

VEHICLE TECHNOLOGY AND THE GREENHOUSE GASES EMISSIONS CONTROL IN BRAZIL

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Motorized vehicles and global warming

The global concern about climate change has occurred more intensely since the establishment of the Kyoto Protocol - KP. Since then, especially in developed countries, there is a growing demand for strategies to control emissions of greenhouse gases - GHGs, mainly carbon dioxide - CO₂ from fossil fuel combustion. Opened for signature in 1997, the KP was ratified in 1999 but entered into force only in 2005, after Russia's joining in November 2004.

In response to international pressure for voluntary commitment of developing countries to the KP, Brazil and São Paulo State recently set ambitious statutory goals for GHG emissions reductions. While national policy focuses on controlling deforestation, the State of São Paulo aims primarily at reducing emissions in agriculture, industrial processes and in the energy sector - especially, motorized transport.

The São Paulo State Law 13.798 issued in November 9, 2009, set the State Policy on Climate Change (known as PEMC), aiming at a 20% CO₂ emissions reduction across the state economy by 2020, with reference to the 2005 total emissions. This implies the urgent need to define robust strategies to limit CO₂ emissions through a more efficient economy, energy conservation, using of more renewable energy and reduced consumption of fossil fuels. The transport sector, which accounts in the state for about 30% of total CO₂ emissions, is the most important challenge.

According to the Intergovernmental Panel on Climate Change - IPCC guidelines, GHG emissions from motor vehicles are basically determined by the amount of fossil fuel burned, their carbon content and/or the corresponding CO₂ emissions. For IPCC, CO₂ is responsible for over 97% of total GHG emissions of the motorized transport, which in turn correspond to 25% of these gases around the planet.

Vehicle GHG reduction measures

Reducing the use of fossil fuels and optimizing transport systems are the way to reduce GHG emissions in the automotive sector. To abate these emissions many countries have quickly set strict laws with mandatory limits for CO₂ emissions and/or limitation of fuel consumption for new light passenger vehicles.

In the United States, the heavy diesel vehicles were recently also included in the national plans to limit automotive CO₂ emissions within a voluntary program called "Smartway" <http://www.epa.gov/smartway/>.

There are many ways to promote energy efficiency in transport and reduce CO₂ emissions. In the field of technology, some measures are highlighted. The use of renewable energy powered engines is one of them. However, it is necessary to consider the "degree of renewability", resulting in reduced emissions of fossil CO₂ or even zero fossil carbon emissions throughout the life-cycle of the fuel - from well-to-wheels. Emissions from vehicles powered by ethanol from sugar cane or from corn, for example, have different degrees of renewability, given the increased use of fossil fuels in the production and distribution of ethanol from corn. In this field, ethanol from sugar cane has a huge lead on ethanol produced from corn or on other alternatives, as indicated by various comparative life-cycle analysis studies available in the literature.

Among the highlights are: the newly developed - and already available in the market - diesel-electric/gasoline-electric hybrid engines, with CO₂ emissions about 30% to 40% less than conventional engines; aerodynamic changes in vehicle design; the use of lighter construction materials; the adoption of start-stop systems; speed governors, especially in cargo; mandatory adoption of energy-efficient tires, called ecological or green, with lower power consumption (-3% to -5%); automatic inflating tires, keeping the ideal tire calibration over use; the use of eco-driving systems (a software that monitors the drivers with GPS to suggest rescheduling their behavior); promotion of fleet renewal, through scrapping and replacing old dirty vehicles with more efficient and less polluting ones; and adoption of comprehensive environmental vehicle inspection programs. The latter, if properly implemented with adequate inspection equipment and procedures, compatible with the existing vehicle technology, may provide a fleet average fuel consumption reduction rate of up to 5%.

Non-technological measures

In addition to the technological measures, actions in the fields of on-road control, traffic management and logistics should also be encouraged: laws that prohibit and penalize the unnecessary vehicle idling; construction of Bus Rapid Transit - BRT systems; integration and intermodal transfers for passengers and cargo; the essential practice of compulsory monitoring and detailed reporting of "corporate CO₂ footprint" from transport companies etc. The latter is based on a well-known principle amidst areas of quality and eco-efficiency: "whom measures reduces".

Co-benefits of compulsory limitation of CO2 emissions and fuel consumption

The adoption of these measures opposes the current Brazilian market tendency of larger and more powerful individual and family vehicles as the Sport Utility Vehicles - SUV's. Its icon, the Hummer from GM - with its models of about 3.1 tons, 6.1-liter engine and autonomy of less than 3 kilometers per liter - is mostly used to transport a single passenger. According to an US National Highway Safety Administration study, the proportion of deaths and serious injuries related to traffic accidents involving SUV's is 3.4 times higher than that from compact models.



Photo: Smart x Hummer

The Hummer became famous as the ultimate symbol of the waste and ostentation of American society. Fortunately, its production was discontinued due to a new economic reality, the geopolitical conflicts involving the major oil producers in the Middle East, the financial crisis of the U.S. automakers at the time of the inauguration of President Obama and also due to changes in consumer preferences on a global scale, oriented by the emerging consciousness and citizenship principles created by the climate change issue.

The Brazilian attitude towards the international trend on mandatory automobile CO2 emission limits

Despite the less "dirty" Brazilian fuel matrix due to the large scale use of automotive ethanol, Brazil should not refrain from following the most important global technology trends of the automotive sector in this century: increased engine efficiency and vehicle size and weight reduction (downsizing).

Even in situations of cyclical price and availability of ethanol in Brazil, where flexible-fuel cars are predominantly fueled with pure hydrated ethanol, the downsizing - induced by some form of limitation of CO2 emissions and/or consumption - could bring significant co-benefits for the local economy and the environment by reducing, not only consumption and exhaust CO2, but the emissions of local toxic pollutants causing serious public health problems. The more efficient the engine is, irrespective of the fuel-type, less emission of toxic substances. This becomes even more relevant when one realizes that the Brazilian fleet and congestion (that greatly increases fuel

consumption and emissions) are growing at an alarming scale and there is a clear social perspective of universal access to inefficient cars with low occupancy rates.

Moreover, Brazil will get the abundant pre-salt oil in the near future if the promise of exploiting these reserves materializes. Thus, flex-fuel vehicles, which run today most of the time with ethanol - in São Paulo for instance - will be running on gasoline in a few years, depending on the regional availability and price of ethanol. Given the increasingly international demand for biofuels, as part of the developed countries' strategy to reduce GHG emissions, there may be risk of domestic shortages of ethanol and its replacement by gasoline - non-renewable and damaging to public health and climate.

In 2011, bad weather events caused the breakdown of the sugar cane harvest, leading to the importation of corn ethanol from the United States. The higher prices of ethanol resulted - for the largest portion of the flex-fuel fleet that used to run on pure ethanol - in a shift to gasohol (mixture of 25% dehydrated ethanol added to 75% gasoline). Therefore, there was also the need to import gasoline. Furthermore, the current fuel price policy of freezing the gasoline price, made flex-fuel cars opt for the fossil fuel, thus exacerbating GHG emissions in Brazil.

Many countries, like the United States, the European Union, Japan, Korea, and even Mexico and Chile, among others, are developing regulation proposals, or have already established specific regulations for limiting the average CO₂ emissions from new vehicles - or the average corporate consumption¹. President Obama announced a goal of issuing a 95g CO₂/km limit by 2020, similar to the European target. The Brazilian gasohol compact cars today emit something around 200g CO₂/km, more than double the goal of the United States and the European Union.

Thus, the United States, although standing outside of the KP, is responsibly reducing since 2006 its emissions at a rate of 7.7%, while Brazil, although showing off recent national and state policies with extremely ambitious GHG reduction targets, instead of pursuing to reach them - and ultimately reducing emissions - increased in 2011 its contribution to global warming at a 3.2% rate, as reported by the International Energy Agency.

If Brazil does not comply with its own legal targets and does not follow the trends observed in developed countries - and even in some developing countries - a markedly negative scenario will soon emerge, showing a less compact average fleet, less efficient and more polluting than those of other countries that intelligently paved their way through vehicle efficiency and downsizing (Smartway), driven by mandatory regulations limiting consumption and/or CO₂ emissions.

These advanced environmental control measures aiming GHG abatement should already have been transparently and decisively discussed in Brazil, especially among environmental authorities that already manage emissions control programs as the

¹ *Vehicle manufacturers, based on their certified CO₂ emissions or fuel consumption weighted by the number of units sold for each model, cannot exceed the limit established by law for average CO₂ emissions or consumption. This allows manufacturers/importers continue the production of their most powerful and pollutant models, however they are required to offset those higher emissions with the sales of more efficient models that meet well below the legal limits.*

PROCONVE - National Air Pollution Control Program from Motor Vehicles. This program was first regulated in 1986 by CONAMA - National Environment Council based on a proposal from CETESB - Environmental Agency for the State of São Paulo.

In this context, one cannot ignore the vigorous and well-designed U.S., European and other countries' mandatory targets to reduce vehicle GHG emissions, both for cars and light commercial vehicles, which are also based on the use of renewable fuels, especially those that are already part of Brazilian reality: ethanol and biodiesel.

But, despite of the immediate adhesion or voluntary commitment of developed and some developing countries towards the principles of the KP, as well as of the worldwide spread laws to limit automotive CO₂ emissions and fuel consumption, the currently discussed issue in Brazil in restricted and ultra-specialized forums (seldom in the media) is focused just in the disclosure by manufacturers of the consumption and CO₂ emission rates for each vehicle model sold in the country, under a national vehicle (voluntary!) labeling program.

If really implemented, this label would be among milder measures to mitigate the greenhouse effect, for it would allow consumers (only those more aware and attentive), to choose more clean and efficient vehicles. In this sense, the Brazilian Vehicular Labeling Program from the National Institute of Metrology and Industrial Quality - INMETRO, although voluntary, is a small seed to public awareness towards more sustainable vehicles. This program could also be integrated to the "Green Rating" system issued by the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA, which disclosures information on automotive toxic emissions.

However, although the present dominant issue among specialists in Brazil is the voluntary vehicular labeling, what really matters most in this crucial moment of urgent need for compliance with national and state policies on climate change, is to immediately reproduce what many countries have been responsibly doing for over a decade - but the environmental and energy sectors in Brazil have not begun to do: transparently evaluate, and get broad agreement on a regulation proposal for mandatory limitation for CO₂ emissions from light passenger and commercial vehicles.

Limit with an iron fist or just suggest?

The question to be answered is simple: to mandate legal CO₂ emission limits for Brazilian cars and light commercial vehicles or just inform users about the typical level of fuel consumption of each model?

The CO₂ limitation could be made in a similar manner to what is already practiced with great skill and success to control toxic emissions from new vehicles under the PROCONVE. It would be extremely easy to immediately introduce one more parameter in the PROCONVE regulation. CO₂ emissions have already been routinely measured in type-approval tests of new vehicles in Brazil.

In principle, once the mindset inertia, lack of proper technical information, the typical strong resistance of local vehicle manufacturers and finally, the government

bureaucracy, are overcome, a very simple law or a CONAMA resolution would be sufficient to effectively introduce vehicle CO₂ emission limits in Brazil, as a complementary PROCONVE measure shaped to meet the recent national and regional legal GHG reduction targets.

The laboratory and bureaucratic PROCONVE structure is already there, ready and nicely working for over 25 years. CETESB has been doing it very properly as an IBAMA delegate agent.

As mentioned, Europe has already progressive mandatory CO₂ emission ceilings in g/km. Japan, Korea, Chile, Mexico and the U.S., among others, also have their own particular requirements. This will leverage the production of a technologically advanced and more compact and efficient fleet, which will consume less fuel, among other environment, economical and social benefits.

But if Brazil, meanwhile, just chooses the easy, but risky and ineffective way - a labeling program that eventually allows the consumer choice of a more efficient vehicle, which is still dependent on the establishment of a national better designed compulsory (not voluntary!) program - the country could plunge back into a scene from the past when it comes to efficiency and sustainable transport.

Besides not pursuing the national and regional GHG reduction targets, Brazil would be heading towards the opposite direction compared to the modern world trend, burning important currencies and releasing uncontrolled emissions of CO₂ from bigger and more gas-guzzling vehicles. And soon, all the pre-salt oil will be dumped into the Brazilian atmosphere in the form of fossil carbon, without controls and limits, indifferent to all the principles of the Climate Convention, born in Rio-92 Conference.

The CO₂ emissions control of flex-fuel vehicles when they run on pure ethanol has also a key benefit: it saves fuel that could be exported or stored during contingency situations, such as that shortage of 2011. It also helps to oppose the fallacious and childish argument that CO₂ emissions from ethanol - for being (partially) renewable - need not be subject to compulsory limitation.

It is therefore extremely important, for the sake of coherency and environmental policy principles, shifting the Brazilian current discussion focus to the evaluation of a proposal for a Brazilian mandatory regulation limiting CO₂ emissions from passenger and light commercial vehicles, as an essential complement of the PROCONVE - or carry out some other alternative, at least with the same or greater simplicity and control potential, which may arise during the discussions that (hopefully) will soon necessarily follow.

In addition to the strategic global and local environmental and socio-economic benefits, one could expect even more gains coming up from this win-win regulation. These are related to the optimization of the use of road space - otherwise, it could be almost totally occupied by huge SUV`s - and the consequent reduction in mortality in traffic accidents, which, as mentioned, is directly related to the size and weight of vehicles. In the medium and long term, in the same way it was done by the PROCONVE for toxic emissions, this development effort of the Brazilian automotive industry will be fully rewarded with the ability to export to other countries, given the similarity of the Brazilian automotive future technology with the global advanced, low-carbon, efficient and clean automotive product.

But there is no use having a fleet of private cars for personal transportation which is more economical and less harmful to respiratory health, and to the planet, if we continue on the current irrational and perverse social and urban development model that is radically blocking the mobility in our Brazilian bigger cities and bringing a billionaire hole to the national economy and a concrete threat to the physical and mental health of tens of millions of Brazilians.

Finally, a really strong and intelligent action towards mandatory vehicle CO2 emissions limitation - which the Americans wisely call "Smartway" - converge with the goals of national and state policies on climate change. In principle, any reasonable control measure should be discarded.