GFEI
GLOBAL FUEL ECONOMY INITIATIVE
www.globalfueleconomy.org

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

SEMARNAT

ine Instituto Nacional de Ecología

# Proceedings of a GFEI workshop: Mexico Climate Change Mitigation Workshop: The Importance of Passenger Vehicle Efficiency

Working Paper 2/10

FIA Foundation for the Automobile and Society

iea International Energy Agency

International Transport Forum

UNEP

**Global Fuel Economy Initiative**

**Mexico Climate Change Mitigation Workshop:**
**The Importance of Passenger Vehicle Efficiency**

8-9 March 2010 in Mexico City

**Summary of Discussions**

The objective of the workshop was to support development of policies to improve the fuel efficiency of cars, in order to cut CO2 emissions and oil dependency. Presentations and background documents are available at http://www.theicct.org/information/workshops/climate_change_mitigation. The workshop focussed on the design of fuel economy standards for new cars in Mexico and other Latin American markets.

Many technologies are available for improving fuel economy and more are under development. Many of these technological improvements can be employed either to improve fuel economy or to increase power. Vehicle manufacturers generally find performance and comfort (with associated weight gain) to be more successful marketing criteria for their products than fuel efficiency. Government intervention in the market is designed to shift the balance of compromise between fuel economy and power/weight towards fuel economy. At a price, improvements in both fuel economy and power can be delivered, as illustrated by the development of hybrid vehicles for high-end compact cars, and especially the recent deployment of hybrid technologies on luxury sedans and sports vehicles.

Experience in the USA, Europe and Japan with fuel economy and CO2 emissions standards provides some valuable guidelines for the design of effective regulations and also avoiding unintended distortions to the market as a result of intervention. At the same time the economic characteristics of car markets vary greatly from region to region. The feasibility of employing different types of instruments to influence fuel economy (fuel taxes, vehicle taxes, standards, labels), also varies greatly between regions. These differences are important in designing intervention.

The workshop discussed the economic rationale and options for intervention to promote fuel efficiency and examined how market conditions in Latin America, and particularly Mexico, determine the way regulatory standards for new cars and other instruments for fuel economy might best be designed.

**The potential**

Efficiency technologies that pay for themselves through consumer fuel savings are widely estimated to be able to cut average CO2 emissions by 50% in the 2030 timeframe. Technologies available to improve fuel economy, and cover their costs through fuel savings, are estimated to be able to cut average new car CO2 emissions by around 50% in the time frame 2005-2030. These conclusions are in line with and follow from the analyses of well known engineering studies in the US (Heywood 2008) and Europe (King 2007). This suggests that around 2030 average new car fuel economy could be around 25 km per litre (60 mpg, 4l/100km, 90gCO2/km).

This level of improvement was modelled by Heywood and King for North American and European markets. A broadly similar level of improvement appears feasible in Mexico. Some of the automobile plants in Mexico already produce engines employing some of the technologies considered for wider deployment in the Heywood and King studies.

An indicative target of 25 km/litre also seems feasible in a similar timeframe for high-growth car markets in developing countries such as China and India, given the lower average weight of vehicles in these markets. Although growth in GDP per capita and consequent shifts in consumer demand towards cars at the upper end of the product range is likely to increase the average weight and power of vehicles in these markets, technology improvements should be able to more than compensate these effects given appropriate regulatory incentives.

**Why Regulate Fuel Economy**

Despite the potential to save fuel costs, consumers give a lower priority to fuel economy in their decisions on new car purchases than might be expected. As David Greene's presentation to the workshop explained, this appears to be mainly because fuel prices are uncertain and it is not easy for consumers to predict exactly what fuel consumption different vehicles will give in everyday use (Greene 2010). A vehicle's average fuel efficiency (based for example on US EPA label values[1]) may vary widely depending on individual drivers, vehicle use patterns, and vehicle loading (see Figure 1).

Manufacturers, in turn, face risks in investing in fuel efficiency because of the uncertain value that consumers place on fuel economy. Engine plants are highly capital intensive, making them a potentially very risky investment for car companies. Research by McKinsey (German 2010) suggests that the transport sector requires much higher capital investment per ton of CO2 emissions avoided than greenhouse gas mitigation measures in other parts of the economy (see Figure 2). This suggests it might be appropriate for governments to intervene relatively more for climate change mitigation in the transport sector.

Governments can take some of the risk away from manufacturers through intervention of several kinds. They can set a regulatory standard for the fuel economy and/or CO2 emissions of new vehicles so that, if standards are set far enough ahead, car companies can make major investments in new technology with a reasonable degree of certainty that their vehicles will be competitive, in the sense that competitors will comply with the same standard. Strong long-term commitment is required to maximise the effectiveness of incentives for fuel economy. Therefore targets should be agreed over a time frame of a decade or more with regulatory risk minimised by making standards legally binding as far in advance of target deadlines as possible.

Vehicle purchase and registration taxes (and annual circulation taxes) can be differentiated to reduce taxes on low emission vehicles and increase taxes on poorer performing vehicles. Some of the 16 European countries using this kind of tax differentiation have made it neutral in terms of the impact on finance ministry budgets; although greater than anticipated success in promoting fuel efficient vehicles have resulted in net tax losses in some cases. Where there have been revenue losses these have been justified by the value of the CO2 emissions avoided and the foreign currency saved by reducing oil imports.

[1] The EPA publishes standard fuel economy test figures for new vehicles and also adjusted figures to reflect average fuel economy achieved in typical real world driving conditions. The adjusted figures give about 20% increased fuel consumption over the standard figures.

To take one example, France introduced its Bonus-Malus (feebate) tax on car purchases in January 2008 and saw an immediate 7% reduction in average CO2 emissions, which have since continued to decline (see Figure 3). The initial goal was for the system to be revenue-neutral. In fact it cost the French government 300 million Euros in the first year. However, the system was not adjusted, partly in order not to discourage new car purchases at a time of economic recession.

Feebates[2] are compatible with standards, and make achieving average corporate fuel economy standards easier. Conversely where fuel taxes are low and vehicle standards are stringent problems can arise. The disparity between fuel tax rates and standards made marketing fuel efficient cars more difficult in the US and probably diverted marketing efforts towards light trucks and SUVs which have been subject to relatively weaker standards. Interestingly, the Heywood and King studies suggest the same potential scale for fuel economy improvement in the US and European markets despite the large differences in the rate of fuel taxation and the consequent difference in current average fuel efficiency of the vehicles sold in these markets.

**The car market in Mexico and Latin America**

The average fuel economy of new cars sold in Mexico is somewhat higher than in the US, reflecting the lower average weight of the vehicles sold in Mexico. Figure 4 places the Mexican new car fleet average in relation to the US fleet average in 2008 and the proposed new Corporate Average Fuel Economy (CAFE) standards for the US. 60% of the vehicles manufactured in Mexico are exported to the US and 40% of Mexican car sales are US imports, reflecting a highly integrated North American market. As a result there is broad access to US vehicle technologies in Mexico and vice versa.

The number of diesel cars in Mexico is larger than in the US (where they are virtually absent) but still only 3%, far below Europe. Any increase in diesel car sales in Mexico would exacerbate air pollution for two reasons. First, air emissions regulations in Mexico lag US and European standards by a number of years. Thus NOx and particulate emissions from diesel cars are much higher for new cars sold in Mexico than in the US and Europe and will not achieve stringent control levels unless and until these regulations are revised. Second, low sulphur diesel is only imported to cities on the US-Mexico border and domestic diesel production is high in sulphur. This is one of the reasons for relatively less stringent NOx and particulate controls on Mexican diesel cars, as the catalysts and filters required to remove NOx and particulates to very low levels are poisoned and clogged by sulphur. High sulphur fuel in a diesel engine designed to run on high sulphur fuel also contributes to forming sulphate particulates, further exacerbating particulate pollution. Dieselisation needs to be avoided until air emissions regulations and fuel sulphur content permit it.

[2] Differentiation of annual circulation taxes can also provide incentives for fuel efficient vehicles. The stimulus is generally weaker than with purchase taxes. In Mexico the revenues from the “tenencia” annual circulation tax flow to local governments and the federal government has given local authorities the option to abolish or continue collecting the tax.

For gasoline cars, 30 ppm sulphur gasoline is widely available in Mexico, making all current fuel efficient gasoline technologies viable in the Mexican market. While not related to near-term technology options to improve fuel efficiency, the universal availability of 150 ppm sulphur gasoline may result in mis-fueling of vehicles designed to run on low sulphur fuel. Use of 150 ppm sulphur fuel in the cleanest cars currently sold in Mexico will result in higher levels of NOx emissions and has the potential to damage catalytic converters. Higher particulate emissions are also a concern, although to a lesser degree. In Europe, differentiation of the excise tax level for high and low sulphur fuels to eliminate the price difference at the pump resulted in a very rapid conversion of the market to low sulphur fuel. There may be an opportunity to do this in Mexico, at least with respect to gasoline, during the ongoing phased reform of fuel excise duty that is designed to end the effective subsidy of auto fuels that resulted from earlier price controls on oil products. The timing of such an incentive program would need to be coordinated with planning for production of low sulphur fuel in Mexican refineries, with desulphurisation units currently expected to come on stream in 2014.

The high altitude of Mexico, 5000 feet on average, and consequently thin air slightly reduces the power of engines. This has little impact in terms of the design of fuel efficiency incentives. The main approach to improving efficiency by US and European manufacturers is turbo charging engines so that they can be down-sized. Turbochargers increase the amount of air fed into the engine – compensating for thin atmosphere. For air pollutants altitude does have significant consequences but standard engine oxygen sensors adjust the air fuel ratio to compensate for altitude (the problem is not unique to Latin America, Denver in the USA for example is at a similar altitude to Mexico City).

Per capita incomes are growing in Mexico and some other Latin American countries more rapidly than in North America and Europe. This creates a challenge for fuel economy standards as it produces upward pressure on car specifications as richer consumers aspire to larger, more powerful cars. It also creates an opportunity, as ability to pay for technology also increases. The challenge is to avoid extreme upsizing.

**Design of intervention for Mexico and Latin American Markets**

The Mexican government is developing standards for improved fuel economy and lower CO2 emissions from new cars. A regulatory proposal is expected later this year on the basis of joint work by the Ministry of Environment (SEMARNAT) and the National Energy Efficiency Commission (CONUEE).

The standard under development in Mexico will be an average target for the new car fleet. This is also the approach used in Europe, the USA and Canada. China is the only major economy using the alternative approach of setting minimum fuel efficiency limits and is now moving to a corporate fleet average approach, more suited to pushing performance of the whole fleet.

The way standards are structured determines their impact on the car market and the way manufacturers achieve improvements in efficiency. With fleet average standards, some kind of differentiation according to the weight or size of vehicles is usually employed. This ensures that manufacturers producing different ranges of vehicles are affected more or less equally. Some methods of differentiation are superior to others:

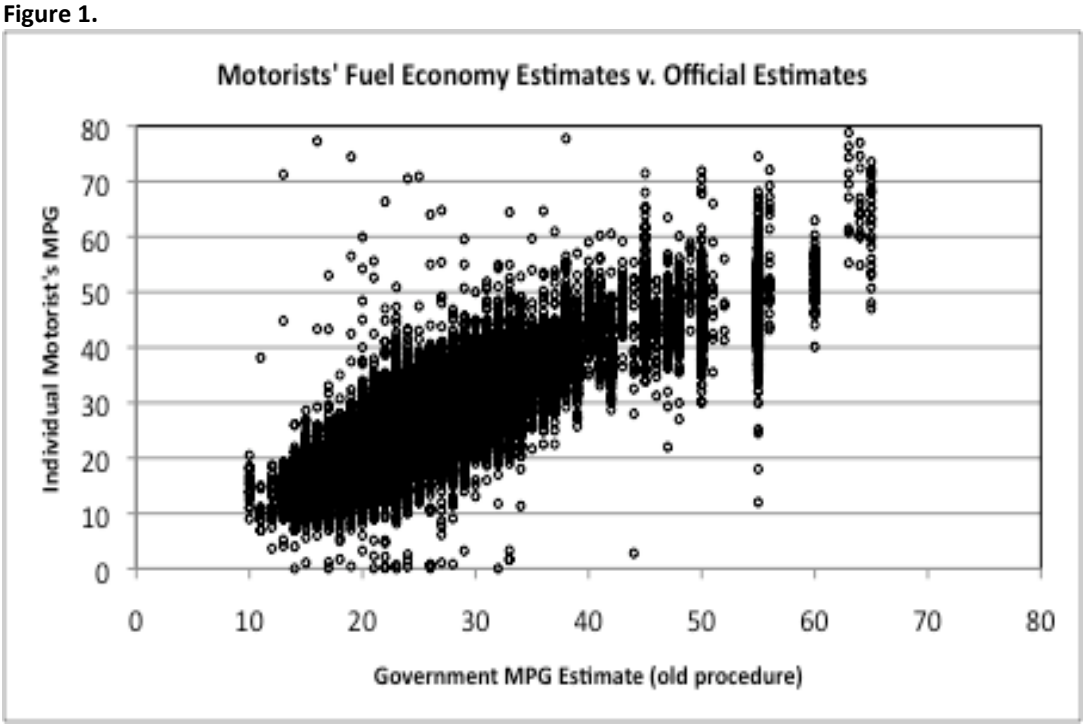
- Differentiating by vehicle size (or “footprint”), using some combination of vehicle dimensions, is preferable to weight as it avoids creating a disincentive to meet the standard through weight reduction.
- Linear differentiation is much better than steps between size categories, as steps create incentives to design vehicles that just qualify to cross the boundary to a more favourable “bin”, leaving further opportunities for improvement untapped.

Linear differentiation also avoids fragmenting car markets, as has happened as a result of the diversity of tax incentive and fuel economy labelling schemes in Europe, each country employing different break points in the way incentives are structured (see Figure 5). The Mexican and US car markets are highly integrated, as already noted. A linear differentiation of the Mexican standard would preserve this integration with respect to the incentive structure of US regulations. At the same time, the stringency and timeframe for the Mexican standard, and relative stringency towards smaller and larger cars, can be determined to suit local market conditions.

The auto industry needs a regulatory environment that provides as much certainty as possible if it is to make the capital investments necessary to maximise the fuel economy of new cars. Standards can provide this certainty and the longer the planning horizon the better. Binding standards for the next few years can be complemented by indicative targets for the longer term. The European Union's standard of 130 g CO2 / km by 2015 for the new car fleet average is accompanied by a 95 g CO2 / km target for 2020. Several European governments have used this figure as a reference point for tax incentives for low carbon vehicles in anticipation of the target being adopted as a binding standard.

**Figures**

**Figure 1.**




Source: Greene 2010.

**Figure 2.**

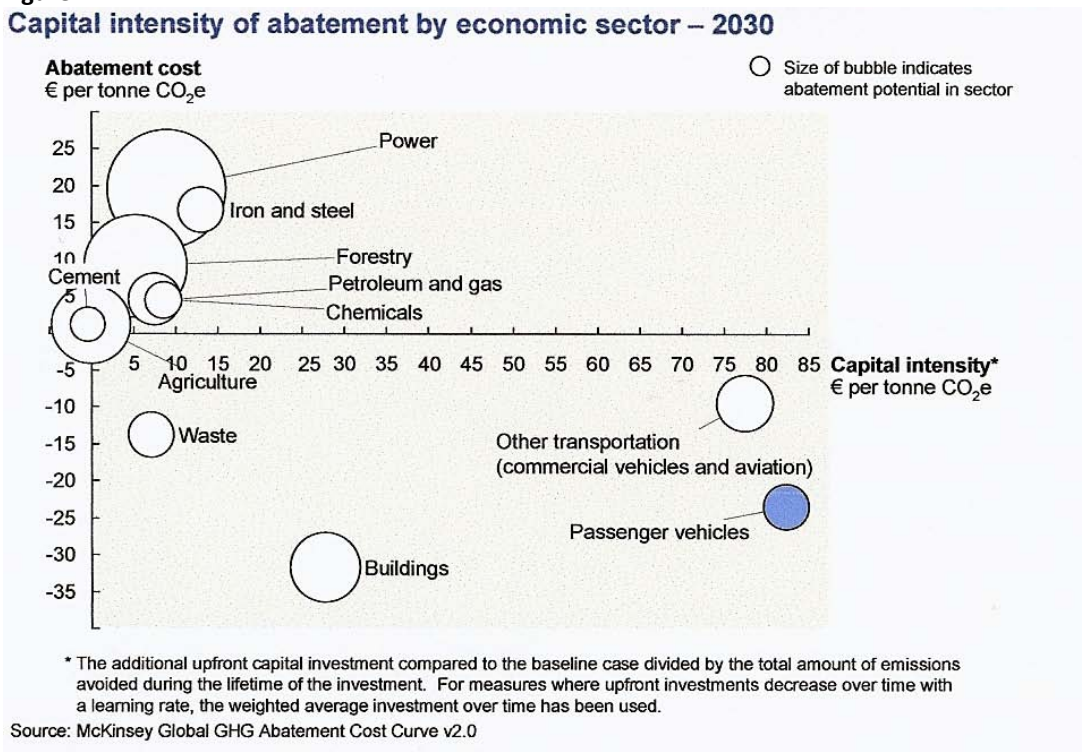
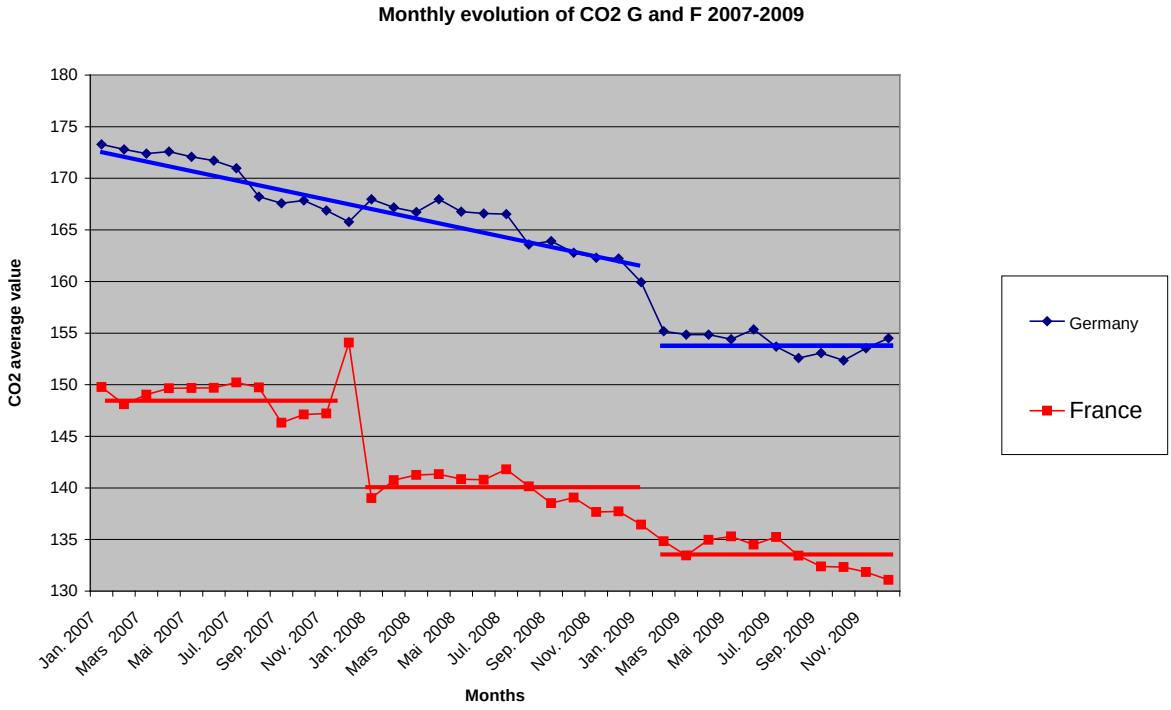
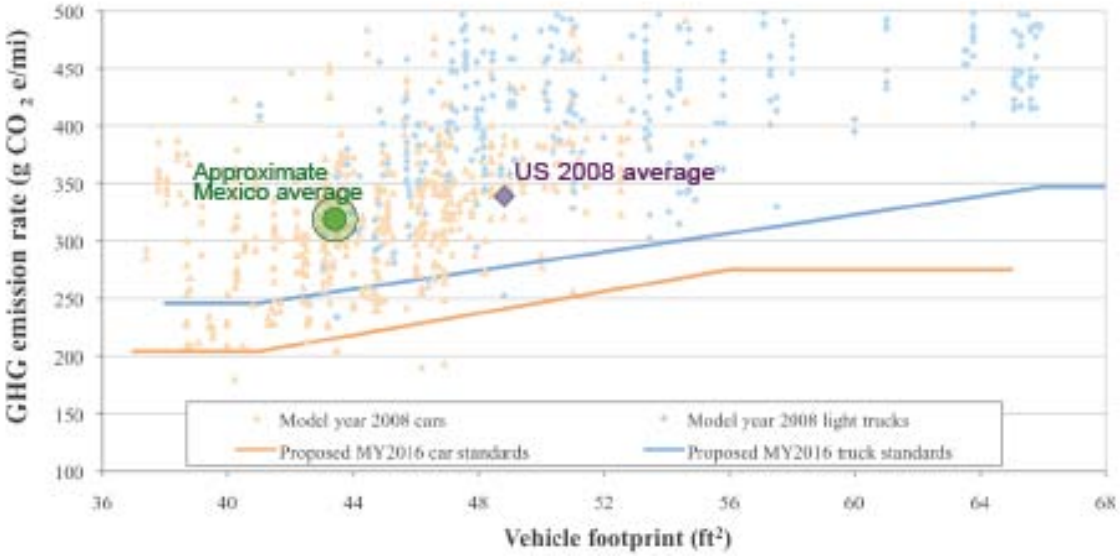


**Figure 3.**
**Monthly Evolution of Average Specific CO2 Emissions from New Cars sold in France and Germany**



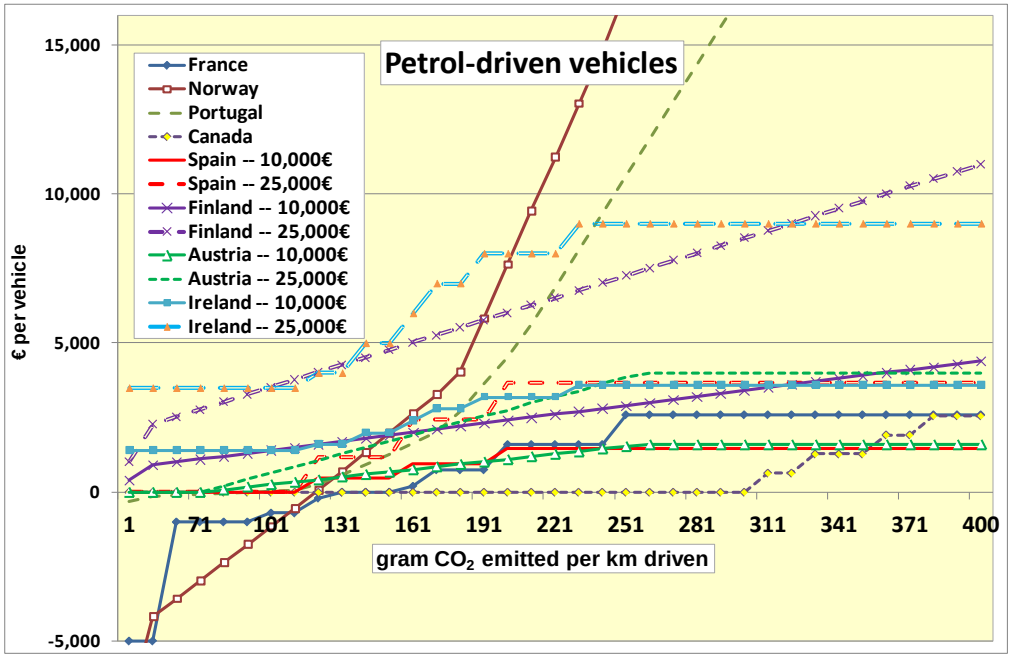

Source: Bastard 2010.

**Figure 4.**
**US CAFÉ Standards Proposed for 2016 Compared to Light Duty Vehicle New Car Fleet Averages in 2008 in the USA and Mexico.**




Note: US standard - MY2008: 26 mpg, 339 gCO2e/mi; MY2016: 34 mpg, 250 gCO2e/mi
Source: Lutsey 2010.

**Figure 5.**
**Differentiation of One-off Vehicle Taxes (purchase or registration taxes) in Europe**




Source: OECD 2009.

**References**


Bastard (2010), Luc Bastard, Renault, *The Impact of Economic Instruments on the Auto Industry and the Consequences of Fragmenting Markets - Focus on the EU Case*, ITF JTRC Discussion Paper 2010—8. http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201008.pdf

German (2010), John German, ICCT, *Impact of Standards on Industry, Consumers, and Economy,* http://www.theicct.org/documents/0000/1424/German_ICCT_Standard_impacts.pdf

Greene (2010), David Greene, Oak Ridge National Laboratory USA, Transportation Research Centre , *Why the New Market for New Passenger Cars Generally Undervalues Fuel Economy*, ITF JTRC Discussion Paper 2010—7. http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201007.pdf

Heywood (2008) John Heywood, MIT, *More sustainable transport: the role of energy efficient vehicle Technologies*, report prepared for the International Transport Forum, Leipzig 2008. http://www.internationaltransportforum.org/Topics/Workshops/Workshop1.html

King (2007) Julia King, Aston University, The King Review of Low Carbon Cars – Part I: *The potential for $CO_2$ reduction*, Crown, UK, 2007.

Lutsey (2010), Nic Lutsey, ICCT, *Design Considerations for Fuel Economy/GHG Standard* http://www.theicct.org/information/workshops/climate_change_mitigation

OECD (2009), *Incentives for CO2 Emission Reductions in Current Motor Vehicle Taxes,* OECD 2009, www.oecd.org/nv/taxes and http://www.internationaltransportforum.org/jtrc/roundtables.html#RTLow-carbon

GFEI

GLOBAL FUEL ECONOMY INITIATIVE

www.globalfueleconomy.org

## SECRETARIAT


Global Fuel Economy Initiative
60 Trafalgar Square
London WC2N 5DS
United Kingdom

+44 (0)207 930 3882 (t)
+44 (0)207 930 3883 (f)

info@50by50campaign.org
www.50by50campaign.org


## PARTNERS


FIA Foundation for the Automobile and Society

**Sheila Watson**
Director of Environment
FIA Foundation
60 Trafalgar Square
London WC2N 5DS
United Kingdom
www.fiafoundation.org

International Transport Forum

**Stephen Perkins**
Head of Joint Transport Research Centre of the OECD and the International Transport Forum
2 rue André Pascal
F-75775 PARIS CEDEX 16
France
www.internationaltransportforum.org

iea International Energy Agency

**Lew Fulton**
Senior Transport Energy Specialist
International Energy Agency
9, rue de la Fédération
Paris 75015
France
www.iea.org

UNEP

**Rob de Jong**
Head, Urban Environment Unit
Division of Technology, Industry and Economics
United Nations Environment Programme (UNEP)
P.O.Box 30552
Nairobi
Kenya
www.unep.org/PCFV


For more information visit the GFEI website: **www.globalfueleconomy.org**