Reduction of carbon dioxide emissions in the automobile industry

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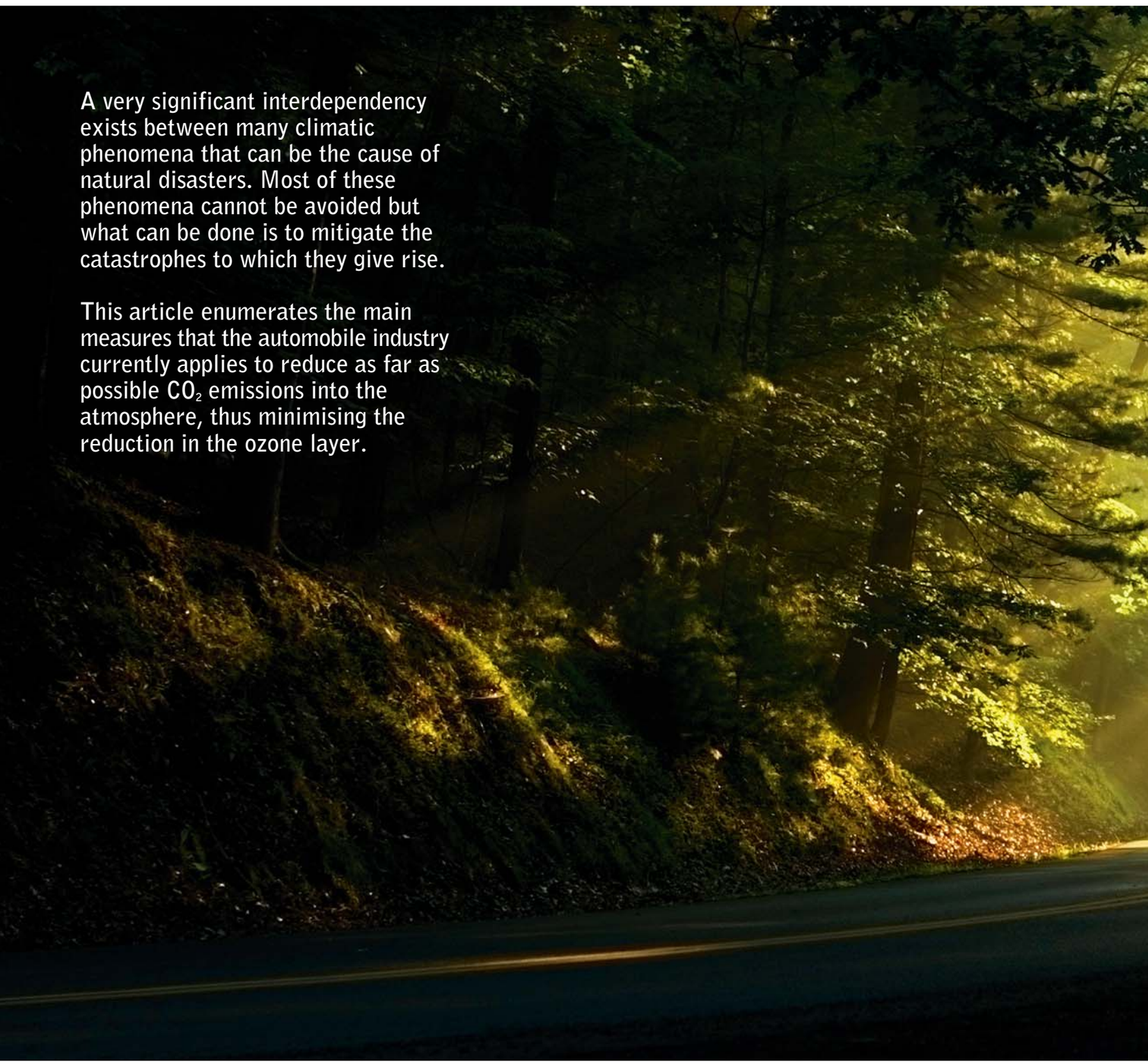


A very significant interdependency exists between many climatic phenomena that can be the cause of natural disasters. Most of these phenomena cannot be avoided but what can be done is to mitigate the catastrophes to which they give rise.

This article enumerates the main measures that the automobile industry currently applies to reduce as far as possible CO_2 emissions into the atmosphere, thus minimising the reduction in the ozone layer.

Introduction

The climate is mainly governed by short wave length radiation coming from the Sun, which is the only significant source of energy. This energy is partially captured by Earth's surface and partly reflected outwards by the atmospheric components or the surface.

To establish energy balance the Earth must emit the same amount of energy as it absorbs from the Sun. Thus although the atmosphere is to a large degree transparent to -it does not absorb- solar radiation, nonetheless the radiation emitted into space by the Earth's surface is long wave, which is indeed absorbed and emitted in turn by the atmospheric components.

This phenomenon, called the natural greenhouse effect, gives rise to heating of the atmosphere's lower layers, commonly known as greenhouse effect gases. These are natural components of the atmosphere. This greenhouse effect is a natural phenomenon and thanks to it life on Earth as we know it today is possible.

Scientists recognise three processes as the main causes of changes in the energy balance that is established in the climatic system:

- Changes in the energy source -the Sun-.
- Variations in the Earth's surface's response (deforestation, changes in the use of land, changes in the extension of the snow cover).
- Alternatives in the atmosphere's radiation characteristics.

Any one of these processes, by itself or jointly causes a change in the radiation balance.

The problem of detecting the changes arises because the climate's natural variability is

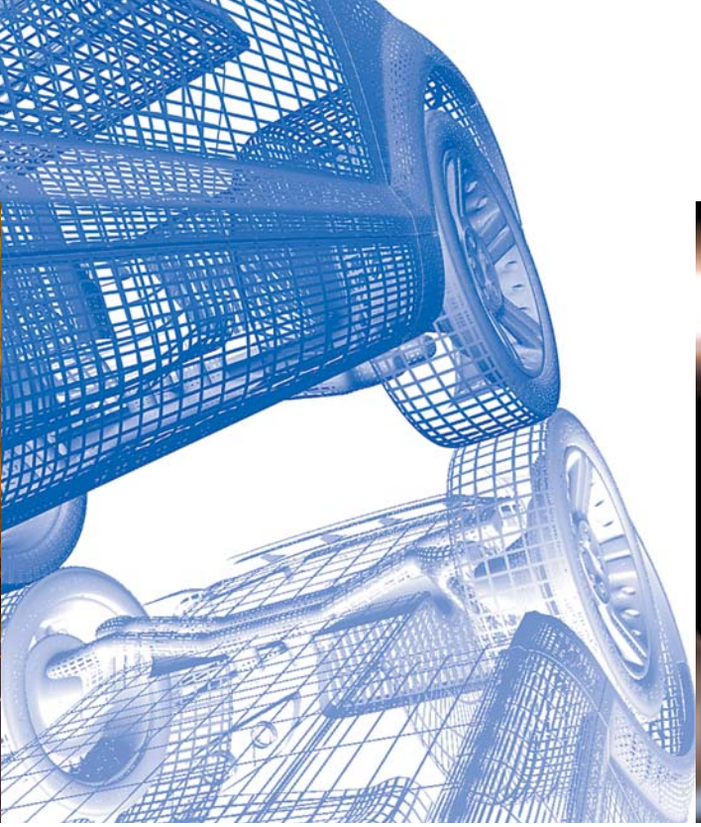
superimposed to it, which partially masks detection.

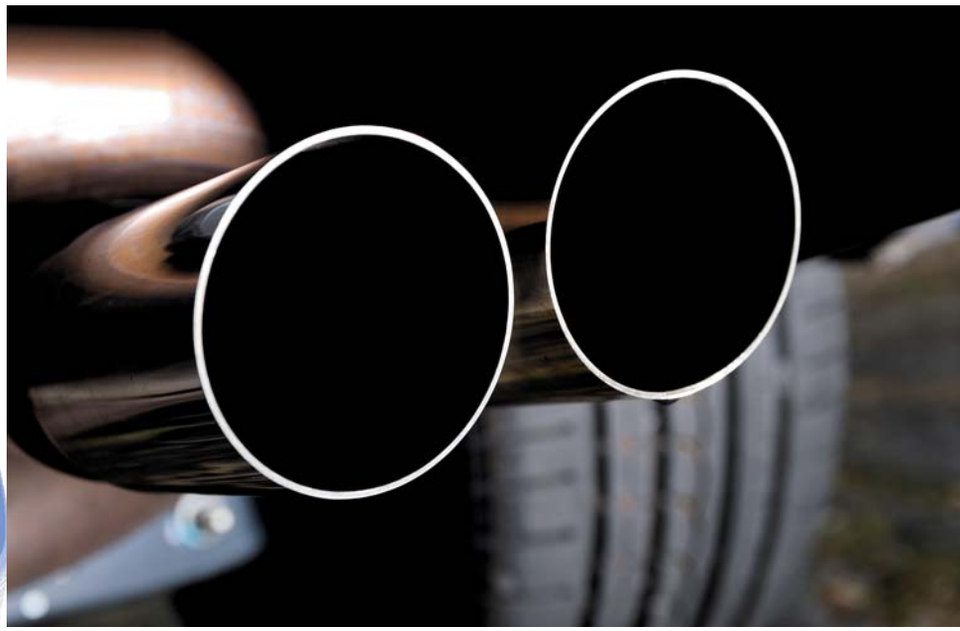
The Intergovernmental Panel on Climate Change (IPCC) confirms in its Assessment Report III that throughout the last century the average global temperature at the surface has increased, attributing this for the first time to human activities.

The changes in the climate derived from human activity are due to intensification of the natural greenhouse effect, when the atmospheric concentration of radioactively active gases increases and gives rise to what is known as radiative forcing.

If we focus on analysing CO_2, the gas with most influence in the causes of climatic change, we find that one molecule of this gas –once emitted– remains in the atmosphere for an average term of four years before being captured by a reservoir, although the Earth overall needs more than a hundred years to adapt itself in the changes in its emissions and stabilise the atmospheric concentration again. Consequently if as of today one could achieve worldwide stabilisation of CO_2 emissions, their atmospheric concentration would continue to increase throughout almost two centuries.

The international response to the challenge of climate change is materialised in two judicial instruments, the United Nations Framework Convention on Climate Change and the Kyoto Protocol, which develops and endows Convention's generic prescriptions with concrete contents. The ultimate objective of the Protocol is to achieve stabilisation of the atmospheric concentration of greenhouse





effect gases with the aim of preventing dangerous man made disturbances of the climatic system. The Kyoto Protocol -adopted in 1997- establishes for the first time, targets for reducing the net emissions of these gases for the developed countries or those with economies in a state of transition.

In the automobile industry the gas most monitored of those governed by the Kyoto Protocol is CO_2. This is because internal combustion engines produce this gas.

Fundamental measures adopted by the automobile industry to reduce CO_2

Ecological driving

In Spain the transport sector is the one with the highest consumption, totalling 42% of the final energy consumed in the country. Moreover this sector is responsible for more than 60 % of oil consumption and 30% of the total CO_2. This explains the importance of adopting a cheap, ecological and safe driving style.

Over recent years the enormous progress in vehicle technology has not been accompanied by the corresponding evolution in the way of driving. Consequently as of today there is a major imbalance between both aspects.

In Spain the IDAE (Instituto para la Diversificación y el Ahorro de la Energía) (Institute for Energy Diversification and Saving) is currently implementing and promoting efficient driving techniques of private cars through two routes:

- In collaboration with the DGT (Dirección General de Tráfico) (General Directorate of Traffic) and driving schools associations.
- Training courses and programmes in collaboration with motoring clubs, hauliers associations, insurance companies and driving schools associations.

Efficient driving is a new driving style based on a series of new and simple techniques whose application (in injection vehicles) entails:

1. Fuel savings in the region of 15%.
2. Reduction of environmental contamination.
3. Reduction of acoustic contamination.
4. More comfortable travel.
5. Savings in maintenance costs.
6. Increased driving safety.

All this is achieved without increasing travelling time.

Sustainable vehicles

The current solutions for the environment in the field of mobility are materialised in three basic technologies that meet the need to reduce emissions into the atmosphere from terrestrial transport.

▶ Hybrid vehicles

These vehicles incorporate two engines that combine fossil fuel and electricity. These constitute one of the innovations of transition towards truly sustainable vehicles.

This is an ingenious proposal for people who want all the performance of a high range vehicle and to minimise consumption and contamination.

▶ Electric vehicles

In electric vehicles the fuel consists of electricity stored in the form of chemical energy in batteries. They do not release emissions and have high performance, although their autonomy is limited. For this reason their main design is aimed at urban vehicles and the majority of designs have reduced capacity.

▶ Hydrogen vehicles

The essence of the hydrogen vehicle is the fuel pile that extracts hydrogen's electrons to convert them into electricity. Currently the fuel piles have achieved good levels of efficiency and compactness, achieving modern driving speeds.

▶ Other technologies: compressed air vehicles

This type of vehicle, currently in a very advanced stage of development functions with an engine whose fuel is compressed air stored in tanks that it carries.

The energetic power of compressed air is in quadratic proportion to the pressure, and therefore any increase in power and autonomy

demands an aerodynamic design, minimum weight and high performance on the road.

The driving force is obtained from the expansion of compressed air fed into a closed chamber (the cylinder) that drives the pistons that create the motor's stroke.

Alternative fuel engines

In addition to electric, hydrogen and compressed air combustion engines, others exist that allow alternative fuels such as ethanol, biodiesel or natural gas.

These cannot really be seen as non-contaminating vehicles with zero emissions, particularly those that work with biofuel made from vegetal materials, but we ought to consider them as sustainable vehicles. Some manufacturers have adapted models to allow them to work with ethanol and biodiesel. In Germany Elsbett modifies diesel engines so that they can work with any vegetal oil.

Vehicle weight reduction

As we all know the energy required for an automobile of mass "m" to reach a speed S (km/h) is:

$$E = 0.5 * m * S^2$$

If we imagine that we do not want to dispense with travelling at a certain speed, the only way that exists of reducing energy requirement and thereby energy consumption is to make the mass "m" of the vehicle as small as possible.

Various manufacturing methodologies are applied to make vehicles' bodywork ever lighter: new types of welding and ever thinner panels for example.

Another possibility is the use of ever lighter materials (essentially fibreglass, compounds).

Conclusions

To summarise, after a short introduction explaining why the climate is changing, this article has enumerated the various strategies that the automobile industry currently applies to resolve the problem of excessive carbon dioxide emissions. These are all aimed at solving it in the near future.

One can conclude that the automobile industry, for many years now, has been betting on ever cleaner technologies and is investing massive technological to alleviate the problem. We must not lose sight of the fact that we all form part of the automobile industry, because we are all, or at least the large majority of us, drivers, and thereby indirect CO_2 contributors.