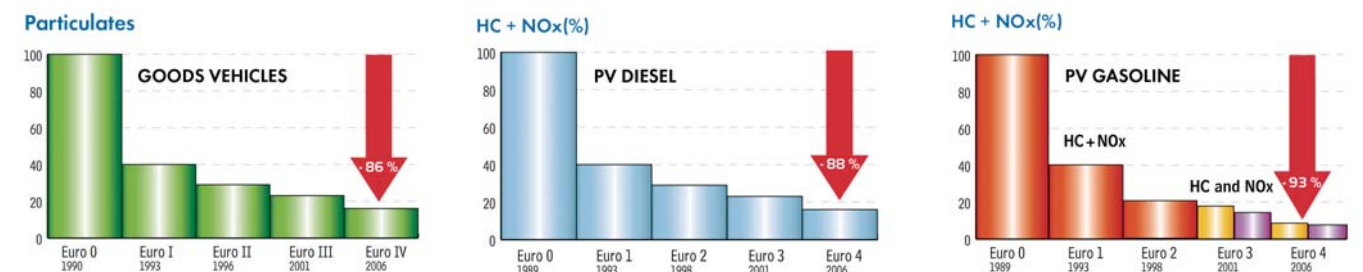
What is CO₂?

Carbon dioxide (CO₂) is not a pollutant in the sense of being harmful to humans, in fact it is a natural component of our atmosphere.

Humans and animals breathe out CO₂, and it is produced when any carbon-based fuel burns. This, of course, includes the normal automobile fuels – gasoline and diesel, which are made up mostly of Carbon and Hydrogen. It also includes almost every other fuel and especially coal, which is very high in carbon content.



Vehicle manufacturers have already reduced pollutant emissions to a tiny fraction of the levels in the 1970s, by radical improvements in fuel combustion and by after-treatment devices like catalytic converters.



Now, increasingly, attention is turning to CO₂.

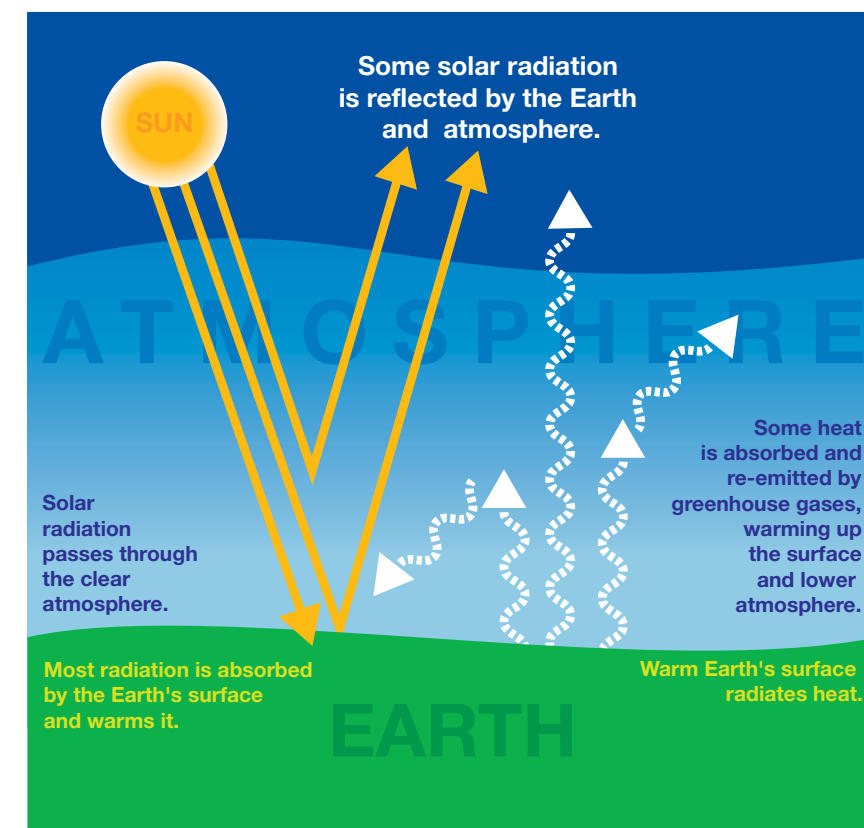
Because burning carbon-based fuel creates CO₂, the only ways to reduce it are to use less fuel or to use alternative fuels containing less, or no, carbon, or which are renewable. With renewable fuels, the CO₂ generated when driving is offset by absorption of atmospheric CO₂, for instance during growth of plants used to make biofuels.

There is no aftertreatment, like a catalytic converter that can be attached to a vehicle to filter out CO₂.

...a natural component of our atmosphere

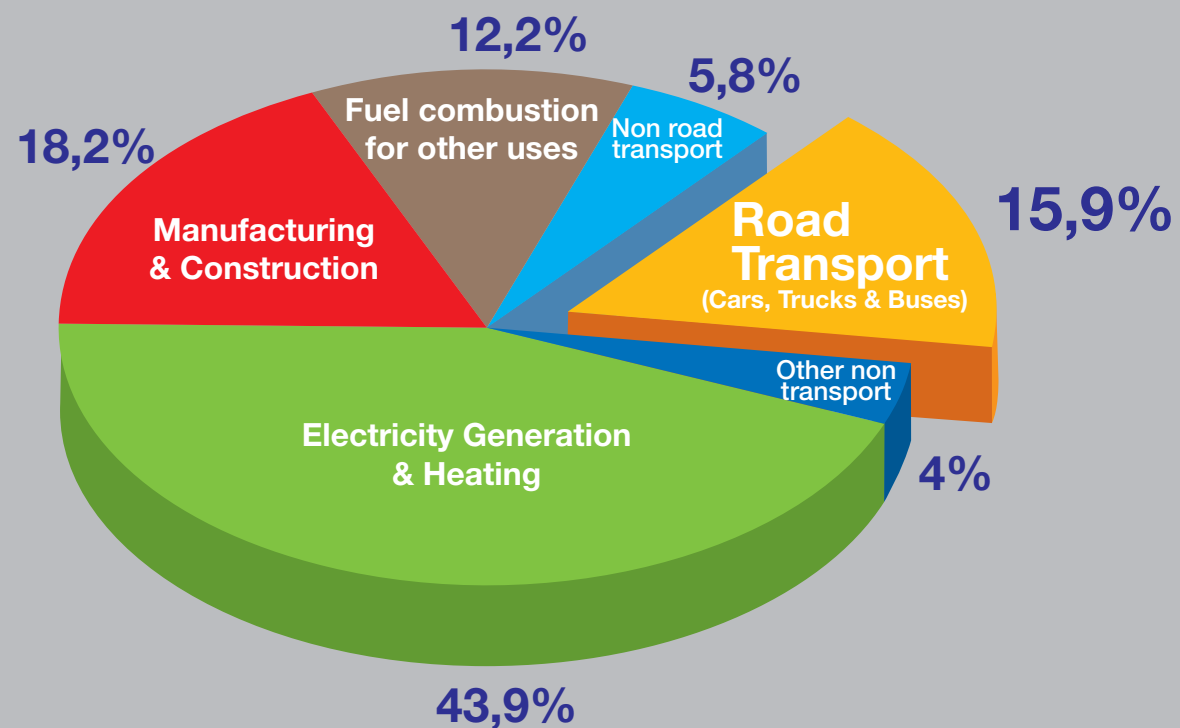
What is the problem with CO₂?

CO₂ is associated with climate change. It is widely agreed that raised levels of CO₂ due mainly to human activity, are contributing to the so-called "greenhouse effect" raising global temperatures and affecting climate. CO₂ is not the only gas that has this effect, there are other "Greenhouse Gases", but it's by far the one most associated with our products so we'll concentrate on that.



Man-made emissions of CO₂ represent less than 5% of the total, including CO₂ emissions from natural sources, but even this relatively small increase can shift the Earth's natural balance. That is why we believe it is important to continue to reduce CO₂ emissions from all sources, including those resulting from burning fuel in automobiles.

How much CO₂ comes from automobiles ?



World Resources Institute, Climate Analysis Indicators Tool



SHARE OF ROAD TRANSPORT

Estimates vary, but we can say that up to about 16% of global man-made CO₂ emissions come from motor vehicles. (about 13% of total Greenhouse Gas).

Automobiles are by no means the biggest CO₂ contributor, but they are a significant factor. As more and more people in emerging countries demand more and better mobility, the number of vehicles in the world is set to rise, offsetting progress already made in reducing fuel consumption of new vehicles. The International Energy Agency forecasts the increase in CO₂ emissions from traffic worldwide keeping pace with average increases from other sectors, so although the overall problem is set to get bigger, the road transport share should stay about the same.



Looking at the big picture then, including all sectors (energy generation, manufacturing, etc.) dealing with this problem is going to have a real economic effect on the whole of society. It is therefore essential to find the measures that will deliver the biggest CO₂ reductions for the lowest cost to society, and concentrate first on those.

This doesn't mean that the auto industry minimises its role. What it does mean is that, in view of the relatively low contribution of vehicles to CO₂, we cannot solve the problem alone. The most cost efficient approach must be used **across all sectors** if society is to effectively meet the challenge of climate change.

It's worth noting that the Stern Review, the UK government's 2006 study on "the economics of Climate Change", indicated that addressing vehicle technology measures alone is the least cost-effective way to reduce road transport CO₂ emissions

In October 2007, vehicle manufacturer CEOs from around the globe met in Tokyo to discuss climate change, and they said "these issues must be addressed on the basis of an integrated approach, involving not only automakers but also government, the energy industry, and vehicle users."



All around the globe, the automobile is indicative of an improved quality of life. The mobility provided by automobiles expands the possibilities for employment, education and health care, as well as social and leisure activities. For automakers, one critical priority is to sustain the benefits that autos provide, while keeping them affordable, preserving the diversity of automobiles and reducing their environmental impact. Automakers accept this responsibility, but there are many factors and challenges to be addressed.

WHAT ARE WE DOING ?

Vehicle manufacturers are already taking action to make sure we're part of the solution:

Leaders in Research and Development

Vehicle manufacturers rank among the highest R&D-performing companies in the world. In fact, 12 auto companies rank among the top 50 companies investing the most in R&D, according to the European Union's 2006 R&D Investment Scoreboard.

http://iri.jrc.es/research/scoreboard_2006.htm .

The industry spends 85 billion € per year on R&D to help build safer, cleaner and more fuel-efficient automobiles, with the majority dedicated to environmental improvement.



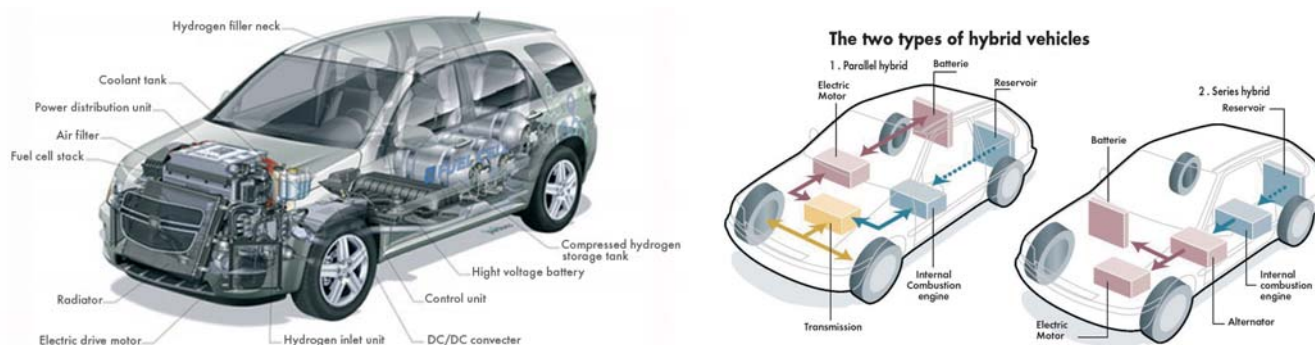
More vehicles for sale that are CO₂-efficient, because they use less fuel.

Billions of Euros are invested annually in refining and improving conventional petroleum-burning engines, making them more efficient by managing the process of combustion through improvements like electronic control of fuel injection, air flow and valve timing.

Vehicle energy consumption is being cut using a wide variety of improvements from lightweight and low friction materials, through optimised manual and automatic transmissions, stop-start control and regenerative braking to electric power-steering and low-energy lighting. Increasing the share of clean diesel cars can further improve the fleet's fuel efficiency. Today, in the European Union alone, more than a million vehicles emitting less than 120 grammes of CO₂ per kilometre (the European Union's very ambitious target for the fleet average) are sold every year and the endeavour continues to drive down CO₂ even further.

New approaches to reduce fuel use, and to use new fuels and technologies.

Huge resources are expended annually developing diverse CO₂-efficient vehicles that run on alternative fuels like bio-diesel, ethanol, hydrogen and natural gas or that use electric or hybrid vehicle technology. There is no one single technology that is the answer. We are pursuing multiple technologies because no one can predict future winners and losers in the marketplace.



WHAT ARE THE CHALLENGES ?

To be effective in the push to reduce CO₂, industry must face a number of challenges:

Long "lead times" are necessary in the production of automobiles.

Typically, 5-7 years are needed to design, test, build and introduce new models, especially with new power units which need extensive development and testing, government certification and very complex automated production tools. Proposed CO₂ reduction programs must recognize this lengthy process. Any policy that is implemented without allowing sufficient time can adversely affect manufacturers, their suppliers, their employees, and consumers.

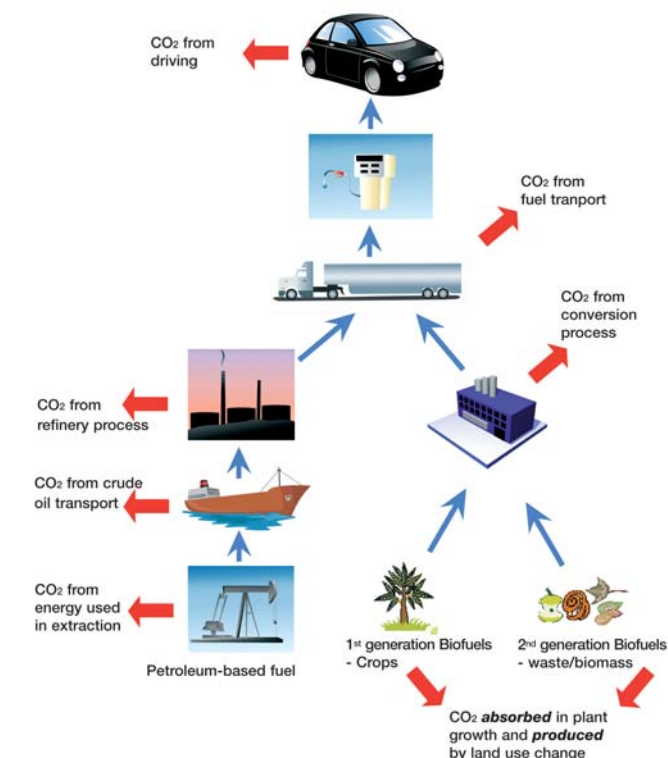
New fuels need infrastructure support.

Before manufacturers can commit to the massive investment necessary to prepare vehicles to use new fuels, they must be sure that they can sell them – so the wide and easy availability of suitable fuel, at a viable price level and meeting clearly defined quality standards, must be guaranteed in advance.



New fuels must be truly sustainable.

Biofuels represent an attractive new resource that can reduce CO₂ emissions as well as improving energy security by reducing reliance on imports from the traditional oil-producing regions. However biofuels made from crops can only be considered truly "sustainable" if their production can be certified as not threatening food, water supply, or the environment, if they can become economically competitive with oil-based fuels and if they can be shown to produce lower CO₂ when compared with fossil fuels on the same "well-to-wheels" basis – considering the CO₂ effect of the agricultural cycle (including change of land use), fuel production, fossil fuel substitution and use in vehicles.



Consumers buy vehicles to meet their needs, and their needs vary.

Consumers are in the driver's seat when it comes to determining what vehicles will be on our roads and their preferences vary by region. In some regions, sport utility vehicles, vans and pickup trucks are very popular. In other regions, tendencies are towards smaller and more fuel efficient vehicles, due to space restrictions and higher fuel prices.

Vehicles must be affordable to consumers.

Affordability must be addressed while reducing CO₂. The automotive industry introduces vehicles when the technology is ready for market, and can meet consumer expectations and needs, and when the vehicles are affordable to consumers. If consumers can't afford to buy new vehicles they will keep their old ones – and that will not help the environment.

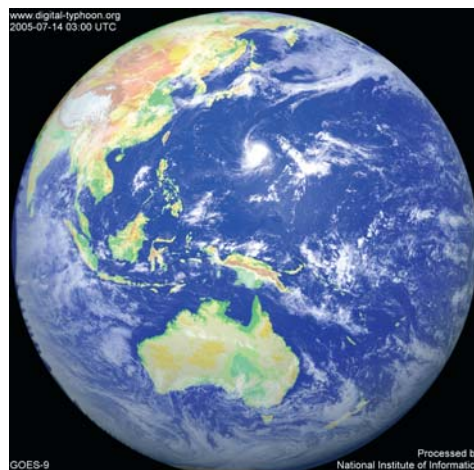
A stable, predictable political and fiscal environment is necessary.

Quickly changing policies can create conflicts with other requirements of the vehicle, such as safety. An automobile is a complex machine with more than 3,000 parts. A model undergoes years of development and testing before reaching the market. No one can predict the future, or the markets, or technology breakthroughs, but automakers need as much predictability as possible to plan years in advance. Government activities should leave manufacturers as much freedom as possible on how to deliver further CO₂ cuts thus not restricting measures adopted to certain technologies or fields of technology.

Worldwide action is necessary.

Climate change is a global issue, demanding global approaches. For example, carbon taxation has been discussed around the world. Clearly tax policies should be designed to suit the needs of different countries and the fuels or technology available in different parts of the world. Nevertheless, they should be compatible with one another, allowing global manufacturers to respond in a coordinated way.

Tax policies should take into account that every gram of CO₂ saved is worth the same.



WHAT CAN BE DONE BY OTHERS ?

Research and Development

Governments can play an important role in advancing research and development of even more advanced vehicle technologies, such as advanced battery technology, plug-in batteries, fuel cells and the hydrogen infrastructure.

Research on Alternative Fuels

More research is necessary to advance knowledge and commercialization, leading to more sustainable "second generation" biofuels from waste material and biomass. Second generation biofuels, such as cellulosic ethanol, "Biomass To Liquid" (BTL) and renewable diesel, may reduce CO₂ emissions by up to 90% compared to conventional fuels, and have improved compatibility with existing vehicles and the fuel delivery infrastructure compared to first generation biofuels.



Policies to Encourage Alternative Fuels

Appropriate government policies are needed to drive the development and availability of clean, affordable low carbon fuels. Government can support research, provide evaluations and adopt fuel quality standards that can help ensure the success of fuels that are new to consumers. Government involvement is necessary to make sure appropriate standards are enforceable within a jurisdiction. If good fuel quality cannot be assured, vehicles could perform poorly or become damaged, and this would lead to increased vehicle emissions as well as consumer rejection of the fuel and its vehicle technology. Carefully targeted government incentives should be provided to drive the penetration of clean and sustainable alternative fuels in the market.

Fuels Infrastructure Development

Government must play a leadership role guiding and encouraging the development of the necessary infrastructure for fuels, including diesel (where limited diesel infrastructure exists), biofuel, natural gas and hydrogen.



Incentives for Fleet Renewal

Government incentive measures to promote purchase of fuel-efficient vehicles, and/or scrapping of old vehicles, can accelerate fleet renewal and help put newer, more fuel-efficient cars on the road to replace old vehicles that produce more CO₂.

Congestion Mitigation

In the USA it is estimated that relieving the country's worst 233 traffic bottlenecks would save more than 40 billion gallons of fuel over the next 20 years and reduce CO₂ emissions by nearly 400 million (metric) tonnes.

The Japanese government estimates that 28.3 million tonnes of CO₂ will be reduced by 2010 through improved traffic management in Japan.

Test drives in the Stuttgart area of Germany have shown that a car's fuel consumption can be 60% higher with congestion compared to driving the same route when there is free flow.



Consumer Eco-driving

All these efforts will only work if consumers are engaged, practicing eco-driving. It is widely recognised that eco-driving is one of the most cost-effective measures for CO₂ reduction, making an immediate improvement with both old and new vehicles. Promotion of eco-driving should be part of all CO₂-reduction strategies. Vehicle manufacturers already contribute to this by offering eco-driving training courses.

The November 2007 IEA/ITF Workshop on Ecodriving concluded that "ecodriving has significant potential to deliver CO₂ reductions quickly and often relatively cheaply.there is a saving potential of 10% of surface transport sector emissions."

Golden Rules of ecodriving (from www.ecodrive.org)

- | | |
|---------------------------------------|--|
| 1. Shift up as soon as possible | - Shift up between 2.000 and 2.500 revolutions. |
| 2. Maintain a steady speed | - Use the highest gear possible and drive with low engine RPM |
| 3. Anticipate traffic flow | - Look ahead as far as possible and anticipate other traffic |
| 4. Decelerate Smoothly | - When you have to slow down or to stop, decelerate smoothly by releasing the accelerator in time, leaving the car in gear |
| 5. Check the tyre pressure frequently | - 25% too low tyre pressure increases rolling resistance by 10% and fuel consumption by 2% |

CONCLUSIONS

Motor Vehicle Manufacturers want to be part of the solution, but we cannot provide the whole solution.

The only viable way forward is an intelligent, coherent and pragmatic integrated approach. It must cover all aspects, not only vehicle technologies, but also fuels, the fuel infrastructure, improved roads and traffic management and, importantly, consumers who ultimately hold the key, through their purchasing decisions and the way they use their vehicles.

To be effective, policies must involve all stakeholders, including energy suppliers, the research and development community, the financial investment community, government at all levels, and especially consumers.

Prudent policy must address availability of diverse fuels, development of fuel infrastructures, and consumer usage, as well as automobile technology.

Automakers are ready to continue to outperform other sectors of the world economy in terms of fuel efficiency, but we need the contributions of the other stakeholders to make it work. It should be recognized that the auto industry, besides fulfilling the need for efficient and affordable mobility, is also one of the main drivers of the economy in many nations around the globe. Any government measures affecting the auto industry should be well balanced and take into account all the aspects of the issues at stake, including of course the sustainability and competitiveness of the auto industry.



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