Towards a Global Approach to Automotive Fuel Economy - 2008 Symposium

May 15th-16th 2008 - FIA HQ, Paris

Summary of Workshop

On 15 and 16 May 2008, the FIA Foundation, International Energy Agency, International Transport Forum, and UN Environment Programme jointly held a multi-stakeholder roundtable workshop entitled *Towards a Global Approach to Automotive Fuel Economy* at FIA headquarters in Paris.

With the world motor vehicle fleet forecast to double over the next twenty years there is growing international concern about the combined challenges of improving air quality, avoiding dangerous climate change, and reducing fossil fuel consumption. As a group of organisations with these issues at the heart of our agenda, we were keen to consider in greater detail one element of the debate which we believe to be key, namely a global approach to automotive fuel economy. Such a sectoral approach could also be relevant to the post 2012 Kyoto protocol discussions within the United Nations Framework Convention on Climate Change.

The workshop included about 50 participants (list attached) ranging from high-level representatives from governments and NGOs around the world, to auto makers and suppliers, energy companies, and recognised experts on relevant aspects of fuel economy, vehicle technology and oil markets.

The primary objective was to explore the opportunities and barriers related to improving automotive fuel economy worldwide, including ways to speed up adoption of key technologies, avoid on-going losses of potential fuel economy improvements to ever-increasing vehicle size, weight and power, explore the role for alignment of policies over time, and better understand the current and likely future dynamics of vehicle markets around the world, and in particular the increasing role that will be played by developing countries in the future. Finally, we hoped to gain an understanding of the role that a new, coordinated, international initiative could play in making progress on this issue over the next 3-5 years.

The programme (attached) included presentations and lively round-table discussions of the key relevant issues, including global trends in automotive fuel economy, the potential contribution of fuel and vehicle technologies to reduce fossil fuel consumption, the role of fuel economy testing, labelling and standards, and of market mechanisms and pathways towards a global policy framework.

The following summarizes the presentations and discussions in the workshop, organised along the major themes (not by session). The session outlines and individual presentations are available separately. The points shown below were made at the workshop by various participants, and though there appeared to be broad agreement on many issues, the specific points were not explicitly agreed on by all participants. *Participants have not explicitly endorsed these summary points, though they have reviewed and commented on them.* Areas of uncertainty and disagreement are in some cases noted below.

We are headed in an unsustainable direction:

- Oil prices have reached all-time highs. The situation appears to be demand-driven, with potentially long-term supply constraints developing.
- One agency's baseline (business as usual) projection shows that the global light-duty vehicle fleet and its use of fuel could more than double by 2050, though high oil prices could dampen this growth somewhat.
- Nearly all the expected future demand growth will occur in developing (non-OECD) countries, with China and India among the major drivers.
- Many existing large oil wells are now in decline and just replacing this production will become increasingly challenging, apart from meeting future demand growth.
- Oil supply faces other problems such as imperfect competition – 80% of oil supply controlled by 8 nationalised oil companies. Insufficient rates of investment plus supply disruptions have also factored into current high prices
- In order to meet future demand, liquid fuels will likely need to be derived increasingly from unconventional sources (e.g. tar sands) and synthetic fuels (e.g. coal-to-liquids). Such fuels are more CO2 intensive than oil and would require even more CO2 mitigation. Even some types of biofuels could lead to higher GHG emissions (particularly when land-use changes are taken into account).
- The IPCC projects that the planet must cut energy-related CO2 by 50% by 2050 to keep climate change to a minimum (~2 degrees C).
- One company's new scenarios include "Scramble" and "Blueprints", roughly reflecting, on the one hand, a future where there is a scramble for resources, fears over energy security and insufficient attention to the environment and on the other hand a situation where coalitions emerge to take action earlier and move toward a more sustainable energy system including carbon trading. Clearly the world must move toward the Blueprints scenario. Scramble is simply not sustainable or acceptable as a way forward.

Vehicle efficiency improvement is a key to changing course:

- Improving vehicle energy efficiency is among the most important (largest potential impact) and lowest cost ways to cut fuel use and reduce CO2 emissions from transport.
- Beyond efficiency, further cuts in vehicle emissions per kilometre would require a major fuel shift (e.g. to low-GHG electric or H2 vehicles), with full decarbonisation of energy production/conversion. This will require massive shifts in investment patterns, e.g. no more coal plants but many thousands of wind turbines, solar panels, etc. added every year. Adding transport demand to, for example, clean electricity demand from other sources will make this challenge even bigger.
- Various recent studies (including three presented at the workshop) estimate that new vehicles globally can be improved by at least 30% (reduction in energy intensity) by 2030, cost-effectively, using existing incremental technologies. In the same time-frame an up to 50% reduction in energy intensity could be achieved via full hybridization of gasoline and diesel vehicles. Efficiency improvements beyond this are possible but may be much more expensive, e.g. via additional weight reduction, introduction of battery electric vehicles, fuel cell vehicles, etc.

- As shown in some scenarios at the meeting, by doubling new LDV fuel economy (cutting fuel intensity by 50%) by 2030, with full effects felt across the entire stock by 2050, we could limit LDV fuel use and CO2 to about current levels by 2050 even if global LDV travel doubles (if travel more than doubles, we will need additional measures to stabilize). Doubling efficiency along with other measures (namely managed travel growth, some shifts in travel to more efficient modes, and shifts to less CO2 intensive fuels), could allow us to achieve a 50% reduction in LDV CO2 emissions by 2050 relative to 2000 levels.
- Even achieving a return to year 2000 CO2 levels would save an enormous quantity of CO2 compared to baseline projections, building up annually (as more efficient cars are sold) to reach on the order of 1 gigatonne per year by 2025 increasing annually thereafter.
- A major challenge is to limit future increases in vehicle size, weight and power. In fact reducing vehicle weight and power (and even in some cases size where this makes sense and is acceptable, e.g. fewer large SUVs) could play an important role in achieving fuel economy targets (though 50% improvement is achievable through technical improvements with constant size/weight/power).
- Achieving greater energy efficiency is more than just making cars more efficient. It also involves the customer perspective and demand for more efficient vehicles. More broadly, it will involve decisions on how we travel – e.g. modal choices; a broad approach is required looking for low cost measures across the board.
- Efficiency also covers all the vehicles on the road – with a need to improve vehicle maintenance, promote eco-driving, and promote more efficient aftermarket parts like tyres and lubricants. Reductions in traffic congestion and improvements in road quality can also help.

The Developing world should be a major focus:

- Developing world car fleets are growing very fast – many countries' car fleets have doubled or tripled (or more) in just the past few years. Most of the growth in global fleet, travel, and energy use will be in non-OECD countries.
- Average use of a car can be up to 20 years in some countries – and developed country cars get transferred to developing countries, meaning that efficiency considerations must extend beyond new vehicle sales within countries.
- Markets are changing rapidly – need to look forward 5-10-20 years into the future to understand where developing countries are headed, not just look at today's situations
- In many developing countries (such as India) average fuel economy may currently be quite good (low fuel use per km), since cars are small with small engines. The challenge will in part be to maintain low fuel use as cars get bigger and more powerful, which will require new technologies and strong policies (e.g. fuel economy standards), as have been implemented in OECD countries.
- Improving fuel economy in the developing world can have co-benefits in terms of large fuel cost savings and reductions in some types of pollutant emissions. Some pollutants (e.g. black carbon) may be strong GHGs.
- A new generation of very small, relatively fuel efficient vehicles (e.g. Tata model) may change markets and provide better fuel economy than an imported energy inefficient 2nd hand vehicle. However if these vehicles are very low cost they will also likely increase the rate of growth in car ownership, so the net impacts are unclear.

- Cities are a key element – most people now live in cities and the share keeps rising. Policies related to spatial structure and transport infrastructure will have a big impact on transport patterns.
- Slowing growth of vehicle sales and reduced use of private vehicles (e.g. while maintaining higher transit use, creating better non-motorized transport facilities, etc.) can also create real benefits. Cities congested with car traffic suffer from (among other problems) low on-road fuel economy.

Measures are needed:

- Relying only on high prices (and current fuel taxes) to solve the oil dependence problem is dubious – consumers are very unreactive. With current oil prices at around $130/bbl (about 3x higher than 3 years ago), we are beginning to see significant reactions, but oil prices are notoriously volatile and we cannot rely on a consistent price signal.
- Various market failures were identified (e.g. high cost of aquiring detailed knowledge of fuel economy choices), though consumer disinterest in fuel economy it was also described as an institutional problem related to a market approach for a relatively low value vehicle attribute.
- Historically (though maybe changing now with high prices), few people have figured out their fuel consumption or calculated net cost/benefit of different fuel economy choices. Further, given uncertain future fuel prices and other uncertainties, people are risk averse, so they tend not to be willing to pay much extra now for what they see as being a risky bet on future returns (fuel savings).
- New measures should be taken, e.g. standards and tax incentives to promote cost-effective technologies, in some cases even focus on specific technologies (e.g. efficient air conditioners, tyres).
- There is a need for medium and long term targets – industry would benefit from a clearer picture of where society needs to be going over the next 10, 20, 30 years so they can plan effectively.

Designing measures:

- It is important to focus on the most cost effective measures if we are to get the maximum CO2 (GHG) mitigation with the limited resources available.
- Should uniform targets or attribute-based standards be considered? Too much correlation (between the attribute, such as weight, and fuel economy) could limit opportunities for fuel economy improvement. However, high correlation can increase the perceived fairness and the political acceptability. Gaming is also a concern with attribute-based standards (e.g. increasing size or weight to move to a less stringent class).
- Incentives or regulations are needed to limit vehicle size/weight/power and, in some cases, to encourage reductions in these. Weight reduction is an important fuel economy improvement strategy in any case.
- Fuel and vehicle taxes also affect fuel economy and can complement standards by sending direct market signals to consumers. Fuel and circulation taxes (e.g. .congestion charges) are probably more efficient overall, but vehicle taxes or

registration fees based on fuel economy or CO2 may have greater impacts on vehicle choice than fuel taxes do. Annual fees also affect choices of second hand vehicles.

- Vehicle tax systems around the EU are highly varied and fragmented, sending myriad different signals to consumers and manufacturers. Fuel efficiency standards vary substantially around the OECD.
- It is unclear how to structure policies for countries that mainly import (new and used) cars. Can such countries effectively use fuel economy standards? Or are import tax approaches more appropriate?
- Perhaps we should look at the design of standards around the world – they all work differently at the moment – should they start moving in a similar direction? Possible benefits for manufacturers – e.g. lower costs related to harmonized policies and similar market signals around the world, on the other hand markets and transport systems are very different in different countries, one size does not fit all.
- UN-ECE/WP29 is looking at harmonized test cycle, but their process will take time. In parallel it would be useful to consider an international reference test procedure well matched to the driving conditions of countries and cities (e.g. with more stop-start cycles) in order to reflect the predominant conditions for an increasing share of the worlds driving.
- There is a need for more and better consumer information – e.g. as related to vehicle fuel economy testing and labelling - around the world.

Current Measures by Country – Case Studies:

- **In the United States**, fuel economy is not a priority for people unless the oil price is up, but this creates a timing problem since it can take 5-10 years of policy lead time before real impacts are felt. U.S. CAFÉ law has finally recently been reformed profoundly (EISA legislation in November 2007, NHTSA rulemaking). The new approach is vehicle footprint based - each manufacturer effectively will have it's own standard. This allows for differences in positioning of different companies. Attribute-based standards– size (e.g. footprint) v. weight as the attribute – size was chosen over weight since a weight-based standard tends to remove incentives to reduce weight (depending somewhat on the slope of the line used). And a real problem if weight of fleet increases because it erodes the benefits of the standard. Thus you may need a backstop approach.
- **In Japan**, fuel use and CO2 from LDVs has been dropping in recent years. A range of coordinated improvements have led to this fall – eco-driving, traffic flow improvements, etc. The "Top Runner" approach is used to set the standards – i.e. standards are based on best practice (and expected best practice) in each vehicle weight category. A large proportion of vehicles already exceed the basic Top Runner standards; however, there are substantial differences between the tested and actual in-use fuel consumption. Top Runner is supported by green taxation has helped Japan to meet its 2010 fuel economy target 5 years early.
- **In the European Union,** voluntary fuel economy targets were first adopted in 1995. From 2007, a new integrated (and probably mandatory) approach is under development. This will include both improvements in the vehicle itself (as tested by the standard test) and elements from outside of that test (e.g. off-test-cycle components). The focus is on measurable/monitorable/accountable elements. They are considering an ultimate target of 95g/km with intermediate targets, probably starting with 130 g/km.

Timing still is uncertain. The standard will be weight-based with a carefully set slope in terms of stringency for different weight classes – the slope is in part set to achieve fairness and satisfy countries and automakers.

- **In India,** fuel price is critical – a prime consideration in choosing type of vehicle. The same new technologies are being explored in India as elsewhere. As Indians gain wealth, they are beginning to buy bigger vehicles; SUV sales are increasing. Regulations for fuel economy are under development, referenced from elsewhere; EU often used as a reference point. India wants to make cars and the car parts for the rest of the world, so must meet global standards. Other factors have an impact on fuel economy e.g. safety requirements, road conditions, driving habits – these factors play a particularly large role in India.
- **In China,** urbanization is key - Cities are growing very fast. Most of the big cities are as congested as anywhere in the world. Driving force for the fuel economy regulations – oil price etc – massive oil imports, and fuel prices subsidized. China took the Japanese Top Runner approach as a model and developed fuel economy standards by weight class. However the Chinese approach differs from Top Runner in that each model must meet a minimum requirement to be certified for sale (no averaging allowed). The "slope" of the standard and starting location of vehicle models on a weight/fuel economy graph suggests that the standard is more stringent for heavier vehicles and less stringent for lighter vehicles. In fact many US SUV models would not comply with Chinese regulations. Fuel savings from the standard have so far been impressive (over 1 million tonnes of fuel), but this has been overwhelmed by growth in vehicle population. China now needs a longer term plan and efficiency targets to keep the program strong and maximize fuel savings.
- **In Chile, i**ncome is the main determinant of how the individual gets around – people change mode as their incomes change. Above a basic income transit is used, toward upper incomes cars are dominant. Difficult to change this relationship. The same sorts of cars are on the market as in the EU. There is not much regulation of efficiency, the primary measure at this time is an incentive for hybrid vehicles.
- **In Brazil,** automobile companies are extremely important – Brazil is now the 7th largest auto manufacturing country in the world. Strong growth for both domestic and export markets. Older Brazilian cars often ran only on ethanol – but now 100% of Brazilian new cars are flexible-fuel cars. A program of energy efficiency was legislated in 2001 and the application of this program to the vehicles fuel consumption testing and labeling using the U.S. test cycle will be introduced next year. It will be a voluntary program without fuel economy mandatory standards. A standard label is to be applied on all high volume production cars.

Technology Considerations:

- Technology can be global, but application will often be applied differently depending on the local or regional context; for example, the cost effectiveness of a technology varies by car market segment and fuel price.
- Many incremental fuel economy techs are available at low cost and lots of new incremental techs are coming - but cost and impact differences do matter in terms of the types of vehicles and income levels, etc in poorer regions. Small cars in low-income countries may not justify use of some technologies used in larger cars in richer countries.

- The estimated cost of fuel economy improvements varies (different estimates were given at the workshop for different levels of improvement) but the technology cost associated with a 30% improvement in fuel economy appears likely to be under $2000 per vehicle (retail price equivalent). If so, this would be mostly or completely offset by the fuel savings over a vehicle's life at current (even well below current) fuel prices.
- Greater fuel economy increases costing several thousand dollars (e.g. hybridization) may not be fully paid for by fuel savings, though they could be, e.g. at higher fuel prices or using low social discount rates for fuel savings. Further, the cost of hybridization is expected to continue to decline.
- The best hybrids today can provide large efficiency benefits, though hybrid efficiency is quite variable (depending both on hybrid design and in-use conditions) and their advantage relative to conventional vehicles may decline over time as conventional vehicles improve and in fact begin to adopt certain hybrid technologies (such as idle stop/start). This suggests we will move toward a continuum of partial to fully hybridized vehicles, though full hybridization will remain a key part of maximizing vehicle efficiency over the next 20 years.
- Plug-ins are coming, but not clear how big a role they will play. Key questions mainly regard batteries, including their cost, energy density, power density, range and (the resulting) weight. Plug-in hybrid vehicle costs are likely to be high unless battery costs drop significantly. Lower range (on electricity) plug-ins will require fewer batteries (and be cheaper) but provide less oil savings. The fuel source of electricity generation will determine the CO2 benefits. Large scale introduction of plug-ins will need to be carefully managed.
- Diesel provides efficiency benefits compared to gasoline, and meets the same tough emission standards in OECD countries, but is still a dirty technology in the context of developing countries with poor fuel quality and lax emissions control requirements. Air quality is still a huge problem and a dominant consideration in most cities around the world. In coming years gasoline vehicles will likely narrow the gap with diesels on efficiency, reducing diesel fuel economy benefits. Low-sulphur diesel is a must before a pro-diesel policy is adopted in a country.
- Tech transfer – before China had standards the US and other car companies did not transfer any western pollution-control technologies into the vehicles produced and sold in China. But when China imposed it's first pollution-control standards they complied with the standard – though not beyond. Manufacturers have gone beyond compliance now – particularly as they were looking towards the 2008 renewal of standards. This suggests that standards (and possibly other policies) play a key role in technology transfer. There may be a tendency to see the technology as being 'good-enough' for one's country, not push too hard. And there is generally tension between environmental, energy security and economic development goals.

Role of Fuel Economy Testing:

- Currently different test cycles are used in U.S., E.U. and Japan. Though there is a reasonable understanding of how these tests compare, there is considerable uncertainty how the wide range of different vehicle types and specific models would perform on these different tests, and therefore how the fleet average estimates should be adjusted for comparative purposes. This makes international fuel economy comparisons difficult and unreliable.

- It is unclear to what extent each country needs to have its own testing system to reflect local conditions – conditions vary enormously even within each country and region (Greece or Athens are not very similar to Sweden or Stockholm). The main point is to be able to compare different vehicles to get meaningful, fairly accurate relative scores.
- One possible approach would be to create a few different test cycles, testing all vehicles on all cycles, then taking different weighted averages of the different tests for use in different countries with different average conditions.
- One testing system exists today that is increasingly being used around the world – the EU NEDC. Some wondered why not use it further? It could be the basis of some world fleet comparisons. At least it would offer a quick way forward while more complex approaches are under development. Others argued oppositely saying it may not be very representative for most countries/cities.
- As noted above, UN-ECE/WP29 is looking at harmonized test cycle, but their process will take time. In parallel it would be useful to consider an international reference test procedure well matched to the driving conditions of countries and cities (e.g. with more stop-start cycles than NEDC) in order to reflect the predominant conditions for an increasing share of the worlds driving.
- Policies to improve on-road fuel efficiency such as those promoting or requiring wider deployment of "off- cycle" fuel efficient components (such as a/c systems, after-market tyres) are needed. Promotion of eco-driving is also important.

Role of Industry:

- What people say and what they do is different – industry can help shape behaviours - environmental leadership is needed
- Industry can set examples (Toyota has cut energy use at factories by 44% since 2001)
- Need to step up cooperation – public/private/academic partnerships, identify long term targets and roadmaps. Industry should be part of the on-going target-setting process.

Role of other transport modes and fuels:

- Trucks, aircraft, ships are all big users of fuel, growing rapidly, and need attention, though outside the scope of this workshop.
- We must not forget rapidly increasing role of motorized 2-wheelers. These are efficient compared to cars, and provide tremendous mobility, but are unsafe.
- Biofuels – jury is still out, but likely to play some sort of long-term role; size and nature of role is uncertain; should not be relied on to solve the transport oil/CO2 problem.
- Electricity and H2 – in future, could be important fuels for transport but will take time and costs must come down.
- Role of buses in developing countries – currently dominant, but as people get richer they will buy cars on current trends. But high quality bus systems can still play a major role as they do in Europe. However current bus systems in the developing world are typically far below European standard. Huge investments are needed to change this.
- In China, sudden emergence of electric bikes – more than 10 million sold in 1997. Perform much better than motorbikes regarding emissions (particulates, VOCs NOx), but perhaps not as well as (or not much better than) a modern gasoline motorbike in regard to CO2 emissions (with Chinese electricity mix, largely from coal). This depends

on relative on the specifics of the electricity mix and the specific characteristics (e.g. efficiency) of the 2-wheelers being compared.

Need/role for a new global fuel economy initiative:

- Any initiative should be a public-private partnership at global level, OECD and non-OECD countries and organisations should be involved.
- Partnership for Clean Fuels and Vehicles – a successful model for action
- Development of global testing/rating/labeling systems could be quite useful
- Should include development of long-term targets in cooperation with, e.g. international agencies, countries, vehicle manufacturers – to come to a common agreement on where fuel economy needs to be in 10, 20, 30 years.
- Should include developing better information on vehicle sales/stock/fuel economy trends, vehicle movements around the world, cost of fuel economy technologies and improvements in different contexts, policy analysis
- Should provide support for countries interested in developing fuel economy policies, coordination of policy development in different countries
- Should support public dissemination of information, awards for leading car models and manufacturers, etc.
- ASEAN (SE Asia) countries – a possible early area of attention for such an initiative? Regional group a logical early adopter of a common approach to fuel economy policy. Latin American region also could be an area of common interest and early actions. Some early actions may also make sense for selected countries in Africa.
- Involvement and support should be sought from key international organisations like the World Bank, and from OECD national governments. Financial support (for an initiative and for countries' own efforts) could be sought from international systems such as GEF and CDM. All stand to benefit from large CO2 reductions from vehicles that such an initiative could help leverage.