50BY50

GLOBAL FUEL ECONOMY INITIATIVE

www.50by50campaign.org

Making Cars 50% More Fuel Efficient by 2050 Worldwide

FIA Foundation for the Automobile and Society

iea International Energy Agency

International Transport Forum

UNEP

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Foreword

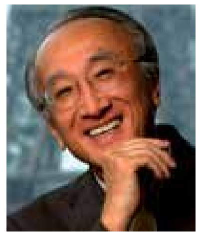
Transport will play a critical role in delivering the CO_2 emissions cuts needed to meet global political climate change targets. The world's car fleet is expected to triple by 2050, with 80% of the growth in rapidly developing economies. At the same time the car manufacturing industry is facing huge difficulties in the economic recession. We have to find ways to reconcile legitimate aspirations for mobility, an ambitious reduction in CO_2 from cars worldwide, and global economic recovery. There are opportunities to combine support for the industry with measures to achieve governments environmental and energy policy goals.

We believe that the findings of this report are highly significant in addressing that challenge. A move across the global fleet towards far better fuel economy at a scale which is already technically achievable, could save over six billion barrels of oil per year by 2050, and cut close to half of CO_2 emissions from cars, as well as generate significant local air pollution benefits - and all using existing, cost-effective technologies. This is simply too good to ignore.

After launching the partnership in March 2009, at the Geneva Motor Show, we have been working to fully develop the Global Fuel Economy Initiative, including setting priorities and developing a plan of action.

Our explicit objective is to promote further research, discussion and action to promote cleaner and more efficient vehicles worldwide. We intend that this work will be intensely practical, and focused on making a real difference - from working with governments and their partners in developing policies to encourage fuel economy improvement for vehicles produced or sold in their countries, to supporting regional awareness initiatives that provide consumers and decision makers with the information they need to make informed choices. Our goals for 2020, 2030 and 2050 can only be achieved if we start today.


David Ward
Director General
FIA Foundation

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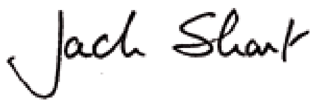

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Introduction

Four organisations – the FIA Foundation, International Energy Agency, International Transport Forum and United Nations Environment Programme – have joined together to launch an initiative to improve vehicle efficiency worldwide, the Global Fuel Economy Initiative (GFEI).

The initiative aims to facilitate large reductions of greenhouse gas emissions and oil use through improvements in automotive fuel economy in the face of rapidly growing car use worldwide[1]. The initiative targets an improvement in average fuel economy (reduction in fuel consumption per kilometre) of at least 50% worldwide by 2050[2]. With efficiency related flanking measures this is likely to result in at least a stabilisation of CO_2 emissions from the global car fleet. This would make an important contribution to meeting the CO_2 targets identified by the International Panel on Climate Change (IPCC) and supported by G8 recommendations. The benefits will also include significant reductions in oil expenditures and reductions in urban air pollution around the world.

The potential benefits are large and greatly exceed the expected costs of improved fuel economy. Cutting global average automotive fuel consumption (L/100 km) by 50% (i.e. doubling MPG) would reduce emissions of CO_2 by over 1 gigatonne (Gt) a year by 2025 and over 2 gigatonnes (Gt) by 2050, and result in savings in annual oil import bills alone worth over USD 300 billion in 2025 and 600 billion in 2050 (based on an oil price of USD 100/bbl). The Initiative proposes several steps and actions to work towards the 50:50 overall goal and each step will achieve some of this overall benefit.

The partners of this initiative recognise that especially during troubled economic times, automakers can be daunted by the idea of making major changes in product plans. We take a long range view in this initiative, and plan to work with automakers and other stakeholders to ensure that targets can be met cost-effectively and most importantly in a coordinated manner that helps prevent a patchwork of different and conflicting policy incentives around the globe. More than ever, clear signals are needed regarding where vehicle designs and markets should be heading over the coming decades.

The initiative has developed a core plan of activities and is establishing partnerships with other organisations and governments around the world to achieve its goal. This is described in the last chapter of this document.

The Global Fuel Economy Initiative aims specifically to improve the understanding of the potential for improving the fuel efficiency and reducing the CO_2 emissions of cars around the world, and providing guidance and support on the development of policies to promote more fuel efficient vehicles. Priorities for the Initiative are:

- Develop improved data and analysis of the current situation on fuel economy around the world.
- Work with governments to develop sound policies to encourage fuel economy improvement for vehicles produced and/or sold in their countries.
- Work with stakeholders (such as auto makers) to better understand the potential for fuel economy improvements and solicit their support.
- Support awareness initiatives to provide consumers and decision makers with information on options.

[1] In this document, "car" includes all light-duty vehicles, e.g. cars, minivans and SUVs.
[2] In this document, "fuel economy", and "efficiency" are treated as synonyms. These should both be taken to mean "fuel consumption per travel distance" (e.g. L/100 km) unless otherwise specified. This is the inverse of distance per unit fuel use (e.g. MPG), so a 50% improvement in fuel economy in L/100 km is equivalent to a doubling of MPG or KM/L.

Summary of the key issues

1. The average fuel economy of the global light duty vehicle fleet can be improved by at least 50 percent by 2050 relative to 2005 levels. Improvements of this order of magnitude appear possible in non-OECD countries where car fleets are growing fastest, as well as in OECD countries. Improving the efficiency of new cars at this rate would make possible at least a 50% improvement in the average fuel economy of all cars on the road worldwide by 2050 – thus, the 50:50 initiative.

2. Even if vehicle kilometres driven double by 2050, efficiency improvements on this scale worldwide would effectively cap emissions of CO_2 from cars at current levels. It is estimated that by 2025 over 1 Gt of CO_2 emissions would be saved annually, rising to over 2 Gt of CO_2 emissions by 2050 compared to a business-as-usual case. Additional vehicular pollutants that also impact on the environment and contribute to climate change, including black carbon, would also be significantly reduced.

3. This would be likely to save over 6 billion barrels of oil per year by 2050, worth USD 600 billion at an oil price of USD 100/bbl. In rapidly urbanising countries local air quality benefits would also be considerable.

4. These levels of improvement are achievable using existing, cost-effective incremental fuel economy technologies.

5. The technologies required to improve the efficiency of new cars 30% by 2020 and 50% by 2030, and the efficiency of the global car fleet 50% by 2050, mainly involve incremental change to conventional internal combustion engines and drive systems, along with weight reduction and better aerodynamics. To achieve a 50% improvement by 2030, the main additional measures would be full hybridisation of a much wider range of vehicles (possibly including, but not requiring, plug-in hybrid vehicle technologies). Vehicle technology is changing rapidly and more cost-effective technologies are likely to emerge in coming years, increasing the potential and/or lowering costs further.

6. Battery electric vehicles, plug-in hybrids and possibly hydrogen fuel cell vehicles are expected to become increasingly available in the near-to-medium term given recent improvements, especially in batteries. However, these advanced technologies are not necessary to achieve the 50% potential described here, but could result in further CO_2 reductions and oil savings if they succeed in achieving mass-market commercialisation. This will also depend on the provision by the electricity sector of low-CO_2 electricity[3].

7. For many individuals, much or all of the cost of improved technology for more fuel efficient cars could be offset by the fuel saved in the first few years of use of a new car, especially at high oil prices. But unstable oil prices, which can fall as well as rise, create risks that dissuade many car buyers from paying an upfront premium for efficiency and dissuade automobile manufacturers from investing in highly fuel efficient vehicles because they can not be sure of selling them.

8. Governments and their partners can take action to counter these risks and facilitate the introduction of cost effective fuel efficient technologies.

   a. They can improve the information on fuel consumption and CO_2 emissions available to consumers. For example, some fuel efficiency tests can be somewhat misleading as they do not accurately reflect average in-use fuel economy.

   b. They can set regulatory standards for fuel consumption or CO_2 emissions that remove the uncertainty over how much investment in fuel efficiency is viable.

   c. They can differentiate vehicle taxes according to CO_2 emissions or fuel economy to encourage consumers to prefer improved efficiency.

   d. They can provide incentives and set regulations for vehicle components that fall outside current vehicle testing, incentive and regulatory systems.

9. Governments also have a responsibility to minimise the costs of intervention, for example by keeping the differentiation of vehicle taxes simple and similar across regional markets and ensuring coherence with vehicle fuel efficiency labelling systems.

10. Car manufacturers can support the shift to more fuel efficient vehicles by committing themselves to the objectives of this initiative and working toward producing vehicles that use 50% less fuel than at present. They need to work with governments to ensure effective regulatory standards are adopted and to incorporate international market considerations in the design of national tax incentives and labelling systems. There should also be consideration that different manufacturers focus on different market segments.

11. Beyond technology-based improvements to new cars, further low-cost efficiency improvements are possible for the entire global stock of cars, affecting actual "on-road" efficiency. These include programmes to promote efficient after-market products like replacement tyres, fuel-efficient driving style (ecodriving), improved traffic and speed management, better maintenance of the stock of vehicles and better management of mobility in cities. Finally, a number of countries have used regulation or incentives to promote the fuel economy of imported 2nd hand vehicles. And reduce the number of grossly polluting vehicles in circulation. Such approaches might improve fleet efficiency particularly in the developing world. Such measures represent an important complement to technology measures for new cars and are also included in this initiative.

[3] Through non fossil fuel generation or with CO_2 capture and storage.

The Global Fuel Economy Initiative

The Global Fuel Economy Initiative, launched in early 2009, aims to improve the understanding of the fuel economy potential and cost of cars built and sold around the world, and to provide guidance and support on the development of policies to promote fuel efficient vehicles. Its activities will include the following:

- Development of improved data and analysis on fuel economy around the world, monitoring trends and progress over time and assessing the potential for improvement.
- Work with governments to develop policies to encourage fuel economy improvement for vehicles produced or sold in their countries and to improve the consistency and alignment in policies across regions in order to lower the cost and maximise the benefits of improving vehicle fuel economy.
- Work with stakeholders including auto makers to better understand the potential for fuel economy improvement and solicit their input and support in working toward improved fuel economy.
- Support regional awareness initiatives to provide consumers and decision makers with the information they need to make informed choices.

This will include periodic reports by the initiative and support for the development of vehicle testing and consumer information systems in regions where these are not yet available.

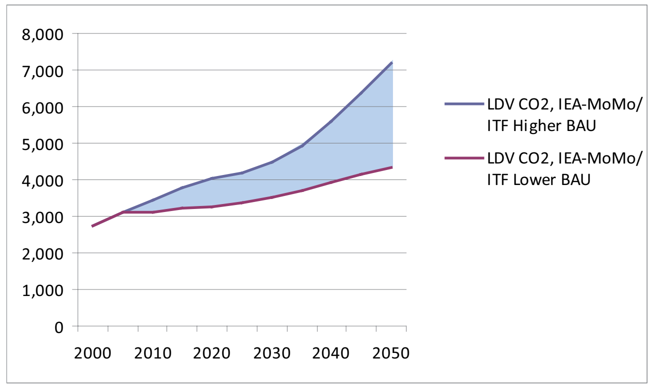
Fuel Efficiency and Climate Change

Trends in Fuel Consumption and CO_2 Emissions

The International Energy Agency (IEA) has estimated that fuel consumption and emissions of CO_2 from the world's cars will roughly double between 2000 and 2050 (IEA, 2008). The IEA and ITF have developed a range of projections of possible "business-as-usual" scenarios around this, as shown in figure 1.

These "baseline scenarios" indicate the potential for a doubling (or more) of vehicle kilometres travelled combined with modest improvements in vehicle fuel economy. These take into account an improvement in the fuel efficiency of new cars based on existing fuel economy regulations, mainly in OECD countries, with improvements slowing in most regions after 2015.

Figure 1. **World CO_2 emissions from cars**
(Mt of CO_2 equivalent GHG, well-to-wheels)
Range of possible futures; a CO_2 doubling or more by 2050 is possible

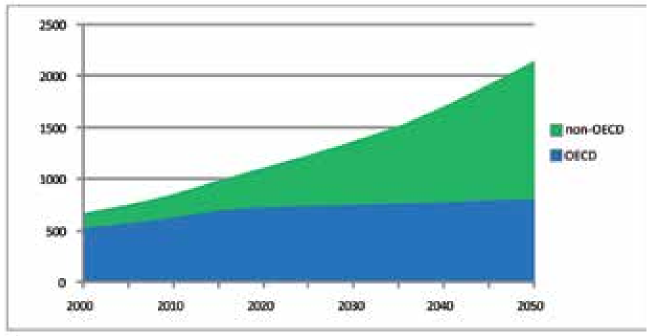


Source: IEA and ITF calculations using the IEA MoMo Model Version 2008.

If something close to the higher-end trajectory occurs, fuel economy improvement will be even more important to contain the rise in global CO_2 emissions. And other complementary measures, such as careful land-use planning, travel demand management, development of high quality transit systems where these provide more efficient transport services than private cars, and strong shifts to low-carbon fuels, will be needed to help move toward outright reductions in CO_2 and reach levels well below those of 2005. In any case, cutting vehicle fuel use per kilometre by half by 2050 is central to transforming current trends into a more sustainable picture.

Worldwide, cars currently account for close to half of the transport sector's fuel consumption and CO_2 emissions. Their dominant position in the sector is set to remain although their share will fall to just under 40% by 2050, with aviation set to grow to match road freight at around 22% of fuel consumption and emissions each (IEA, 2008). A major challenge is the rapid growth of the vehicle fleets in developing and transition countries.

Figure 2. **Global Growth in Light Duty Vehicles**
Tripling by 2050



Source: IEA , Energy Technology Perspectives 2008

Electric vehicles offer substantial savings in gasoline and diesel and will reduce CO_2 emissions. Significant CO_2 reductions will be achieved if these vehicles use electricity generated from low carbon or renewable resources.

The Potential for Improved Fuel Economy

There is a clear opportunity to improve new car fuel economy 30% by 2020 and 50% by 2030, compared to 2005 levels in a cost-effective manner (e.g. low or negative cost per tonne of CO_2). Improving the efficiency of new cars at this rate would make possible a 50% improvement in the average fuel economy of all cars on the road worldwide by 2050, compared to 2005.

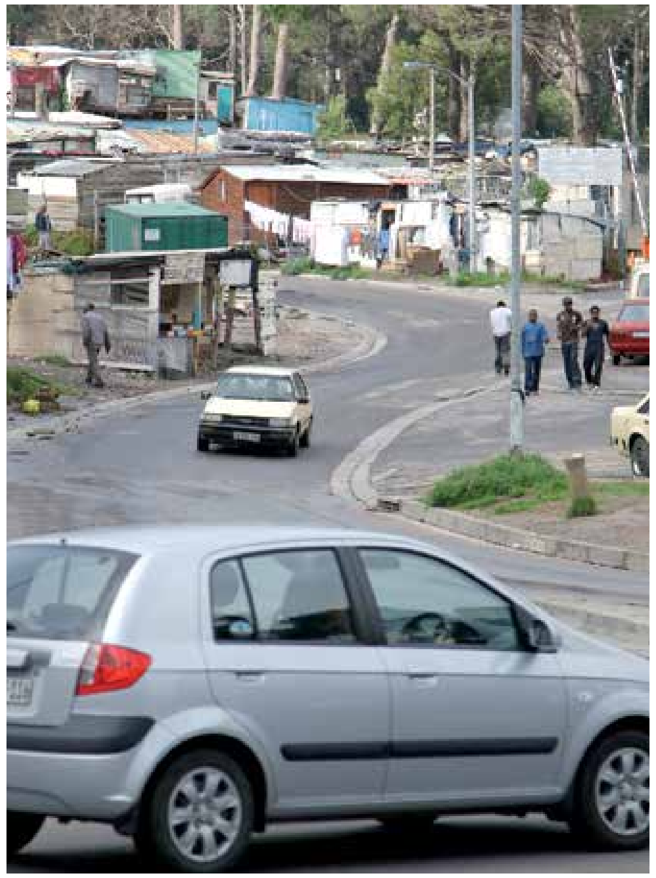
This view is supported by academic engineers and the car manufacturing industry, as presentations at the 2008 International Transport Forum in Leipzig suggested[4], and by the analysis presented in the IEA's report, Energy Technology Perspectives 2008 (IEA, 2008). Professor Julia King of Aston University, in a report to the UK Government (King, 2007), identified a potential to improve fuel efficiency of new cars by 30% within a decade with conventional technologies. For the United States, a team at the Massachusetts Institute of Technology finds a similar potential for improvement (Heywood, 2008) without significant change in the quality of vehicles marketed, if all the technological potential available is channelled to improving fuel economy rather than the performance of new model cars. Already a number of major car manufacturers have strategies to incorporate technologies in their main car models to achieve this level of improvement over the coming decade.

King, Heywood and others foresee the potential for further improvements in new car fuel economy, up to a 50% reduction in L/100 km by 2030-2035, mainly through the wider penetration of technologies leading up to, and including, fully hybridized vehicles. (Table 1 over.) The introduction of grid-connected battery electric vehicles (probably first as "plug-in" hybrids) would also contribute to efficiency improvement (in addition to fuel shifts toward electricity), assuming sustained progress in battery technology. Electric vehicles offer substantial savings in gasoline and diesel, although their potential to reduce CO_2 emissions depends on whether low carbon electricity can be generated on a much larger scale than today. Similarly, hydrogen fuel cell vehicles can offer efficiency improvements and CO_2 reductions, if they are commercialised. However widespread introduction of such advanced technologies should not be necessary to achieve 50% fuel economy improvement.

Current average fuel economy levels vary considerably by country. Across the OECD the average figure in 2005 was around 8 litres per 100 km for new cars (including SUVs and minivans and including both gasoline and diesel vehicles). With a 50% fuel economy improvement, the average new car performance in OECD markets would improve to around 4 litres per 100 km (about 90 g/km of CO_2). More work is needed to improve data and better understand the full potential in non-OECD countries.

In the United States, fuel consumption is considerably higher than the OECD average: doubling of tested fuel economy would mean moving from the current new car (and light truck) average of 26 mpg to 52 mpg (about 9 to 4.5 litres per 100 km). In non-OECD countries, more work is needed to better understand current fuel economy levels and their likely future trends, but a level of 4 litres per 100 km (or even lower) should be attainable in most countries over the time frame considered. This will depend on considerations related to variations in the test cycles used in different countries – an area where a consistent measurement and comparison approach is still under development.

The existing global stock of vehicles can also be made more efficient in their daily use. A wide variety of measures exists to do this, including better



[4] See www.internationaltransportforum.org/Topics/Workshops/Workshop1.html

Table 1 **GFEI Fuel Efficiency Targets (relative to a 2005 baseline)**

	2020	2030	2050
New cars	□**30%** average fuel economy improvement (reduction in L/100 km) for new vehicles worldwide, mainly from incremental efficiency improvements to engines, drive trains, weight, aerodynamics and accessories. □Plug-in hybrids, electric and fuel cell vehicles are not required to meet this target but certainly may help to reach it, reach it faster or even exceed it.	□**50%** average improvement for new vehicles, worldwide; mainly from incremental improvements and full hybridisation of most models of vehicles. □Plug-in hybrids, electric and fuel cell vehicles are not required to meet this target but certainly may help to reach it, reach it faster or even exceed it.	**50%+**□(currently unspecified target): Additional improvements in new car fuel economy are possible from on-going light-weighting, shifts to electric motor drive, possible adoption of fuel cell vehicles – all of which could also occur before 2030 but are expected to become much more important after.
Stock of all cars	**20%** improvement in stock-average (on-road) efficiency, reflecting both the improvements in new car fuel economy (with some lag time for stock-turnover) and additional measures such as eco-driving, improved aftermarket components, better vehicle maintenance, etc.	**35%** improvement in stock, roughly trailing new car improvements plus on-road improvement measures.	□**50%** (50 by 50: the ultimate goal) improvement in global stock average fuel economy, following the new car improvement in 2030 and with in-use improvement measures.

engine tuning; better driving styles; use of more efficient after-market replacement parts like tyres and lubricating oils; reducing vehicle weight by removing unnecessary items and reducing drag by removing objects such as ski racks when not in use; and reducing traffic congestion. The initiative will include efforts to improve in-use efficiency as well as the tested efficiency of new cars.

The UNEP based Partnership for Clean Fuels and Vehicles (PCFV) has shown that it is possible to set global targets for reduced vehicle emissions and, through a concerted effort of governments, the fuel and vehicle industry, international organisations and civil society, achieve major results in a short time frame. A similar partnership approach can be followed for this initiative. This is especially important to ensure a harmonised approach and to ensure that automotive fuel efficiency will be prioritised and addressed in developing and transition countries (see www.unep.org/PCFV).

CO_2 Emissions

In principle, cutting vehicle fuel use per km in half will halve the rate of CO_2 emissions from vehicles. he overall change in CO_2 emissions will also depend on the types of fuels used, the rate of growth in vehicle ownership and annual distance driven per vehicle, and on in-use conditions that can cause vehicles to perform far below their tested efficiency rating.

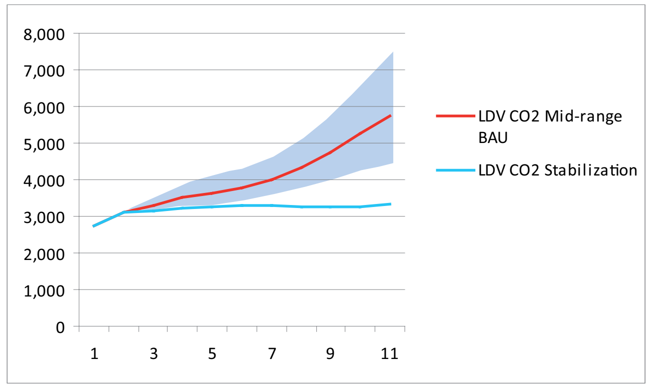
Improving fuel efficiency and promoting, newer, more fuel efficient cars, will also reduce other vehicular emissions that contribute to global climate change, especially N_2O and black carbon. Recent studies show that black carbon is likely to be the second most important contributor (next to CO_2) to global warming[5].

Figure 3 shows a potential business as usual (BAU) case roughly in the middle of the range shown in Figure 1. A second case ("Stabilisation") shows the potential impact of strong fuel economy improvement, as targeted in the GFEI. The 50% improvement in fuel economy (i.e. cutting stock energy intensity in half) by 2050 stabilises CO_2 at just above 2005 levels, down from the more than 100% increase that occurs in the baseline (business-as-usual) projection[6].

[5] See Ramanathan, V., Role of Black Carbon in Global and Regional Climate Changes, US House of Representatives Committee on Oversight and Government, October 18 2007 Hearing on Black Carbon and Global Warming, http://oversight.house.gov/story.asp?ID=1550

[6] Note that if the baseline increase in CO_2 is higher than shown in Figure 3, e.g. from higher than expected vehicle travel (as illustrated in the ITF scenario in Figure 1 above), then a 50% improvement in fuel economy will not be sufficient to return to 2005 levels or even to achieve stabilisation – in which case supporting measures will be needed.

Figure 3. **CO_2 emissions from more fuel efficient cars**
(MT CO_2 equivalent)
Improving new car fuel efficiency 50% could stabilise world emissions through 2050.



Source: ITF and IEA calculations using the IEA MoMo (January 2009)

Going beyond stabilisation and reducing emissions below 2005 levels would require a combination of strong measures. This could include, for example, achieving the 50% improvement in fuel economy of new vehicles globally by 2030 (or before) and maintaining progress beyond that target, e.g. via vehicle electrification and deploying other advanced technologies. It may also require a variety of measures to help manage growth in travel demand, encourage modal shift to more efficient modes like transit, and spur a shift to much lower carbon fuels like low CO_2 biofuels or electricity. A decrease of CO_2 emissions in the coming decades, compared to today's emissions, is possible but would probably require, in addition to a full use of present technologies, a breakthrough in for example battery technologies and pricing, and a wide application of the production of electricity from renewable resources. This would make electric vehicles a cleaner and cost effective competitor to combustion engine vehicles. High oil prices will further support such a shift. The GFEI will be key in supporting societies in moving in this direction if and when these circumstances prevail.

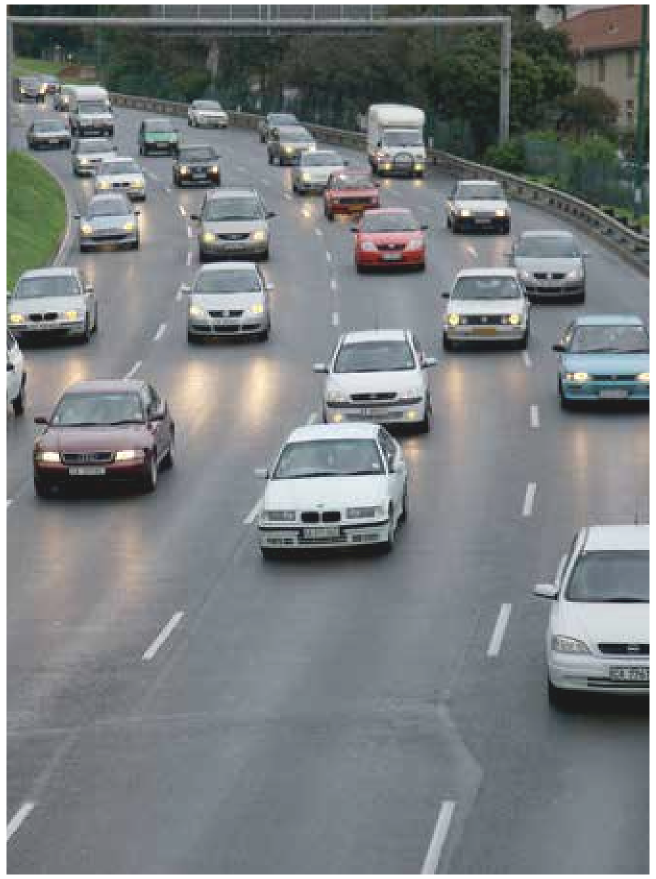
The Costs of Fuel Economy

The costs of introducing technology to improve the fuel economy of conventional engines and drivetrains by some 30% are likely to be relatively small, since increases in vehicle purchase price are likely to be mostly or fully compensated by savings on fuel within a few years of vehicle operation. Even cutting fuel use in half (50% improvement), including full hybridisation, will in many cases be paid for over the vehicle's life even with lower oil prices, when using a social cost/benefit calculation (with low discount rates) (IEA, 2008).

With higher fuel prices and/or high fuel taxes, hybridisation can pay for itself even using a private (e.g. 10%) discount rate for fuel savings[7].

However, despite the apparently good economics of improving fuel economy, consumers are unlikely to demand a 50% improvement in fuel economy without government intervention and pro-active industry action for several reasons:

- First, many technologies that can improve fuel economy can instead be used to increase the power of vehicles, a traditionally strong selling point for cars.
- Second, given consumer aversion to risk, and the presence of risks such as fluctuating fuel prices, manufacturers will not invest in new technology unless they are sure of selling cars equipped with it.
- Third, consumers need additional information when new vehicle technologies are introduced to ensure that they work properly, provide performance similar to standard technologies, and provide the cost efficiency claimed.



[7] Specifically, the IEA finds that full hybridisation, with some cost reduction over time, will pay back within 200,000 kms even with $60/bbl and no fuel taxes; and within 100,000kms (implying a higher discount rate) at an oil price of $120/bbl and $0.25/litre fuel tax.

Car buyers are naturally averse to taking risks. They are not inclined to pay a premium for improved fuel economy in the face of oil price instability. Car buyers also naturally seek a much shorter payback on any investment than government, which is able to make long term investments on behalf of society as a whole. This makes paying for significantly improved fuel economy unattractive to most car buyers, even if fuel savings would cover the additional costs of buying a superior vehicle.

Such attitudes are not unique to car markets but oil price volatility makes them a more significant factor than in many other consumer decisions. For car manufacturers, the effect is magnified as they are faced with large sunk costs for investment in new technologies. Fuel efficiency regulations can create the certainty required to make these investments.

It is true that higher fuel prices induce consumers and car manufacturers to pay more attention to fuel economy, but this is unlikely to fully counter the effects of short-termism and risk aversion. High fuel taxes account for much of the difference in the average size, power and weight, and thus vehicle fuel economy, between the United States and Europe but there remains a similar potential for improvement in both markets.

Looking further into the future, the costs of technological innovation are less certain. The cost premium for plug-in hybrid vehicles and battery electric vehicles are significant, adding as much as 50% to the price of a conventional car, depending for example on battery price and vehicle range. Expected near-term battery costs are expected to remain above USD 500 per kWh of energy storage capacity, or above USD 10 000 per vehicle for a vehicle with a 200 km range and 0.1 kWh/km battery efficiency. However, for plug-in hybrids with 50 km range, the battery costs in this example might only be USD 200, or well under USD 5,000, depending on efficiency and scaling issues. As battery costs decline, so will the costs of these types of vehicles. Taking into account lower running costs - electricity cost per km is likely to be well below fuel costs for gasoline or diesel vehicles - the net costs to many consumers may be acceptable in the near-medium-term.

Fuel economy improvements using existing technologies are estimated to be quite cost effective. They could have CO_2 reduction costs near or below zero USD per tonne through 2030, taking into account the likely value of fuel savings and assuming a social discount rate (or a private discount rate with fairly high fuel prices). Hybrids also have near zero net cost. Plug-ins also might be fairly low cost, assuming battery costs decline and vehicle driving range on electricity is modest. Pure electric vehicles and fuel cell vehicles are expected to remain quite expensive until 2030. However with successful R&D efforts and cost reduction via increased production scale and learning, their cost-per-tonne CO_2 could drop below USD 200/tonne, perhaps after 2030.

In any case, it is clear that achieving fuel economy improvements with conventional technologies and hybridisation are cost effective, and should be undertaken before embarking on more expensive solutions such as full electrification or introduction of fuel cells.

It is also unlikely in the short or even medium term (e.g. 5-10 years) that advanced technologies will become widespread in many non-OECD countries. As figure 2 shows, more than 80% of the vehicles which will join the world's fleet by 2050 will be added in non-OECD countries. Although a significant portion of the new vehicles added to these markets will be vehicles developed and/or produced in OECD countries, it is likely that the market share of vehicles specifically produced for non-OECD markets, in non-OECD countries, will increase. Fuel efficiency targets in this case will first and foremost need to be met with existing, cheaper, technologies. It is likely that the number of small, inexpensive cars produced in developing countries will significantly increase. But because of their small size and light weight there are good opportunities for these vehicles to significantly reduce fuel consumption with conventional technologies[8].

[8] An example is the recently launched Indian Tata Nano, a small care that will cost only USD 3 000 and reportedly will have a fuel economy of close to 5 l. per 100 km.

Policy Options

Few countries outside the OECD have developed fuel economy policies. Such policies will be needed to ensure progress and achieve the full potential for improvements over time. Possible interventions include fuel efficiency and emissions standards; standards for vehicle components; import controls; taxes and incentives for cars and car components; information campaigns backed by improved testing and labelling of cars; and fuel taxes. These are described below. Different approaches may make sense for different countries, depending on their individual situations, nature of their automobile markets and consumer demand profiles, etc.

Standards

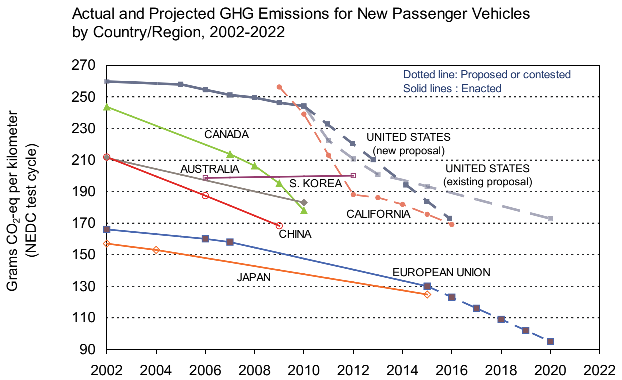
Fuel economy or CO_2 emissions standards are an effective way of overcoming the natural aversion to investing in fuel economy that results from the inherent instability of oil prices.

There are a range of approaches to standard setting across countries, and target rates of fuel economy improvement may differ, but all have the same goal of promoting more efficient new cars. Figure 4 summarises the fuel economy standards in place and under development around the world - making adjustments for differences in fuel economy test cycles in different countries[9]. The standards currently in place cover a relatively short period of time, none extending beyond 2016. It will be important that standards are renewed and tightened in order to keep fuel economy improving.

The **United States** introduced Corporate Average Fuel Economy (CAFE) standards in 1975 following the first oil crisis, in order to improve oil supply security. The Obama administration recently introduced a new fuel economy target of 6.6L/100km by 2016 - a 30% improvement over previous standards.

The **European Union** has adopted a requirement to improve efficiency around 18% over 6 years or more, a roughly equivalent annual rate of improvement compared to the United States (although starting from a much lower level of average fuel consumption). Average new car emissions in Europe were 160 gCO_2/km in 2006 (based on test results) and a new standard of 130 gCO_2/km is to be introduced with phase-in beginning in 2012 and full compliance to be achieved by 2015.

Figure 4. **Comparison of New Car Fuel Efficiency / CO_2 Emissions Standards**[10]



Source: Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update, ICCT. January 2009 update.

[9] The comparison of different standards is complicated by the existence of, among other things, different test procedures, different emission and safety regulations, and different compliance methods. Consideration of these issues is important to avoid misleading interpretations of such fuel economy comparisons (IEA, 2008b).

[10] The ICCT approach converts each regions's test numbers to a common (NEDC) test cycle based on modelling estimates. Therefore these are not the official numbers from each country's own testing system. For additional comparisons see IEA 2008b.

In **Japan**, fuel efficiency standards are developed using the "Top Runner" method. Standards are determined based on the vehicles whose performance is currently the best in the weight class (plus an escalation factor), with a lag time for other vehicles to improve to current best practice. This system was first introduced in 1999 for light duty vehicles (passenger cars and commercial vans). The standards required a 19% improvement in fuel economy by 2010 (in L/100km; equal to a 23% increase in Km/L). In 2007, additional standards were introduced which require a similar 19% improvement in L/100km (24% increase in Km/L) between 2004 and 2015.

Among **non-OECD countries**, only China currently has fuel economy standards. As an increasing number and share of new vehicles will be sold in the developing world over the coming decades, it will be important for rapidly developing countries to establish their own fuel economy regulatory systems.

The research on fuel economy improvement potential discussed in this paper clearly suggests that there is scope for progressively tightening standards over a longer time frame, with milestones for a 30% improvement over current levels by 2020 and around 50% improvement by 2030 or soon after.

Such standards would be valuable for increasing regulatory certainty for manufacturers faced with long investment cycles, enabling them to bring new technology to market. This could facilitate the development of plug-in and battery electric vehicles that will be needed if growth in demand for vehicles and vehicle use is not to rapidly outstrip emissions reductions beyond a twenty year horizon. In the longer term, indicative targets might also be possible to assist development of technology that involves much more than incremental improvement.

Vehicle Taxes and Incentives

Many governments tax vehicle purchases and most levy an annual tax on vehicle ownership or charge for an annual permit to drive on the roads. Ownership and/or circulation taxes can be differentiated on the basis of vehicle fuel economy or CO_2 emissions. Over the last few decades conventional (gasoline) vehicle technology has shown a natural rate of improvement of around 1% a year. In the United States, almost all of this potential has been taken up in power and weight increases, leaving fuel economy roughly constant over the past 25 years. In Europe, in the past decade about half of the potential was used for performance and half of it to improve fuel economy (Heywood, 2008). An increasing number of governments have therefore differentiated vehicle taxes according to their fuel efficiency or CO_2 emissions, charging higher emission cars more and the lower emission cars less. In Japan, tax incentives for fuel efficient vehicles were introduced in 2001, accelerating the penetration of fuel efficient vehicles, with 80% of passenger cars clearing the 2010 fuel efficiency standards by 2004.

Component Standards, Taxes and Incentives

Significant improvements in fuel economy can be delivered from improved vehicle components whose performance is not reflected, or only partly reflected, in the standard car fuel economy tests. Tyres affect fuel consumption considerably and up to 5% fuel savings can be achieved in the medium-term (IEA, 2007). Regulatory standards, labelling and tax incentives can all be used to promote a shift in the performance of tyres. Low friction lubricating oils can cut fuel consumption and can similarly be promoted by standards, labelling and tax differentiation. Air conditioners vary widely in the fuel they consume as do lights and other electrical equipment. Vehicle tests are performed with these switched off so they escape incentives for improved performance.

Ecodriving can be stimulated by car equipment to provide instantaneous and average fuel consumption readouts or prompt gear shifts to keep engine speeds down. The government of the Netherlands successfully stimulated widespread availability of such instrumentation on new vehicles by reducing tax on suitably equipped cars.

Fuel Taxes

Finally, governments set fuel taxes, and this has a direct impact on fuel economy. The 15% difference in the average fuel economy of United States and European cars is in large part a result of differences in the level of fuel taxes, although incomes and the design of CAFE regulations (favouring light trucks over cars) also play a part.

It should be remembered, however, that in most countries the primary reason for taxing fuel is that it is a relatively secure source of public funds. Fuel demand is less sensitive to price than many other goods and services.

Where they exist, taxes on carbon or related to energy security, are usually only very small parts of the total taxation on auto fuels. Existing fuel excise taxes in Europe equate to a rate of 200 to 300 Euros (EUR) per tonne of CO_2 emitted by cars. In comparison, the Stern report on the economics of climate change calculated the cost of carbon to be EUR 60 per tonne of CO_2 and carbon trades on the European Emissions Trading System at around EUR 25 per tonne of CO_2.

It might be argued that high fuel taxes (in those countries that have them) already serve the purpose of a carbon tax. This does not mean that there is no case for the other instruments available to cut emissions and improve fuel economy. As already argued, there is a potential for technology to improve fuel economy cost effectively 30% in the next decade but this will not be unlocked without fuel economy, emissions standards and other incentives even despite high fuel taxes. In reality, a combination of policy instruments is needed to ensure that fuel economy targets can be achieved.

Aligning tax incentives to provide consistent signals to consumers and manufacturers across international markets where the same models of cars are for sale also offers large gains in the effectiveness of fuel economy policies. The current situation in the European Union illustrates this point clearly. Many European countries have recently differentiated vehicle ownership and circulation taxes according to detailed segmentation of the market by CO_2 emissions band. As with labelling, the pattern of segmentation varies markedly from one country to another. The level of tax payable differs greatly too. Manufacturers face a fragmented market where tax bands and tax levels change frequently, increasing costs and inhibiting the manufacturer response to differentiation in any one country by effectively creating niche segments too small to make optimisation worthwhile. National labelling systems for vehicle fuel efficiency, moreover, are frequently based on an entirely different segmentation of the market. There is a clear case for international co-operation to bring order to these standards and tax systems. Greater alignment of fuel economy standards, labelling systems and tax systems internationally would have the advantage of providing vehicle manufacturers with common signals and would lower the costs of meeting the regulatory standards.

Testing

In many countries, cars are tested for fuel economy through standard procedures before being authorised for sale. The tests simulate a range of driving conditions, at highway speeds and at speeds more typical of urban driving. All tests generally underestimate the real-life fuel consumption of vehicles. The tests do not reflect the value of some technologies that cut fuel consumption and emissions in various "off-cycle" driving conditions. For example, systems that cut the engine while the vehicle is stopped at traffic lights or in congestion may be missed in tests that do not feature significant amounts of idling. With testing such a cornerstone of any policy to address fuel economy, improvements in existing cycles are needed.

In most developing economies, vehicles are not tested for fuel economy at all. Governments are perhaps best placed to introduce these tests because they affect sales of competing vehicles from competing manufacturers. In the absence of national tests, consumer organisations such as automobile clubs are well placed to develop test protocols and conduct or finance testing themselves, publishing results in the interests of their members.

Fuel economy tests for new vehicles differ from region to region. This is appropriate to the extent that typical driving conditions differ by region in a number of respects that affect fuel consumption. This includes prevailing urban versus extra urban driving patterns, ambient temperatures that determine the use of air conditioners, and so on. At the same time, there is dissatisfaction with current test procedures as everywhere, real fuel consumption on the road tends to be higher than the laboratory tests used to certify new vehicles. The discrepancy arises particularly in stop-go, urban driving conditions.

The World Forum for Harmonization of Vehicle Regulations of the United Nation Economic Commission for Europe (UN/ECE/WP29) has brought governments and automobile manufacturers together to work on a new harmonised test procedure to be adopted around the world. This may result in an increased focus on urban driving conditions, at least in regions that have least emphasis on these conditions in current tests, but may take many years to agree. In the meantime there might be merit in establishing a world standard "eco-test" as an additional and complementary standard test to provide drivers with information on the level of fuel consumption they might expect to achieve on the road. A global eco-test could include test variants that cover different types of driving conditions, allowing countries to use a weighted average of the variants to best reflect their own conditions.

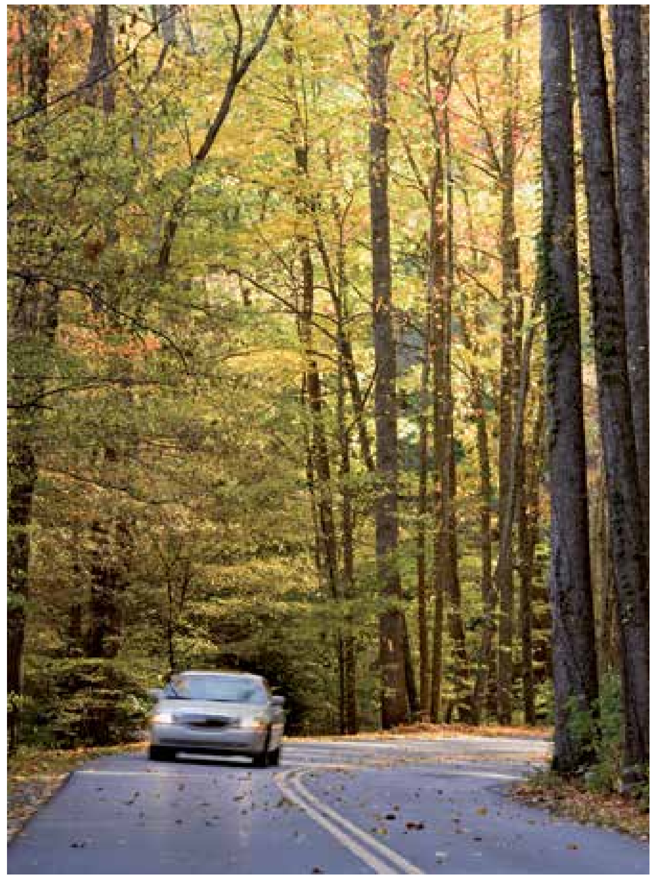
Labelling

In many countries, car showrooms are obliged to display the results of fuel economy testing with standard windscreen labels. Other countries are recommended to follow this practice. Recently, many countries changed their labelling systems to provide more realistic vehicle fuel consumption information and their CO_2 emissions. Labels must be linked to a uniform testing procedure.

Today's labelling schemes differ significantly, even between neighbouring countries. The wide range of labeling systems in the EU is particularly striking. Harmonisation of labels is desirable to provide consistent signals to consumers and manufacturers across international car markets This will improve efficiency and maximise their overall effectiveness.

Policy Alignment

There are likely to be benefits from some international alignment of fuel economy testing, tax incentives and labelling systems to provide increasingly global car markets with consistent signals for product development and marketing. For those countries that already have fuel economy policies, increasing alignment with other countries will only occur over time, as policies are renewed and adjusted. For countries and regions where policy-making is just beginning, alignment may be possible more quickly (i.e. via jointly developing similar policy systems across clusters of nearby countries).



Achieving the 50:50 Initiative

To help achieve the 50:50 target and interim targets (such as a 30% improvement in new cars, worldwide, by 2020), the four partners plan to take the following steps over the coming five years.

Data and Modelling

Better data and information would greatly improve understanding of the current state of fuel economy in various countries and regions around the world, the potential to improve fuel economy, and at what cost. There is in particular a lack of data for many non-OECD countries. The initiative will work in this area, including efforts to:

- Better determine the fuel economy baseline (e.g. average value for cars in 2008) for all countries and regions worldwide.
- Characterise recent trends and project expected future trends in fuel economy and other vehicle characteristics.
- Conduct a similar analysis for the entire stock of vehicles, with particular attention to age distributions and differences across vehicle vintage.
- Identify vehicle movement patterns (the trade of new and second hand vehicles around the world, and the characteristics of imported vehicles in developing countries).
- Summarise and evaluate vehicle-related policies in individual countries, identifying opportunities for policy improvements and optimal policy formulation.

There are obvious shortfalls in the availability of data for many countries and this effort will take time and require strong engagement of the project team with governments and research institutes around the world.

The initiative will benefit from the International Energy Agency's Mobility Model and data system, and from on-going analysis efforts by both the International Transport Forum and the UNEP-led Partnership for Clean Fuels and Vehicles.

Policy Development

The global initiative will support the development and strengthening of fuel economy policies by governments worldwide. A first step will be to better understand the relevant policy development processes and frameworks, and report on the current status of fuel economy policies in key countries.

On the basis of this information the initiative, led by UNEP, plans to develop a fuel efficiency policy "Tool Kit" which will provide information to governments and their partners on possible policies and action to improve national fuel efficiency. The Tool Kit will also include case studies and examples of regional and national fuel efficiency policies and initiatives.

In the first year of the initiative, a broad dialogue will be launched in countries around the world, with the possibility of developing more intensive work with organisations in a few countries, or regional groups of countries, based on expressions of interest.

To facilitate this policy dialogue, GFEI is planning to organise events at the global, regional and national level to promote fuel efficiency policy initiatives in general and the GFEI targets in particular.

Engagement of Stakeholders

The Initiative will engage governments, the fuels and vehicles industries, civil society and international organisations to better understand various views on and to work toward improved fuel economy.

Through direct meetings and via conferences and workshops, the Initiative will solicit inputs and suggestions for how to best move forward and promote fuel economy improvement in a manner that maximises benefits while minimising costs to all involved.

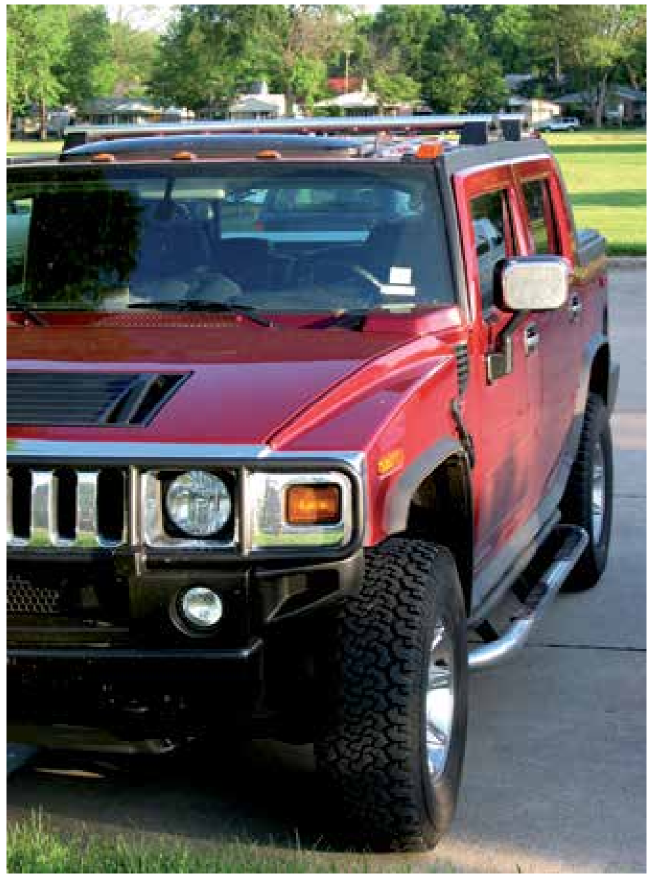
The Initiative will engage with stakeholders at the global level, to get them to support and adopt the GFEI targets and at the regional and national level, to work on practical projects and programmes to implement the GFEI targets.

Information Dissemination, Education and Communication

The engagement activities mentioned above will be accompanied by global and regional awareness campaigns to provide consumers and decision makers with information on options. From sponsored research, to events, publications and competitions, the GFEI will work with partners across the globe to create the sort of momentum for change that is needed.

Structured delivery of information, such as through fuel economy labelling programmes, will be a priority. Education efforts will also extend to raising consumer awareness of improving "in-use" fuel economy, such as through driving style, better vehicle maintenances, etc.

The four GFEI partners, FIA Foundation, IEA, ITF and UNEP, will periodically report on progress and outline detailed efforts and projects linked to the initiative. Updates will be available by visiting www.50by50campaign.org.



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50BY50

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Updated, October 2009