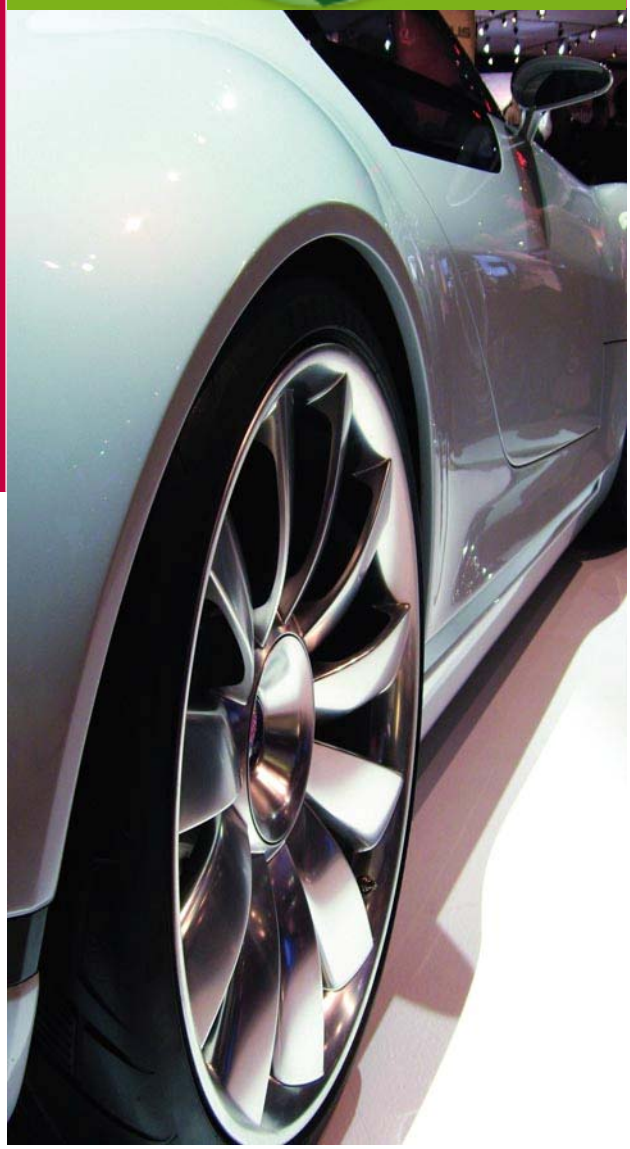
SECTOR REPORT

EUROPE

April 2009

CHEUVREUX

GREEN TECH



Green Cars

Electrify me!

■ At a dead end, the auto industry must reinvent itself

Our 2006 report "Environmental drivers take the wheel" highlighted a shift that has since clearly accelerated, while the automotive sector continues to strive to meet the challenges and opportunities to offer new greener modes of transportation. The current crisis has caught up with the automotive industry, which now finds itself at a dead end. Fuel mix diversification and green consumer services are key to securing positions after 2011.

■ Governments trigger the changes, so do consumers

Changes are being triggered by tightening regulations all over the world, requiring automakers to improve the energy efficiency of vehicles. Consumers are helping this shift, as demand is oriented via tax incentives and stimulus plans towards smaller and more sober vehicles. We estimate European regulation will bring total automobile emissions in the region down 8% by 2020.

■ Growth factors: electricity is a hot item…

We expect continuous progress on efficiency in internal combustion engine (ICE) vehicles as the first stage for meeting European requirements by 2015, then, eventually, a gradual shift to plug-in hybrids and full electric vehicles (EVs). We estimate these technologies will represent 4% of European sales by 2015 and up to 20% by 2020.

■ …and emerging countries have understood this

Emerging countries, and China in particular, are showing vivid interest in these electric technologies, which could help them to reduce oil dependence and health hazards in megalopolises. Automakers' growth in these regions will depend on these technologies and pricing position.

■ Future leaders are already plugged into this trend

Although automakers do not disclose their R&D and capex spending on greening technology, we have identified the companies that are deploying breakthrough innovation on a broad scale while maintaining cost control, and are set to be the future sector winners. **Volkswagen** and **BMW** are achieving major improvements in ICE, while **Renault** is implementing ambitious plans to open the mass market for EVs in the near future, and is thus well positioned to gain additional market share.

■ Who will supply future technologies?

With regard to auto component manufacturers, we have a positive stance on **ElringKlinger**, which benefits from a wide range of innovative products for lowering the CO_2 emissions of vehicles, as well as **Michelin**. Moreover, batteries are an important element in the electrification of vehicles, but manufacturers are mainly Asian. The only European exposure is through **Saft**, which we also consider an attractive stock choice.

Summary

The industry has no other choice but to reinvent itself

In our report "Environmental drivers take the wheel", published in 2006, we highlighted the bend the automotive sector had to take if it was to meet the changing environment. But the industry was reluctant to move while the trend towards greener transportation accelerated. The crisis has caught up with the automotive industry, which now finds itself at a dead end. The automotive sector uses 58% of the world's oil supply and is responsible for 21% of greenhouse emissions in Europe. Diversification of the fuel mix and consumer service are strategic keys for its survival and performance after 2011.

Governments are triggering the changes via regulation and incentives to stimulate and orient demand

All over the world, regulations are forcing change, obliging automakers to offer more efficient models. Europe leads the way with a double-geared directive: a lukewarm objective for 2015 of 120g/km of CO_2 for new vehicles sold, and an ambitious target of 95g/km by 2020.

Consumers are playing their part with a clear shift during the last few months towards smaller and more sober vehicles. This distortion of demand was initiated by attractive tax incentives implemented by States and is continuing thanks to ecological criteria included in the scrapping premium designed to stimulate the market.

Two growth factors: emerging markets and electricity!

We foresee continuous progress and improvement in ICE vehicles to secure the first European requirements by 2015 (downsizing, for example, explains the majority of the progress made in terms of energy efficiency by automakers between 2006 and 2009). Then, alternative fuel vehicles will gradually phase in from 2012, opening the way to plug-in hybrids and full electric vehicles, which, in our bull scenario, should represent 4% of European sales by 2015 and up to 20% by 2020. Automakers will have no choice but to offer increasingly efficient models. Electricity is particularly appealing for emerging countries, and notably for China, in order to reduce health hazards and oil dependence. Success in terms of growth and market share in these regions will depend on automakers' alternative vehicle offer and their pricing position.

Future leaders are already plugged into this trend

R&D and capex spending on green technologies are a hidden secret in the industry, but we believe the future winners will be companies showing a technological lead in terms of more efficient engines, such as Volkswagen and BMW, and those that have implemented strong plans to open the mass market for EVs, such as Renault, or PHEVs, like the Japanese automakers. However, cost control will be necessary to survive until 2011.

But keep an eye on cash!

The sole key word at present is cost-control. However, R&D efforts are essential now more than ever. This is why the financial health of companies is primordial, but the use of cash is not to be underestimated as it is increasingly decisive.

Supplying the future technology: a good asset to weather the crisis

The auto components groups that offer technologies that enable CO_2 gains are set to benefit from significant growth of their products. However, to play this theme, investors will not necessarily have to choose the company with the best technology, but the one that will be most resilient in the crisis and be able to sell this technology at competitive prices. ElringKlinger and Michelin are one of these.

But for both EV and PHEV, battery technology is the chief obstacle to developing mass-market alternative vehicles. Saft is the only European play on this market, and is a fairly attractive stock choice.

THE AUTOMOTIVE SECTOR: TO PLAY THE GREEN CAR THEME

Players	Rating	Green perf. ranking	Comments
			Automobiles
VOLKSWAGEN	3/Underperform	1	Substantial improvement in CO_2 cuts with new model line-up Strong R&D capability and available technologies to make further progress
RENAULT	1/Selected List	2	Strong focus on downsizing, weight reduction and diesel technology Average CO_2 fleet emission already among the best in Europe
BMW	3/Underperform	3	Best performing premium carmaker regarding CO_2 reduction Latest fuel saving technology available for basically all models
FIAT	3/Underperform	4	Lowest CO_2 fleet emission among all European carmakers Focus on smallest car segments likely to retain leading position in coming years
PSA	3/Underperform	5	Expertise in diesel technology and mix, biased to small cars
DAIMLER	2/Outperform	6	Lags somewhat behind BMW in implementing fuel reduction technologies Higher mix compared with BMW makes CO_2 targets harder to achieve
PORSCHE	1/Selected List	7	Most fuel-efficient sports carmaker. Absolute level of emissions will remain above volume carmakers Management plans to achieve specific CO_2 targets that differ from targets for volume carmakers
			Auto components
ELRINGKLINGER	2/Outperform		Basically all products of EK serve to lower vehicle weight or increase engine yield and hence CO_2 emissions
VALEO	3/Underperform		A commodity supplier that is progressively turning into a specialist in low consumption technology: altogether, all its technology propositions can reduce CO_2 emission by up to 45%
			Tyres
MICHELIN	3/Underperform		Low rolling resistance is at the heart of group's strategy, notably for passenger and truck tires. Regulations on tires labelling, which is likely to be enforced in the next few years in Europe, should strengthen the group's leadership (technology and pricing)
			Electronics
SAFT	2/Outperform		The only player in Europe to be exposed to battery expertise. Saft benefits from a resilient and cash generative business and, through its JV with Johnson Controls, it could grab several additional growth opportunities

Source: CA Cheuvreux

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I— Greening the energy mix: it's time to speed up

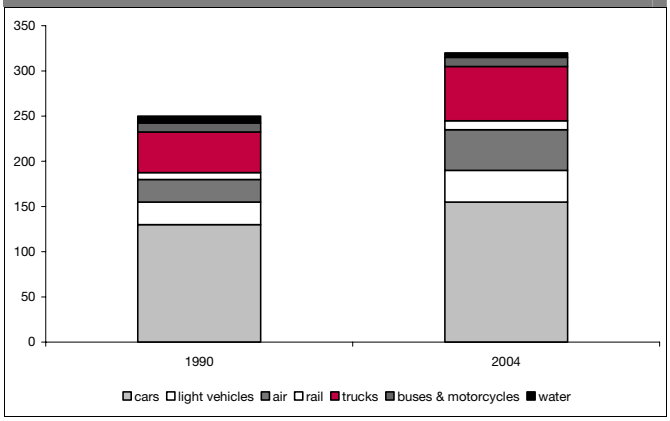
Since the birth of the auto industry, internal-combustion-engine (ICE) vehicles have conquered the world, providing incomparable flexibility in mobility, but have become oil guzzlers and led to very high dependence on fossil fuels. It is urgent, for the climate as well as for international relations, to change the paradigm and create diversity in the fuel mix for vehicles. Two paths are opening: the plug-in hybrid (PHEV) and the full electric vehicle (EV), but this implies structural changes and innovations.

Fossil fuel alone: the limits of the model

The share of transport in final energy consumption is 30% in the EU-25 as a whole (384 Mtoe in 2004), up from 29% in 1996 (304 Mtoe). While in most western European countries, growth in the energy consumption of transport has slowed since 2000 (by around 0.9% p.a. over the period 2000-2005), it has been very rapid in the new European countries (4% p.a.).

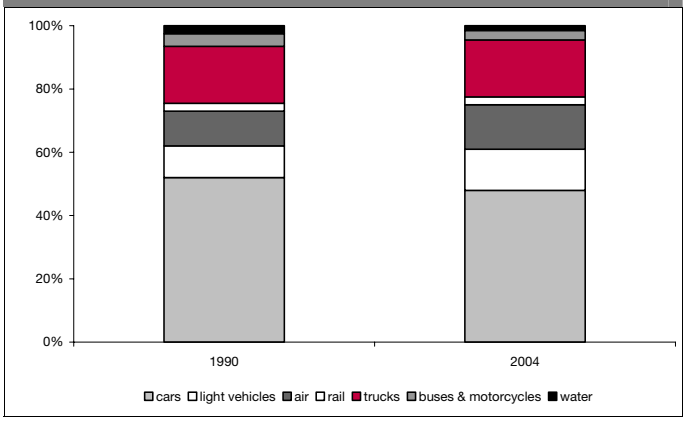
Road transport represented 83% of the total energy consumption of transport in 2004, of which **two-thirds for passenger transport (cars represent 80% of passenger transport).**

ENERGY CONSUMPTION OF THE EU-15 BY MODE OF TRANSPORT (in Mtoe)



Source: Enerdata, Odyssée

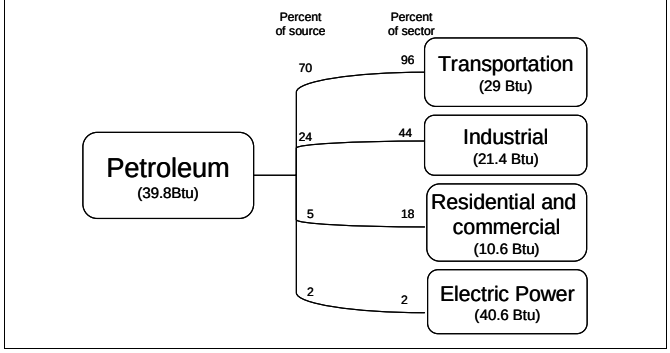
ENERGY CONSUMPTION OF THE EU-15 BY MODE OF TRANSPORT (as a %)



Source: Enerdata, Odyssée

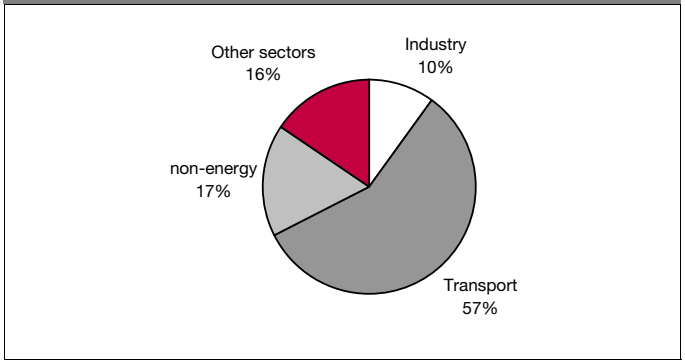
Transport consumes 58% of oil-based energy

US PRIMARY ENERGY CONSUMPTION BY SOURCE AND SECTOR, 2007



Source: Energy Information Administration

WORLD OIL-BASED ENERGY CONSUMPTION BY SECTOR IN 2004



Source: World Energy Outlook

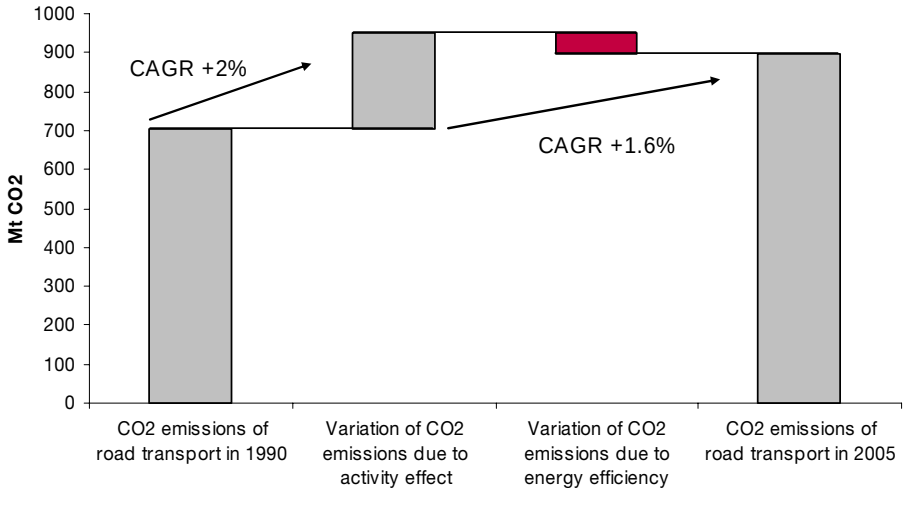
In 1973, transport was consumed 42% of world oil energy but, while other sectors have switched to other energy sources and have become more efficient, transport has not found any other source of energy and increased its share to circa 58% of oil-based energy consumption in 2004.

Transport did not find any other source of energy and increased its share to circa 58% of oil-based energy consumption in 2004

Road transportation consumes 60% of total oil consumption in the EU. The inefficient use of fuel in cars not only results in unnecessarily high emissions, but also increases the threat to Europe's energy security and depletes world oil reserves**. Moreover, 19% of all carbon dioxide emissions in the European Union stem from passenger cars and light commercial vehicles and emissions in absolute terms continue to grow. Despite the fact that average reductions of 12.4% per new car were achieved in the decade to 2004,** the emissions from cars increased by 25% (45% for road goods transport). However, CO_2 savings have offset 20% of the increase in CO_2 emissions since 1990. **The transport sector was 12% more energy efficient in 2004 than in 1990 in the EU-25. Most of the gains come from cars.**

Growth was due to the increasing number, power and weight of new cars

CO_2 EMISSIONS TREND IN TRANSPORT IN THE EU-26



Source: Odyssée

The cause of this growth lies principally in the increasing number of cars and the congestion they generate as well as in the power of new cars, which increased by an average of 28% over the decade to 2004, greatly exceeding the 15% increase in their weight although no government has raised road speed limits.

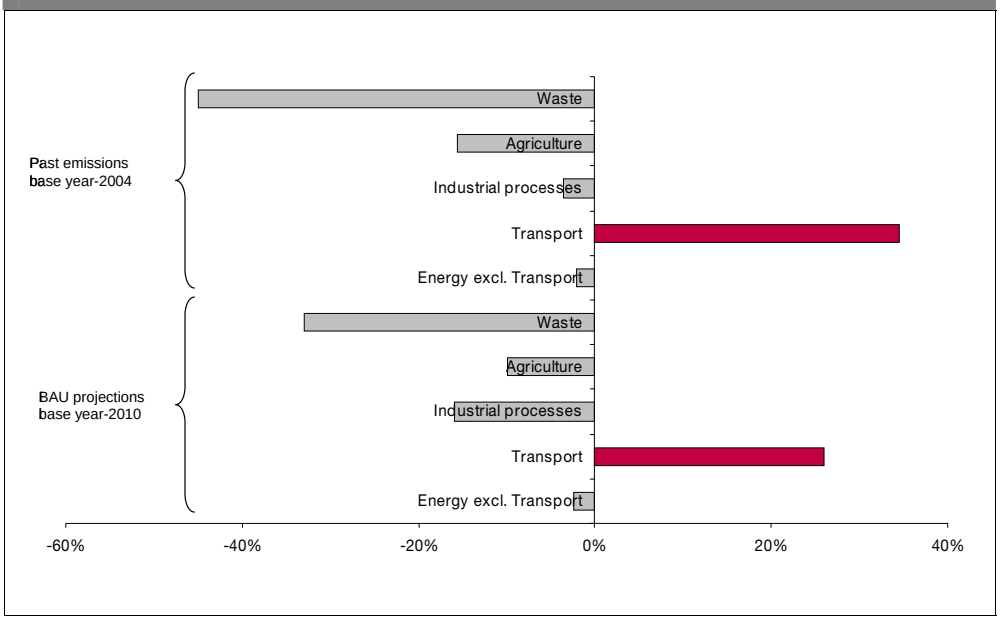
Clearly, this does not assist the European countries in meeting their target of reducing CO_2 emissions by 10% by 2020 for non-ETS sectors.

The story of an unkept promise

Whilst the motor industry made a voluntary commitment to reduce average emissions of new cars manufactured in Europe to a maximum of 140g CO_2/km by 2008, average emissions from all new cars sold within the EU-25 market amounted to 158g CO_2/km in 2007 and are unlikely to be less than 150g CO_2/km by the end of 2008, the European Commission agreed to introduce binding legislation to require automakers to reach the target.

However, it is important to underline that most of the energy efficiency gains come from cars and that there has been no efficiency improvement for road freight transport since 2001 while this is a mode of transport with very rapid growth in energy consumption. This sector is likely to come under scrutiny from the European Commission in the next few years to make things change (note that trucks already have specific EURO standards to curb polluting emissions such as NOx and particulates).

CHANGE IN EU-15 GHG EMISSIONS BY SECTOR



Source: EEA

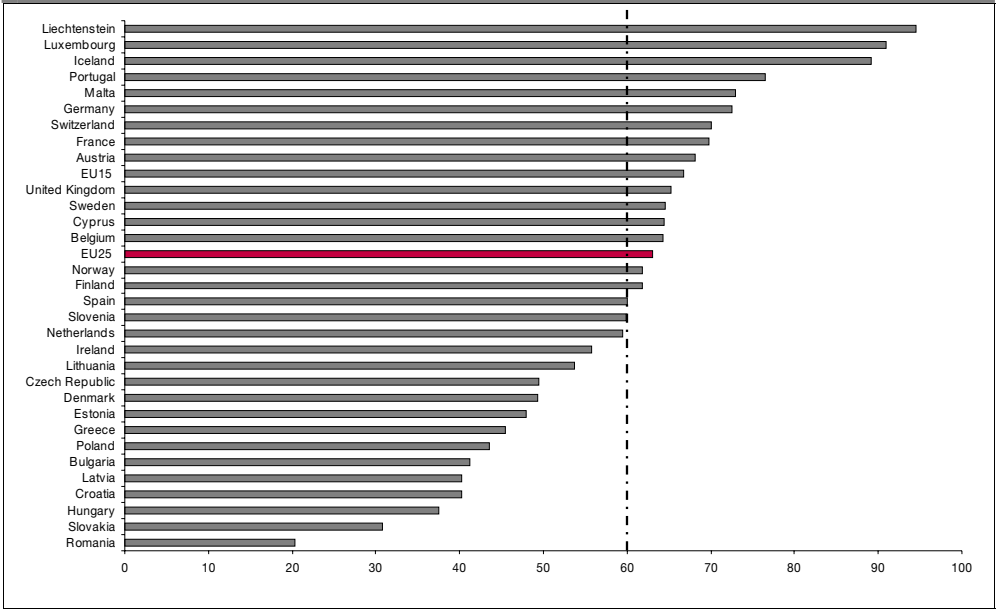
It is urgent to introduce diversification of the energy mix to decrease oil dependency, curb climate change effects and address new segments of demand.

■ Diversifying the transport alternative: is this a consumer option?

As previously stated, 80% of passenger transportation is by car because of the flexibility it offers. However, we believe that, in Europe, many countries have now reached market saturation with car ownership of over 60% in the active population (between ages 19-85). This is far from being the case in emerging countries, and this is why automobile market growth has been driven by these emerging countries in the last decade.

Many countries have now reached market saturation with over 60% of car ownership in the active population

VEHICLE OWNERSHIP PERCENTAGE IN EUROPE FOR THE POPULATION AGED 19 TO 85

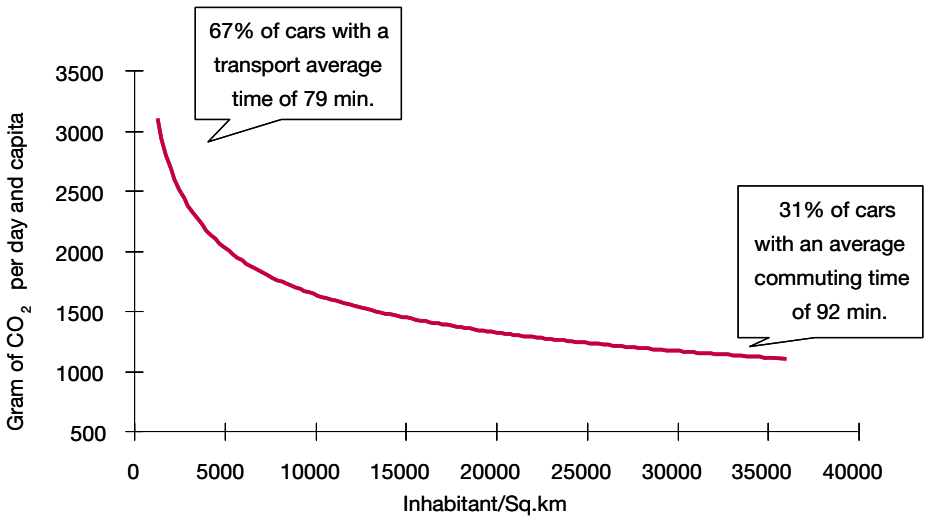


Source: Eurostat, CA Cheuvreux

In saturated markets, and especially in urban centres, governments have been trying to introduce alternatives to promote better mobility through the development of public transport. However, studies show that the number of vehicles per person increases proportionally to GDP, and there exists no economy in which public transport such as the train is sufficiently developed to be a real alternative to the car in terms of flexibility and price before the market is truly saturated with individual cars.

Thus, up until now, the developed economies have all reached the point of saturation of car ownership before the massive development of different modes and increased efforts on mobility.

IMPACT OF URBAN DENSITY ON ENERGY AND CO_2 FOR URBAN PASSENGER TRANSPORT



Source: ADEME, 2007 (INRETS, 1995)

In developed countries, we believe automakers should also work on the evolution of usage to increase growth potential and thus develop a business model based on usage, which is commonly called functional economy.

Beyond car ownership, a new business model

Urban centre policies against congestion and the development of public transport may trigger a change in consumers' choices. We believe car ownership is not the only solution, especially in major metropolitan areas. For the consumer, car sharing could be an appealing alternative to car ownership, because of both its low cost and convenience in urban areas:

- The cost of car sharing (CS) is 4 to 6 times lower than ownership;
- The user has the guaranty of parking, an important issue in dense urban areas;
- Car sharing is adapted to urban centres with a dense public transport network, as it favours inter-modality. One can leave the car at any location in the CS network.

We believe selling the function rather than the product is a rising trend in developed economies (in fact, we are preparing a report on the functional economy). Xerox is a prominent example of the success of the functional business model. During the 1990s Xerox moved from the business model of selling copy machines to document management services. Renting its copy machines has enabled Xerox to implement a highly efficient take-back, remanufacturing and reusing system. Its consulting arm helps customers eliminate redundancies in their copy machine installed base. Although this has an adverse effect on sales, it yields a potentially significant competitive advantage.

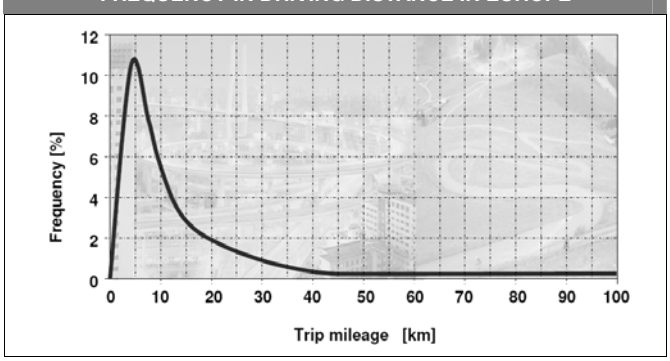
Likewise, car sharing is self-predatory for automakers (it reduces the number of vehicles in use), but we believe it will play an important role as it is more competitive and attractive to the consumer.

Diversifying the energy mix: the industry option

We believe the diversification of the energy mix alternative will be an important driver for future growth because of this deep segmentation in consumer demand

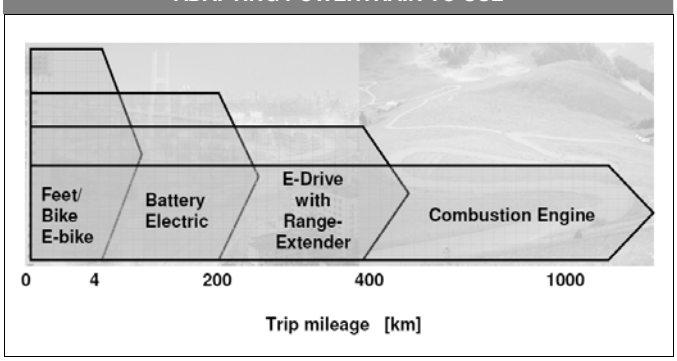
As reflected by the diversification of products and formats, we believe the demand- side has profoundly segmented over the years. Today, consumers can find a large choice in terms of engines from 1 litre up to 6 litres, in diesel or in gasoline. However, the offer remains limited to ICE vehicles. Segmentation has not yet been explored in other fuel technologies. We believe Toyota has been successful, in terms of marketing, with the Prius, because it introduced a new concept, which is meeting a demand, perhaps emerging, of consumers that are looking for another type of product. We believe the diversification of the energy mix alternative will be an important driver for future growth because of this deep segmentation in consumer demand.

FREQUENCY IN DRIVING DISTANCE IN EUROPE



Source: Volkswagen

ADAPTING POWERTRAIN TO USE



Source: Volkswagen

Limits of the combustion engine: not yet reached… but almost

The maximum yield of a diesel engine would be 25% while that of an electric propulsion chain is set to reach 70%

The average yield of a car propelled by a combustion engine is only 18% (maximum yield of 36%). Engineers believe that it would be possible to increase this average yield to 21% (maximum yield of 42%). For a diesel vehicle, the yield is 23% and could reach 25%. Note that the steam engine had a yield of 4% and that the best yield of a combustion engine is around 53% which could be reached by boats. This is explained by the fact that a boat runs at a stable rate whereas cars are required to run at very variable speeds. The rest of the energy mainly dissipates into the atmosphere in the form of heat.

In comparison, an electric propulsion chain would deliver a much better yield, of around 70%.

The improvement underway: downsizing and Kaizen

All carmakers now offer 'downsized' vehicles, i.e. a combination of a lower-cylinder motor and a turbo (and direct injection in some cases for gasoline engines) to maintain **equivalent performances**.

For example, a Renault Laguna 1.5-litre dCi (diesel) engine offers horsepower of 110, equivalent to horsepower of 115 delivered by the 2.2 litre engine of the old Laguna (1994 version) and thus reduces its consumption by 32%.

Downsizing is behind the lion's share of the progress made in terms of energy efficiency between 2006 and 2009

This is in fact the process that explains most of the progress made in terms of the CO_2 emissions of carmakers between 2006 and 2008.

In most cases the technology combines improvements in terms of aerodynamics, weight (even though the trend remains toward heavier vehicles) and reduction of friction inside the engine.

Continuation of this trend is even pushing carmakers to market new very small models (for example the migration of Audi towards the A2 and A1 series, the new Tata Nano, the Toyota iQ etc.) which enables each company to lower its average CO_2 emissions.

On the other hand, we see carmakers communicating on the launch of downsized motors up to one year in advance, a major change compared to the usual secrecy surrounding such launches, and which reflects the strategic nature of these new engines. Thus, Renault very recently announced the development of several downsized motors such as TCe with a cubic capacity of between 0.9 and 1.2 litres and a future 1.6 dCi 130 engine emitting 25g/km CO_2 less than a current 1.9-litre diesel.

According to a study conducted by the Boston Consulting Group, a combination of advanced ICE technologies can give a gasoline-based ICE a maximum 20% boost in fuel efficiency at a cost increase of USD2,100 per engine. For diesel-based ICEs, these technologies offer a 10% boost in fuel efficiency at a cost increase of around USD1,400 per engine.

Euro5 and Euro6 standards could lead to a changing fuel mix

We could observe a shift from diesel back to gasoline in small segments

As described on page 29, Euro5 and Euro6 standards will impose massive reduction of NOx and particulates matter for new diesel vehicles in 2010 and 2014. These pollutant emissions are curbed thanks to post-treatment solutions such as SCR (Selective Catalytic Reduction) and Particulates Filters. These post-treatment technologies not only add weight to the vehicle but render the vehicle more expensive by an average of EUR500. Therefore, for A and even B segment cars, such technologies will prove too expensive. For these categories, it will be easier for automakers to offer efficient gasoline vehicles than diesel ones. As a result, we might observe a shift from dieselisation back to "gasolination" of the sales, especially in the smallest sales categories. This is certainly why we see more and more gasoline downsized engines being produced. In the past ten years in Europe, R&D has been massively focused on diesel engines to look for better yields,

but European automakers will now have to improve efficiency in gasoline motors. Japanese automakers are clearly ahead on this topic, as diesel is not sold in Japan.

Biofuels, LGP and GNV – these alternative energies are losing speed

The idea and the possibility of making a car compatible with several types of fuel is not new, but has nevertheless not yet been achieved despite the flexibility of the system. Gas, natural gas, ethanol (E85), why choose? Fiat will offer a 'MultiEco' Multipla that can function using the three fuels. The sales of cars running on natural gas, which benefit from a very attractive bonus in Italy, are finally taking off: 85% of the sales of Sandero (Dacia – Renault-Nissan group) in Italy are vehicles that run on natural gas. It is cleaner than gasoline but that does not solve the problem of our high-carbon economy: particles that are barely measurable and 90% less NO_x and CO_2 reduction of around 25%. PSA has announced the generalisation of its E85 and B30 compatible sales on its European fleet (80% of sales in Brazil are already of ethanol flexfuel cars). However, this only happens when the infrastructures for this type of fuel is developed, which is the case of natural gas in Italy. The lack of adapted infrastructure still curbs sales significantly elsewhere.

Moreover, the sharp criticism of first-generation agrofuels, their role in the steep rise in agricultural raw materials prices and their low gains in terms of CO_2 emissions have contributed greatly to curbing the development of E85 pumps. They have also led some carmakers to keep a low profile with regard to E85 and B30 compatible models and to reposition their message on second-generation agrofuels. This is the case of Volkswagen, which has mentioned agrofuels such as Choren's Biomass to Liquid (made from wood chips) and logen's ethanol made from straw as diversification solutions for energy sources in the medium term. However, these second-generation agrofuels do not appear to be more advanced than the research on batteries for electric vehicles.

Gradual hybridisation, by common consensus

The Stop & Start function is also being considered by all the carmakers. This technology is now established on the market after a difficult start and a commercial flop for PSA, the first to integrate it on a Citroën a decade ago. However, efficiency gains are limited (around 6%).

In order to obtain significant results, a second-generation Stop & Start is a better option, with a battery that recovers the kinetic energy delivered by braking, called "mild hybrid".

After working on the downsizing and incremental technologies to increase the efficiency of the Golf (from 139g/km to 119g/km, Volkswagen plans to further reduce the emissions of its star product with Stop & Start, with energy recovery and its new 'DSG' automatic dual-clutch gearbox, which will gain another 20g/km!

No European automakers are convinced by the full hybrid, except PSA with the diesel hybrid. All opinions converge on a plug-in hybrid instead

European carmakers all have the same message regarding the full hybrid, as unfurled by the Prius: no one really believes in it, unless a plug-in hybrid is obtained. Note that a classic hybrid can only function on electricity alone for a few kilometres (3 or 4 on average). With the plug-in technology, it is believed that electric autonomy of 50 kilometres could be reached, which would be a real step forward.

However, note that PSA is working on a diesel hybrid for 2011 (already two years late in terms of the announcement made at the start of 2008), first on its high-end models, as it is still unable to reduce costs sufficiently.

Today, a full hybrid bears an extra cost of around USD7,000 compared with a conventional ICE car. But the cost of hybrid components is expected to decrease by some 5% per year so that by 2020, the incremental cost of a full hybrid should fall to around USD4,000 for an average reduction of 25% to 30% of CO_2 (according to BCG).

The next big thing: Electricity – EV vs. Hybrids

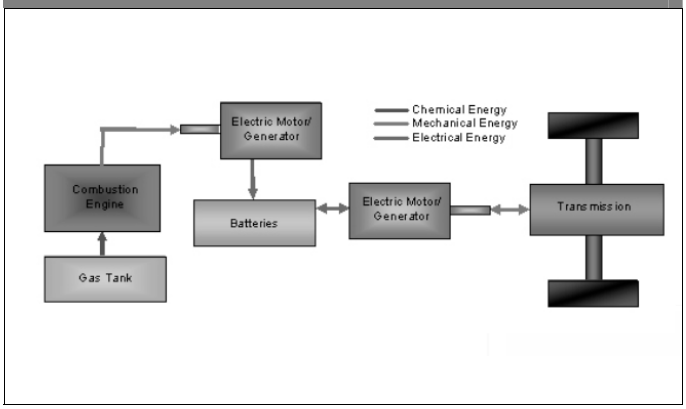
Plug-in hybrids: achieving hybridisation

The plug-in hybrid electric vehicle (PHEV) is an upgrade of the full hybrid. It includes a larger battery that can be charged with electricity from the grid. Both General Motors – GM Volt - and Toyota – Plug-in Hybrid Prius – have made official announcements that they hope to release a plug-in hybrid by 2010. There have also been some notable efforts to sell plug-in conversion kits for current hybrid vehicles but these systems are not yet cost-efficient enough to be widely practical. To date, there has not been a commercially released PHEV due to technical obstacles and impractical costs of the battery.

GM VOLT

Source: GM

GM VOLT: LAYOUT



Source: GM

The "twin drive" unveiled by Volkswagen is innovative: it is set to be a plug-in hybrid with two motors, one combustion and the other electric, functioning alternatively. The particularity of this model is it would have no transmission, which would reduce the total weight of the vehicle and considerably lower the price as well.

Electric cars: the real surprise

The fully electric vehicle is the last step on the electrification path.

2008 was marked by a significant reinforcement of the message for full electric vehicles. After the announcements by Renault and Nissan of projects for electric vehicles in partnership with "mobility suppliers" (e.g. Project Better Place for the deployment in Israel and Denmark) as of 2010 (for Nissan) / 2011 (for Renault), the rivals have adapted their message (so as not to appear to be an outsider, just in case!) although with projects that are more or less ambitious such as Volkswagen, which wants to gradually integrate electric vehicles into its fleet (the same target with Lithium-Ion as French automakers, ten years later). Lithium-ion battery technology will likely be used for automotive applications, thanks to its high energy density and long durability.

For both EV and PHEV, battery technology is the chief obstacle to developing mass-market alternative vehicles

Daimler announced a partnership with RWE to develop electric vehicles in Berlin, where 100 e-Smarts will be put into circulation as of end-2009 (with 500 charging points). BMW has also launched a plan for small electric vehicles for megalopolises with a production plan for 100,000 units p.a. from 2015 (Renault wishes to reach 500,000 vehicles produced p.a. as of 2016). As for Fiat, it is promising an electric Fiat 500… soon.

Outside Europe, automakers such as Nissan, Mitsubushi and GM have stated their intention to release EVs and have developed various vehicle concepts such as the Nissan Denki Cube, Pico2, Mixim and the Mitsubsihi i-MiEV.

In short, a lot of announcements for full electric this year, while there had been no news for years. But many manufacturers remain cautious, even wary: Volkswagen does not see EV taking off before 2025…

Renault is even talking about a radical change in the business model adapted to this technology. We are favourable, but it will require the continuation of public investment (subsidies), and the mobility partner will have to honour its part of the contract.

EV could in fact completely change the whole automobile concept. The heating system would have to be re-worked and thus the entire chassis. Moreover, the absence of an engine and transmission would make significant space for the interior.

For both EV and PHEV, battery technology is the chief obstacle to developing mass-market alternative vehicles.

Today, lithium-ion batteries cost about USD2,000 per kW because production volume is still low. Industry experts expect the cost of these batteries to drop to USD500 to USD700 per kW by 2020. Assuming a cost of USD600/kW, a 25kWh battery, which is needed for an electric driving range of 100 miles (about 160km) would still cost USD15,000. These costs are assumed to be cut dramatically in the event of technological breakthrough.

The future of the future: Hydrogen – "range extender"

Ten years ago, fuel cells were to take over the market in 15 years. However, at present, we believe that another 15 years will be needed for these vehicles to really be developed. The technological barriers, and especially costs, have not been lifted. The limits are still the same, storage is still very difficult and platinum still expensive and scarce. Excluding a few prototypes (BMW H7), nothing definite.

For some observers, hydrogen is a means of largely tackling the main flaw in electric vehicles, namely autonomy.

The environmental dividend of future technologies

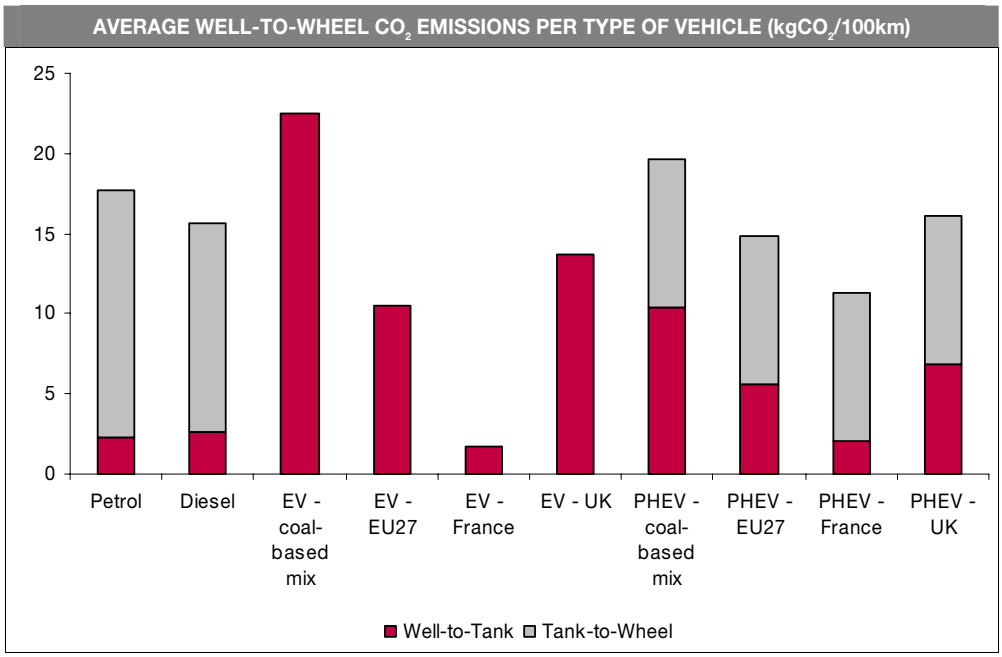
Global warming, the hottest issue

We carried out a life-cycle analysis of GHG emissions, based on assumptions we view as reasonable, in order to assess the effect of introducing electric or plug-in hybrid vehicles on the energy consumption of passenger cars. Numerous articles have been written on this subject, each one presenting widely varying results. In order to better understand the issue, we present the following assumptions for each of our scenarios:

- The calculation of emissions from oil extraction and refining (Well-to-Tank) is based on the conclusions of a well-to-wheel study widely used by the automotive industry that was carried out jointly by EUCAR (European Council for Automotive R&D), Concawe and the Joint Research Center of the European Commission.
- For internal combustion vehicles, we assume average consumption of 130g of CO_2 per km for diesel engines and 155g/km for gasoline engines.
- For electric vehicles, we propose several results depending on the mode of electricity production.
- For plug-in hybrids, we assume typical usage based on the New European Driving Cycle (NEDC), which is used to assess the emission levels of car engines. This driving cycle assumes that 6.9km are driven in a non-urban cycle and 4km in an urban cycle. Thus over the lifespan of a vehicle, we assume that it will spend 36% of the time in town and thus run in electric mode, i.e. 40% electric consumption and 60% fuel consumption. This is obviously a debatable breakdown.

More generally speaking, it is important to note that this analysis has not been carried out based on overall individual mobility usage. Indeed, looking at the usage of electric vehicles, we would be tempted not to base our scenario on the current European average of 15,000km travelled by ICE vehicles, but on an average of daily trips in town plus several weekend trips (see also the chart showing the frequency in driving distance on page 9). In addition, this is likely to result in a transfer to other modes of transport (rail, air, rental cars, etc.) as substitute means of mobility. Moreover, the electric vehicle is ideal as either a household's second car (i.e., to replace a small internal combustion car by a small electric car but not as a substitute means of transport) or the main car for a household living in the city centre that, on average, takes the train or plane to go on holiday more often that the rest of the population. As a result, we use a simplified assumption of usage equivalent to the usage of an ICE vehicle, i.e. an average distance travelled of 15,000km p.a. for electric vehicles as well.

The appeal of the PHEV or the EV depends chiefly on the carbon intensity of the region's electricity grid



Source: CA Cheuvreux

In conclusion, the appeal of the plug-in hybrid or the electric vehicle depends chiefly on the carbon intensity of the region's electricity grid.

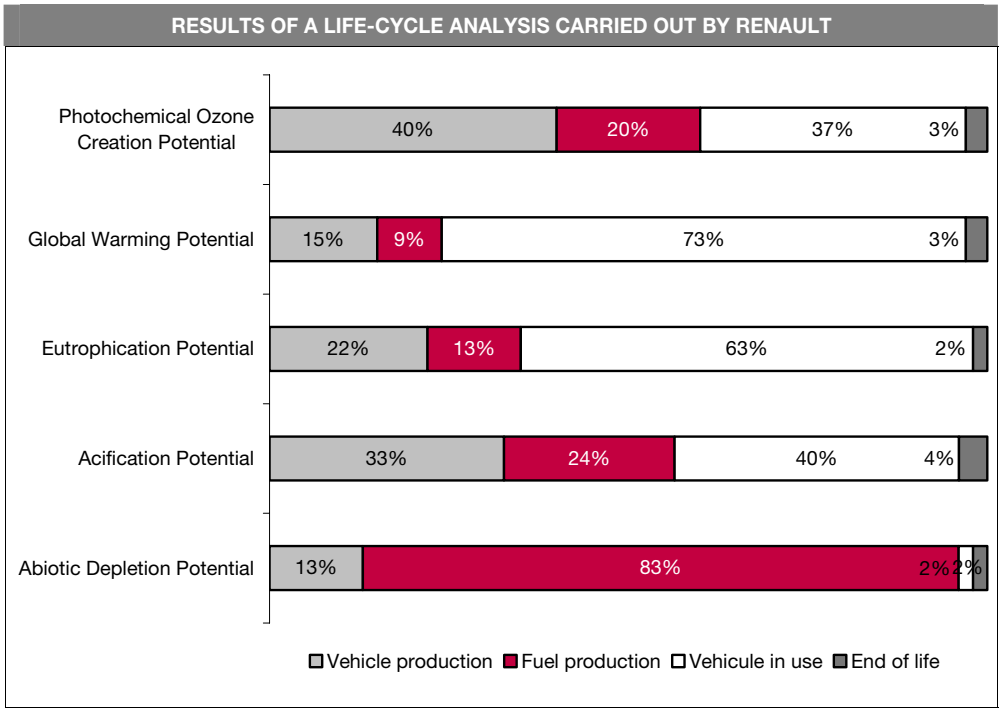
Although it does not provide a real alternative to oil dependence, the plug-in hybrid could enable a level of service similar to that currently experienced in developed countries and thus make up for the main flaw of the EV, i.e., the lack of autonomy.

Going forward, the EV could be a solution to the problem of storing renewable energy. In this respect, the electric vehicle is the best solution to questions of mobility. One of the issues of relying on an increasing proportion of renewable power is its intermittent nature and the energy wasted by coping with the peaks and troughs of the electricity demand. Under a scheme called vehicle-to-grid (V2G), electric cars would be used to balance out those peaks. While today's EVs are charged by the national grid, in a V2G scenario it would also be possible to reverse the flow of electricity so the cars could supply the grid with power.

Other environmental issues: resource depletion and local pollutants

In order to have a more complete view of the choice to be made between EVs and hybrids, other environmental criteria, which are just as important as climate change, have to be taken into account.

The chart below shows the main environmental issues for cars according to a lifecycle analysis carried out by Renault.



Source: Renault

An electric vehicle in use does not emit local pollutants that are harmful to human health

Note first of all that an electric vehicle in use does not emit local pollutants such as unburnt hydrocarbons and nitrogen oxides (HC, CO and NOx), not to mention particles, all of which are clearly harmful to human health (they contribute to respiratory disorders, increased allergies, etc.). In the "Well to Tank" phase, there is:

- Air acidification and photochemical oxidation formation: Air acidification is largely due to emissions of gases such as sulphur oxides, nitrogen oxides and ammonia. Photochemical ozone creation occurs with hydrocarbons and nitrogen oxides.

At the power-station scale, the impact is localised and easier to manage

- EV production causes these effects when the electricity used is produced via the combustion of fossil fuels. This could be reduced dramatically in the case of the French electricity mix by using nuclear power or renewable energies. There are no tailpipe emissions of sulphur oxides or nitrogen oxides, which could potentially help achieve better air quality in urban environments. The higher impact associated with the EV is due to fuel extraction, transport and combustion at fossil-fuelled power stations (particularly coal). This impact is localised and no longer at national scale, hence it is easier to manage and less harmful for the population as a whole.

- Abiotic resources depletion: this concerns non-renewable resources (measured in kg Sb-equivalent, antimony-based comparison factor).

- As we can see in the chart above, this issue is clearly significant (83% of the well-to-tank phase) as fuel depletion is considerable.

Battery recycling is viewed as possible

- Electric vehicles have a lower abiotic resources depletion impact compared to traditional internal combustion vehicles as the contribution to resource depletion is only via the natural resources needed for the battery. There has been commentary recently concerning the potential impact of increased production of lithium-ion batteries on lithium availability and prices. A report from the USGS (US Geological Survey) on lithium reserves states that there is a world reserve of 4.1 million tonnes with a reserve base of 11 million tonnes. This means that 4.1 million tonnes are economically recoverable, with the remainder being proven geological reserves, but not necessarily economical to recover at the present time. John Searle of Saft, a supplier of lithium cells to the automotive industry, has been quoted in Automotive Engineer magazine saying that the quantity of lithium in a lithium-ion battery amounts to just a few grams (i.e., less than 2% of the battery's weight), implying that lithium used in batteries has minimum impact on reserves even if production were to be scaled up. The issue of lithium depletion could potentially be mitigated if it is possible to recycle successfully the lithium from end-of-life batteries back into a material that can be used in new lithium-ion batteries. Renault sees this as a must-have when launching the first EV (2011 in Europe) and believes that such a process is possible.

Scenario for diversification – and the impact on utilities

Our growth assumptions for plug-in hybrid and electric vehicles sales are as follows:

Bear-case scenario:

- 355,000 vehicles en Europe in 2015 (2.7% of the market),
- 700,000 in 2018 (5.2% of the market) and
- 1 million in 2020 (7.4%)

Bull-case scenario:

- 525,000 in 2015 (4% of the market)
- 1.45m in 2018 (11%)
- 2.66m in 2020 (20%)

This would result in a CAGR of 44% for the bear scenario and 27% for the bull scenario.

We believe that EVs can integrate more easily and more rapidly in the urban landscape of countries in Asia such as China and India, etc. where:

- Mobility behaviour is not set in stone and it will thus be easier for users to accept the limits of electric car mobility (limited autonomy, long recharging times).
- As city centres are extremely congested, the distances travelled are actually very slight, and as long-distance weekend trips are not very common either, the electric car seems perfectly adapted to this environment.
- Lastly, record levels of pollution in terms of airborne particles in major Asian cities such as Karachi, New Delhi, Katmandou, Dacca, Shanghai, Beijing and Bombay cause some 2 million deaths a year due to respiratory and cardiac problems and lung cancer. Electric cars could also help make these megalopolises healthier.

Impact on electricity consumption and production

Let us take the extreme assumption that these thousands of vehicles sold are all electric vehicles.

The impact on annual electricity production in Europe (from the fleet of EVs) comes to 2,328GWh in 2015 in the bear scenario and 3,256GWh in the bull scenario, then 6,865GWh and 17,345GWh, respectively, in 2020. By way of comparison, on average a

More than 1 tranche of EPR would be necessary in a bull scenario to produce enough energy for all the electric vehicles in circulation in Europe

coal-fired power plant generates 4,200GWh p.a., a gas-fired plant 2,450GWh, a nuclear plant 7,200GWh and an EPR 13,260GWh p.a. For enough electricity to be produced to supply all the electric vehicles in Europe, a maximum of 4 new coal-fired plants, 7 gas-fired plants, 2.4 nuclear power plants or 1.3 EPRs would have to be brought on stream, in the best-case scenario of electric car technology being developed in 2020. That said, in order to fine-tune our assumptions, we have to take into account the fact that these cars will generally be recharged overnight or in off-peak periods during the day, which will contribute to smoothing energy consumption and thus to using base-load production and not peak-load.

BCG (Boston Consulting Group) calculated that in 2020 investments totalling USD21bn will be needed for battery-charging infrastructure (stations near homes, hotels, shopping centres, etc). Besides, for power companies, it is hard to make a business case for public electric-charging infrastructure.

In conclusion, we see two unavoidable conditions for seeing EV and PHEV take off and deliver on environmental promises:

- Rapid deployment of infrastructure networks to avoid a growth cap as we saw with natural gas;
- Governments will have to subsidise these vehicles to seize the opportunity to generate economies of scale and dramatically reduce the battery costs (see page 38).

II— How to play the theme

Because regulation and fiscal incentives are all pushing towards more efficiency in cars, it makes sense to favour an investment strategy with players that are adapting well to this environment. For automakers, technological performance linked to energy efficiency is key as well as investments to enable rapid deployment of the alternative vehicles of the future. For auto component suppliers, technology is not the only criterion to take into account: competitive pricing is also of major importance. For both, financial health to overcome the current crisis and maintain enough investment capacity to launch innovative concepts is of primary importance.

■ Automakers: fine-tuning arbitrage between cost control and innovation boldness

Our stances on automakers with regard to the theme of energy efficiency in particular reflect both the competitive importance of offering as of present very efficient vehicles (increase in the current performance) as well as the undeniable strategic interest of having already made investments and showing a certain lead on tomorrow's technologies. Note that, to be ready for the electric technology in 2011, Renault has committed to dedicating all necessary investments before end 2009. Conversely, this second facet of our opinion is more qualitative as the differences in terms of investment made on these technologies cannot be clearly distinguished from one carmaker to another.

AUTOMAKERS VEHICLE EFFICIENCY STRATEGY

BMW		Suppliers
Results & commitments	1 million vehicles already equipped in "Efficient Dynamics" technology	
	20 models (1, 3 and 5 series) < 140g/km	
Medium-term gradual improvements	Four-cylinder petrol engines with high precision injection (piezo injector)/ variable twin turbo for diesel	
	Six-cylinder engine with twin turbo/variable twin turbo	BorgWarner
	Start & Stop function with brake energy regeneration (BMW1 and 3 Series with 4-cylinder and manual transmission)	Bosch
Long-term technology strategy	"ActiveHybrid" (X6 and 7 series ready for series production by 2009): a full hybrid	
Our opinion	**We were very impressed by the improvement achieved by BMW since 2007 to reduce its CAFE. We believe the group will benefit from its focus on efficient premium cars as soon as gas prices begin to rise again and customers' fuel price sensitivity rises again. On the other hand, the group has experienced a deterioration in its operating margins due to a mix shift towards smaller cars which is a clear negative for the short-tern investment case**	
DAIMLER		
Results & commitments	Target: 40% reduction of 1995 CAFE level: 138g/km by 2015-2007 performance: 181 (vs. 169 expected on a linear trendline)	
Medium-term gradual improvements	Stratified charged gasoline injection: second-generation gasoline direct injection systems	
	DIESOTTO technology package includes direct injection, turbocharging, variable valve control, fewer cylinders, lower displacement and automatic start/stop feature.	
	Flexfuel Natural gas vehicles	
	Start & Stop for Smart, A and B class. 49% stake in Li-Tec owned by Evonik group	
Long-term technology strategy	“e-mobility Berlin” Electric Smart in Berlin (100 veh. + 500 charging points provided by RWE) by end of 2009 – serial production to start in 2010 - and in Italy (1,000 by 2010 - partnership with Enel). To be launched by 2012 on the market.	
	HEV: Mercedes S-Class 400 in 2009 (gas+e). Diesel+electric to come.	
Our opinion	**Daimler has not yet focused on a single technology to reduce emissions. It was among the first to introduce hydrogen powered vehicles, but in buses only. It lags roughly one year behind BMW in introducing technologies (e.g. start stop) to cut fuel consumption. The new E-Class is an important launch to speed up that process. Daimler recently formed an alliance with the German battery maker Evonik. It will launch the first available European luxury hybrid model (S-Class hybrid) next year.**	
FIAT		
Medium-term gradual improvements	Flexfuel: Natural gas + gasoline (Panda, Multipla, Doblo, Punto)	
	Stop&Start for Diesel	
	Two-cylinder engine	
Our opinion	**Fiat's number one worldwide position in terms of CAFE is mainly due to its product mix overloaded with small cars (almost 47% of 2007 sales made only by Panda, Punto, Palio and Siena). The company is clearly lagging in terms of coming evolution and it has not positioned on a long-term strategy.**	
PORSCHE		
Medium-term gradual improvements	Direct fuel injection, VarioCam Plus and lightweight construction – in-house development	
	Cayenne and Panamera Hybrid – hybrid partnership with Continental	
Our opinion	**Thanks to its merger with Volkswagen group, Porsche is sheltered with regards to the European Commission target. Within the sports car segment, Porsche vehicles are the most fuel efficient. The launch of the Cayenne diesel (2009) and hybrid versions of the Cayenne (2010) and the Panamera will help to lower fleet emissions.**	

Source: CA Cheuvreux

PSA PEUGEOT CITROEN		
Results & commitments	The group sold almost one million vehicles emitting less than 130 g/km of CO_2 worldwide in 2008, with a 46% share of the European market in vehicles emitting less than 110 g/km of CO_2	
Medium-term gradual improvements	Downsizing (>-10% CO_2)	
	Flexfuel E85 and B30	
	Natural gas (206 in Iran, C3, C4 picasso, Berlingo/Partner)	
	Micro-hybrid 2nd generation: C3 + massive development (1/2 sales by 2011 in Europe; <-15% CO_2)	Valeo
Long-term technology strategy	Full hybrid "HYbrid4": diesel engine+EV. 4WD; piloted manual gearbox; by 2011 on 2 models (4km electric-powered)	Bosch
	Plug-in Hybrid (50km electric-powered)	
	Electric cars provided by Mitsubishi	Mitsubishi
Our opinion	**PSA had to scrap its plan for high volumes on hybrid diesel for cost reasons. It will use it for its premium plus offering on both brands, Peugeot and Citroën. It has just released a partnership with Mitsubishi for one EV by 2011, while it has been saying for a long time it did not believe in this technology. However, the group is on track to meet its 2015 objective with a fairly good performance in terms of CAFE and commitment to develop micro-hybrid massively.**	
RENAULT		
Results & commitments	At the end of 2008, target almost reached with 920,000 vehicle< 140g/km (i.e. 60% of sales) vs.1m promised and 335,000< 120g/km vs.30%.	
Medium-term gradual improvements	Downsizing (1.5 dCi; 1.2 TCE 100 ; 1.4 TCE 100; 0.9l TCE to be launched) – Twingo, Clio, Modus, (Scenic, Laguna only in diesel) –Internal development, turbocharger provided by various suppliers-	
	Start & Stop	Valeo
Long-term technology strategy	Electric Vehicle is the main long-term strategy with operational steps: 2011 for Renault (2010 for Nissan). Partnership with a "mobility operator" such as "Better Place" and local government.	
Our opinion	**Renault has the most affirmative EV strategy of all automakers. It has committed to remain in the top 3 in terms of CAFE and has established a clear long-term challenge: mass market for EV. It is addressing the challenge smartly, building partnerships with local States and "mobility partners" to secure infrastructures and incentives for EV. We believe this is an ambitious and bold project which naturally implies risk but long-term high reward as it could emerge as the early mover in a breakthrough technology.**	
VOLKSWAGEN		
Results & commitments	105 vehicles <140g/km incl. 24<120g/km. Each new model has to emit at least 10% less CO_2.	
Medium-term gradual improvements	Downsizing on every engine. (V6 replaced by 4-cylinders, 1/3 lighter) 1.4l tsi twin charge	
	Double clutched automatic gearbox (DSG) saves 5-15% fuel	
	Second generation biofuels	
	Stop & Start on Blue-Motion by mid 2009	
Long-term technology strategy	Hybrid only for high-range vehicle (will be very expensive) by 2010	
	"Twin drive" (Plug-in + engine gasoline without gearbox) currently on test in Berlin (partnership with E-On) plan for 2015-2017.	Sanyo
Our opinion	**Volkswagen is finally coming out with a very attractive medium-term evolution with the next Polo, Golf and Passat (representing c. 30% of its sales) reaching impressive levels of efficiency (respectively 87, 99 and 109 g/km of CO_2). We believe the group will therefore meet its target without difficulty. However, the future is more blurred with a strategy going from second generation biofuel to hydrogen fuel cell through a progressive electrification of its fleet to reach plug-in hybrid with the innovative twin-drive concept and even full EV, but only after 2020. We like some of their projects although the full array of technology seems difficult to manage in our view.**	

Source: CA Cheuvreux

Cash is king

The crisis has hit the auto sector severely. The market plummeted by more than 17% in December in Europe, the most brutal downturn ever seen. Despite the intervention of States to rescue the industry and boost demand, the companies have been widely affected and, for some of them, remain on the brink of bankruptcy (GM, Chrysler…). In this context, cost-control has been the key word, jeopardizing R&D budgets and employees. **Arbitrage in cash spending is necessary**. It is interesting to note, however, that no **carmaker is cutting its strategic long-term effort on future clean powertrain**, preferring to postpone or scrap some model derivatives which anyway would have generated low return in such difficult car markets. The industry as a whole, through its lobbying structure, the ACEA, has asked the EU for some help to finance new technologies: The EIB will provide for up to EUR400m for each carmaker to develop clean powertrain.

R&D and cost-cutting plans

It is hard to differentiate carmakers on their strategic involvement through their R&D efforts. The total investment ratio in R&D remains within a range of 4% to 6% for the whole sector. Structurally, most of it is spent on development of new models and a marginal part is dedicated to advanced research, notably powertrain. In this crisis, the arbitrage in cash spending (Renault is cutting its R&D efforts by 15%) is made in favour of long-term fuel efficient technology and at the expense of some marginal models that are either postponed or even scrapped.

Regulatory requirements basically prevent any cutback on CO_2 reduction related capex. Moreover, it appears that the strong focus of European regulators on CO_2 reduction massively reduced efforts to reduce other pollutants such as NOx. The auto industry has virtually no other choice than to manage lowered capex budgets on CO_2 reduction, simply due to a lack of any further resources to follow other projects: take the entry version of a BMW Z4 which retails for EUR30,000 in Europe vs. EUR24,900 10 years ago. The price increase that equals a 2% annual price inflation did not - in our calculation - trigger any EBIT margin growth, despite substantial efficiency increases in its production within the 10-year period. The vast majority of the price hike of EUR5,100, plus efficiency gains, were reinvested into the car, mostly into safety improvements and reduced fuel consumption.

Regrouping R&D entities to avoid cash burn

The fact that automakers are not working together anymore on R&D is rather a good sign. Indeed, as soon as a specific technology is foreseen as a competitive advantage and a strategically standpoint, automakers work separately. For a long time, for example, they have gathered forces to work on hydrogen, with no results. But now, EV and PHEV are on the brink of being effectively produced by some carmakers and it would no longer make sense, even for the sake of cash, to regroup R&D entities as it clearly is strategic. Note however that on EV, Renault is developing the technology entirely with Nissan and its partner on battery NEC. The ultimate differentiation will be on the model offered to the customer. After development, the technology and production of the powertrain and battery would, eventually, be shared, with no effect on branding.

■ Auto-components: play the theme but not necessarily the technical leaders

EUROPEAN AUTO COMPONENTS SUPPLIERS: OFFER AND EXPOSURE TO THE ENERGY EFFICIENCY THEME

Company	Geographical exposure	Products related to CO_2 reduction	Average of Sales	Price difference towards replaced technology	CO_2 reduction potential	Added 10g	Weight Mgmt.	Hybrid	Downsizing
CONTINENTAL	Germany: 31%	Clean Diesel (Selective Catalytic reduction)			20-24%				
	Europe: 37%	Diesel direct injection			18-22%				
	Asia: 8%	Hybrid electric vehicle	< 1%	EUR500-20,000 per car	5-20%	X		X	
	NAFTA: 21.5%	Gasoline direct injection	ca 12%		5-15%				
		Telematics, ACC, ADAS	< 3%		5%				X
		Tires (rolling resistance, TPMS)	< 3%		2-5%				
		Powertrain (DCT)	ca 12%		4%				
		Transmission			3%				
		Energy management	ca 5%		1-2%				
		Brake system	22%		1-2%				
MICHELIN	Europe: 51%	Passenger tires: new generation of green tires (OE and replacement)	Division is 50% of revenue	10% over last generation	8g	X			
	North America 32%	Truck tire XND2 GRIP (+25% in life cycle of tires thanks to new tread)	Division is 32% of revenue	20% over competition					
	Rest of the World 17%	X One tire (thanks to infinicoil, 600kg less per truck)			5%				
VALEO	Europe:67%	Air quality sensor	740m						
	North America: 14%	Photocatalytic filter							
	South America: 6%	Low Consumption air conditioning			~3%	X			
	Asia: 12%	Themis valve			up to 4%	X			
		The variable-displacement swash-plate compressor	206m						
		* engine control units * electric motor drive * ignition * emission control * Injectors * Sensors * Engine management systems for gasoline & gas engines	162m						
		Reversible Belt-driben Starter-Alternator	595m		up to 10%			X	
		Moto-Alternator Reversible System			up to 20%			X	
		E-Valve			15 to 20%				
		Dual Clutch transmission system			4 to 6%				
		Ultimate cooling			3 to 5%	X			
ELRING KLINGER		Specialty gaskets	18%					X	X
		Cylinder head gaskets	47%						X
		Thermal shielding	8%						X
		Substituting metal by plastic	10%	5-10% cheaper	10%		X		
		Fuel cell components	1%						X
weight management - insignificant CO_2 gain									
PLASTIC OMNIUM		Bumpers and fender modules	1384m			X			
		Body panels				X			
		Body modules				X			
		Fuel systems	621m			X			
HOGANAS		Metal powder	80% of sales			X			

Source: CA Cheuvreux

Technical leaders are not necessarily the ones that will be the most successful

Despite significant exposure of some suppliers to the energy efficiency theme, the opportunity they could have from being a leader in one technology could not be exploited as a unique asset because of OEMs reluctance to buy a technology that is only owned by a single supplier. Indeed, one obstacle for the launch of new technologies can be the increased dependence of a carmaker on a single supplier for a new technology. **A carmaker would never accept to source a new part/module or technology that influences the core characteristics of its vehicles without being involved in the development process of the respective technology at the supplier.** Valeo's cam-less engine may save 15-30% energy if the technology could ever be made ready for series production. However, Valeo would either have to share its core expertise on the technology and provide the carmaker with unlimited access to it or it would hardly succeed in selling it. One reason for the auto industry's reluctance towards single sourcing of such crucial parts is the impact it has on the core characteristics of the autos as well as the risk any production disruption or bankruptcy of the supplier would have on the production of the clients' vehicles. A compromise to that conflict is often that the supplier that developed the new technology licenses it to other suppliers to widen the supply base. As soon as at least two suppliers can deliver the respective products, chances rise to launch it in series production.

■ Batteries: the Grail quest

According to CLSA, lithium-ion is chemically superior to other batteries. Lithium is abundant with enough known reserves for 40 billion Toyota Prius hybrids and thus has the potential for further cost reduction. But benefits are limited by expensive cobalt-oxide cathodes, roughly 50% of total cell costs. Several companies globally are developing promising new cathode chemistries for vehicle use, with some on the cusp of mass production.

COMPARISON OF BATTERY CHARACTERISTIC

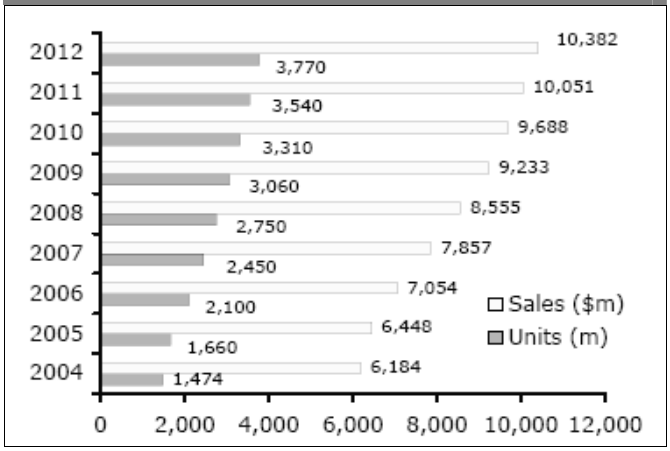
Battery type	Specific energy (Wh/kg)	Specific power (W/kg)	Energy efficiency (%)	Cycle life	Estimated cost (USD/kWh)
Lead-acid	30-50	150-400	80	500-1000	100-150
Nickel-cadmium	30-80	100-150	75	1000-2000	250-350
Nickel metal-hybrid	60-120	200-300	70	1000-2000	250-350
Lithium-polymer	150-200	350	N/A	1000	>400
Lithium-ion	80-200	200-300	>95	1000-1500	>450

Source: CLSA

Li-ion batteries are nearly exclusively produced in Asia. Japanese companies have led the way in Li-ion battery development and the three major cell manufacturers (Sanyo, Matsushita, Sony) account for 47% of total global sales. Korean and Chinese manufacturers make up most of the rest of the market, led by Samsung SDI, LG Chemical and BYD.

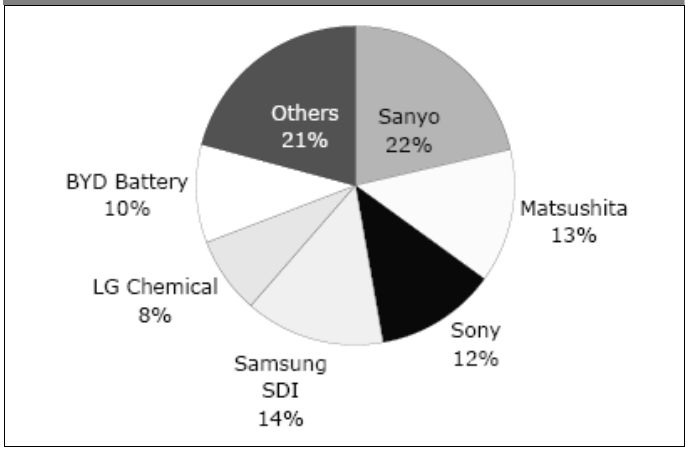
Of the battery cell components, anodes are usually graphite or coke and generally inexpensive to produce. Cathode formulations vary widely, however, each providing different energy characteristics. The most commonly used cathode is lithium cobalt oxide ($LiCoO_2$) due to its superior characteristics. Given the high cost of cobalt, researchers worldwide are developing new formulations. Two promising chemistries for EV battery use are lithium manganese spinel ($LiMnO_2$) and lithium iron phosphate ($LiFePO_4$). The other two cell components are the electrolyte, typically a fluoride-lithium salt in an organic solvent, and the separator, a micrometer-thin porous membrane made of polypropylene or polyethylene. From a total cost perspective, neither of these components adds significantly to the cost of production compared to the cathode (source: CLSA).

GLOBAL LI-ION BATTERY FORECAST



Source: CLSA

CONSUMER LI-ION CELL MARKET SHARE



Source: CLSA

BATTERY MANUFACTURERS

A123	US	Resulting from research at MIT, this start-up is running USD250m in risk capital. It supplies prototypes to Daimler, Volvo and Chrysler and wishes to benefit from federal aid of USD1.8bn to build a plant in the US.
AESC	Japan	Joint venture between Nissan and NEC, this company is undoubtedly the best financed. It plans to invest USD275m in plants able to manufacture lithium-ion batteries for a wide range of vehicles.
BYD AUTO	China	One of the top battery manufacturers, BYD, already offers a rechargeable hybrid vehicle at USD22,000, in China, and hopes to soon market them in the US. Warren Buffett owns 10% of the capital of this company.
ENERDEL	US	EnerDel, a division of Delphi, invested USD200m in a plant in Indiana. Its main client, Norwegian electric vehicle maker Think, is in difficulty. EnerDel wishes to loan USD480m from the US government.
JOHNSON CONTROLS & SAFT	US and France	This joint venture has a plant in France and works with Mercedes, BMW and Ford. The advantage of Johnson Controls is that it is a real auto components manufacturer that has very good relations with US carmakers. As for Saft, it has long-term expertise on all battery technologies.
LG CHEM	South Korea	This leader in lithium-ion batteries for mobile phones swiped away the market for GM's Chevrolet Volt from its US rivals, thanks to its proximity to several small Korean companies specialised in batteries. The LG batteries are nevertheless set to be assembled in Michigan. LG's limits lie in its historical consumer market which is significantly different than that of an automotive activity.
PANASONIC	Japan	Following the acquisition of Sanyo's lithium-ion division, Panasonic could be in the best position, as the company is allied with the powerful Toyota, which plans to market a new electric vehicle in 2012.

Source: CA Cheuvreux, Le Point

Saft, the only European player

In Europe, the only company exposed to this very promising technology is Saft, through a joint venture with Johnson Controls.

The JV, set up in 2006, with 51% for Johnson Controls and 49% for Saft, only appears in Saft's P&L under "associates" for a loss of EUR12m. However, we believe this is a genuine strength enabling the group to capture growth opportunities in the near term.

We have a 2/Outperform rating and we continue to see upside for the stock. Its business is very resilient and cash generative and the stock has been under pressure recently. Without providing any figures, management confirmed in a recent roadshow the partnership with JC in hybrid and electric cars was proceeding well and that various opportunities were taking shape, in connection with both the stimulus plans and the rescue plan for the car sector. Our TP remains at EUR27 (62% upside).

EV: is there a risk of know-how transfer from OEM to suppliers?

Research on battery is already quite advanced. Now what is required is more engineering development than real technological breakthrough. However, developments can be very capex consuming. But lack of experience in the automotive industry might not be such a hurdle and we could see new entrants in this market (just like BYD Auto). Moreover, technological leadership in this sector may not be a key asset as OEMs are extremely worried about relying on a single supplier. Hence, it is very important to see if a technology is exclusively licensed for example, as is the case for a fast-charging lithium-iron phosphate battery, which is not a good sign for industrial development in the auto sector.

EVs mean that the combustion engine would be abandoned. This is undoubtedly a significant change to the existing business model of the auto industry, as the development expertise for combustion engines is one of the core competencies of the auto industry. However, the engine stands for roughly one-third of the value added of vehicles. Two-thirds of automobile features (e.g. safety, electronics, design, braking/damping, comfort) are not affected at all or just receive required energy from a different source. Moreover, electric engines will certainly grab a considerable market share for vehicles used for short-haul traffic (below 100km). Longer distances, specifically those above 500km, will certainly remain the home turf for combustion engines. Hence, even if a carmaker would lose core competencies in the full electric vehicle area to new emerging competitors, a huge part of the entire transportation business remains unaffected by that change for the foreseeable future. This European view does not seem to be shared by Chinese companies such as BYD Auto, which appears to have the same pretentions as an automaker.

III— More regulatory pressure on the car industry

The trend is similar everywhere: governments are attempting to curb CO_2 emissions from the car industry by imposing higher average fuel economy on automakers. In December 2008, European Union Member States finally agreed to limit the CO_2 emissions of light commercial vehicles (LCV) to 120g of CO_2/km by 2015. A phase-in period, running between 2012 and 2015, was eventually granted to the automotive industry, which is hit hard by the current economic crisis.

■ Europe: the new rules

EU legislation guidelines

■ Average emissions from new cars sold in the EU-27 would have to reach the 120g/km of CO_2 target by 2015. Improvements in engine technology would have to reduce average emissions to 130g/km, while complementary measures (tyres, air conditioning systems, biofuels, etc.) will add a further emissions cut of 10g/km.

■ Between 2012 and 2015, a phase-in period for the Directive was introduced, with 65% of the fleet to be concerned in 2012, 75% in 2013, 80% in 2014 and 100% in 2015.

■ To achieve the fleet average target for new cars of 130g/km, the draft legislation defines a limit value curve of permitted CO_2 emissions for new vehicles according to a utility parameter, the mass of the vehicle:

Permitted specific emissions of CO_2 = 130+0.0457 (mass-1,289)

as 1,289kg is the average weight of European cars

■ A penalty premium of EUR5g/km has been proposed for the first gram of excess emissions between 2012 and 2015, rising to EUR15 for the second gram in excess and to EUR25 for the third, then to EUR95 thereafter (each gram per kilometre above the target, times the number of vehicles sold by the manufacturer).

CONSTRAINTS ON AUTOMAKERS

Manufacturer	Average mass in 2007 (kg)	Target for 2012 (g/km of CO_2)	Average CO_2 emissions in 2007 (g/km)	Sales 2007 ('000 units)	Distance to target	Average CO_2 emissions in 2006 (g/km)	Progress 06/07
BMW	1 453	137	170	765	19%	184	-7.3%
Daimler	1 472	137	181	796	24%	188	-3.5%
Fiat	1 112	122	141	1 157	14%	144	-2.0%
Porsche*	1 596	144	282	97	49%		
PSA	1 201	127	141	1 903	10%	142	-0.9%
Renault	1 234	127	146	1 192	13%	147	-0.5%
Volkswagen	1 366	133	163	2 776	19%	166	-1.8%
Volkswagen+Porsche	1 369	134	167	2 873	20%		

* Data for Porsche is available only for 2006

Source: T&E, CA Cheuvreux

Strong lobbying pays off

This agreement, reached by EU Member States (and the final text of which has yet to be issued), is the result of strong lobbying efforts between the automotive industry and environmentalists.

No penalty likely to be applied between 2012 and 2015

The terms of this agreement call for several comments:

- Apparently, because no rule has been established yet to calculate the CAFE result when only a portion of the fleet is taken into consideration (during the phase-in period), no penalty is likely to be applied between 2012 and 2015. All automakers are expected to be unscathed.
- The curve determined by the selected utility parameter, i.e. the average vehicle weight, discourages automakers from making their models heavier to try to obtain a more lenient target.

The long-term target of 95g/km of CO_2 requires a radical technological change and appears very ambitious

- The long-term target of 95g/km, which environmentalists were successful in incorporating into the text, is very ambitious, in our view. It requires a radical technological change (e.g. shifting to electric cars) and possibly an upheaval in the automotive industry (see page 9). Without these breakthroughs, it is likely that this target will be accompanied with flexibility mechanisms to enable the industry to fulfil its obligations without being too adversely affected.

Ten additional grams

In order to reduce emissions by 10 additional grams between 130 and 120g/km, all cars will have to be equipped with the following technologies as from 2012. This list has not yet been voted on and may be subject to adjustments, but we think that any changes will be marginal. After 2015, automakers will no longer be authorised to sell cars that do not include all these technologies.

- Cars will have to be compatible with E7 and B10 (in some countries, such as France, where governments set higher targets than those of the EU for ethanol being mixed with gasoline, vehicles will have to be compatible with E10).
- Gear shift indicator: this device tells the driver when to shift gears to lower consumption.
- Tyre pressure indicators.
- Lower resistance rolling tyres. In fact, labelling will be mandatory and at the same time, the least efficient tyres will be phased out.
- Efficient heating, ventilation and air conditioning (HVAC). The energy requirement for the air conditioning system can be reduced by 15% to 30% compared to usual technologies. Air conditioning increases fuel consumption by approximately 0.5l/100km on average.

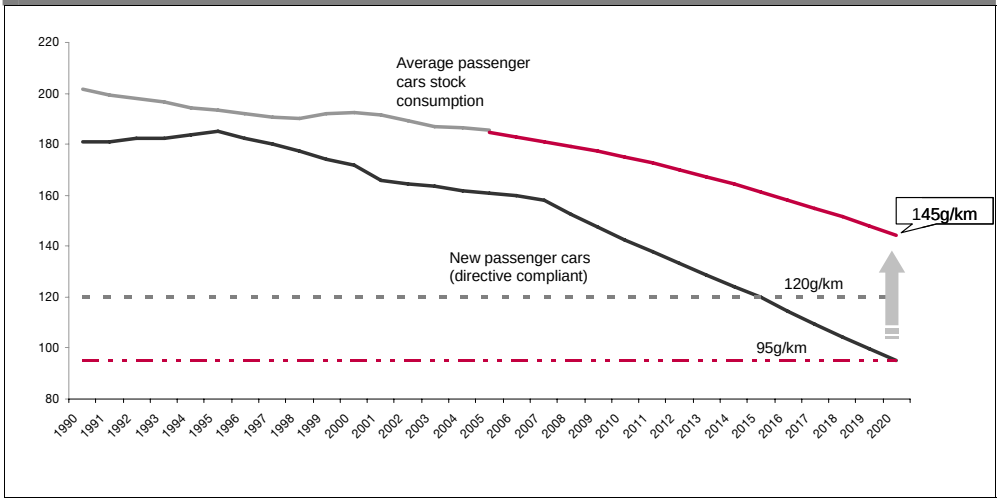
Contribution to global EU Climate Change target

The impact of decreasing new passenger car emissions on the average fleet of passenger cars is naturally diluted. In fact, we believe that the 25% drop expected in Europe for the average consumption of new passenger cars between 2005 and 2015, required by the new Directive, would decrease the overall emissions of the entire passenger car fleet in Europe by 13%.

The 25% decrease between 2005 and 2015 required by the regulation would decrease the overall EU-15 fleet's emissions by 13% and by 8.4% between 2005 and 2020

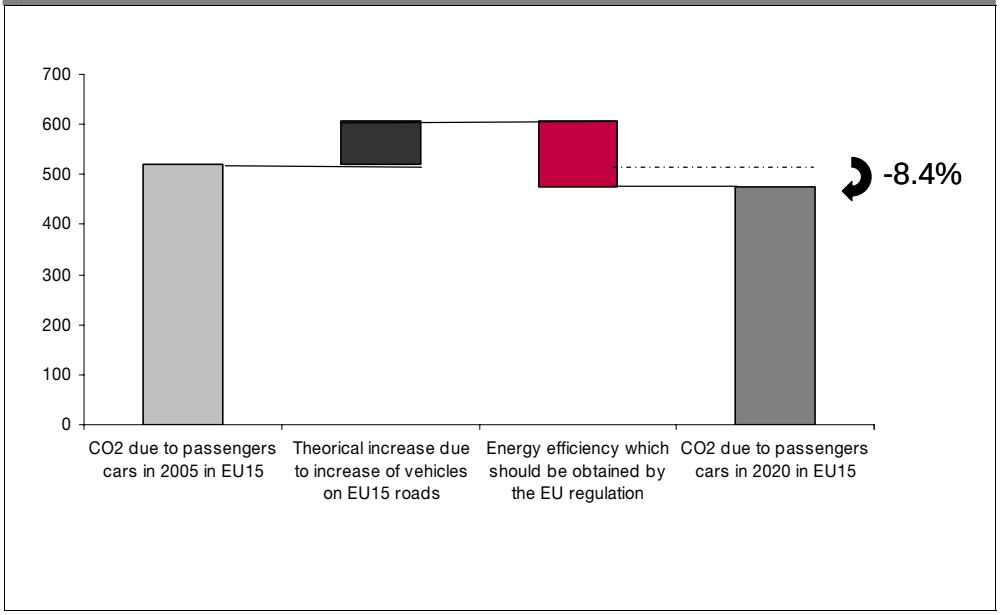
By looking at a long-term scenario with the same assumptions (7.5% of the fleet renewed each year), we find that achieving the target of 95g/km of CO_2 for new passenger cars by 2020 could decrease average passenger car consumption from 185g/km in 2005 to 144g/km in 2020 (figures for the EU-15). If we consider that the total European fleet could total 220 million cars in 2020, driving an average distance of 15,000km each year, compared to 188 million cars in 2005 driving the same distance, we conclude that the **overall contribution of passenger cars to global warming would decrease by 8.4%.** This is to be compared to the 10% reduction target stated by the European Commission for diffuse sectors.

ASSESSMENT OF THE IMPACT OF THE DIRECTIVE ON OVERALL PASSENGER CAR FLEET PERFORMANCE



Source: CA Cheuvreux

ABSOLUTE DECREASE ASSESSMENT OF CO_2 EMISSIONS DUE TO PASSENGER CARS IN EU-15 BY 2020



Source: CA Cheuvreux

It will probably be too expensive to reach EURO 6 standards for small vehicles with diesel engines

Aside from global warming, which is the focus of this report, it is worth noting that road transport is also the cause of adverse health effects due to local pollutants such as NOx (nitrogen oxides) – forming ground-level ozone – and especially particulate matter (among other substances, CO and HC), which can damage lung tissue, reduce lung function and lead to respiratory diseases.

To curb these other – and very important – effects of road transport, the European Commission has introduced the EURO standards, which set thresholds for local pollutant emissions of new cars sold on the market (automakers are not permitted to sell cars that do not comply with these standards).

These standards are likely to influence automakers in their strategy for reducing fuel consumption of cars because technical solutions to reduce NOx are often linked to increased CO_2 emissions. Therefore, EURO 6 standards may have an impact on the fuel types of engines sold, as it may prove too expensive to reach EURO 6 standards for very small vehicles with diesel engines (the most frequent at present).

LEGAL STANDARDS FOR PETROL ENGINES (mg/km)

	Effective since	CO	HCT	Nox	PM
EURO 1	1992	2800	1000		
EURO 2	1996	2200	500		
EURO 3	2000	2300	200	150	
EURO 4	2005	1000	100	80	
EURO 5	2009	1000	100	60	5
EURO 6	*2014*	*1000*	*100*	*60*	*5*

Source: EC

LEGAL STANDARDS FOR DIESEL ENGINES (mg/km)

	Effective since	CO	HC+NOx	NOx	PM
EURO 1	1992	2720	970		140
EURO 2	1996	1000	900	700	100
EURO 3	2000	640	560	500	50
EURO 4	2005	500	300	250	25
EURO 5	2009	500	230	180	5
EURO 6	*2014*	*500*	*170*	*80*	*5*

Source: EC

The rest of the world catching up with the trend

United States

US energy bill, finally passed in mid-December, imposes a long-awaited increase in auto efficiency and fuel standards.

Since 1990, the fuel economy standard (namely CAFE) has remained fixed at 27.5 miles per gallon (201g/km of CO_2), despite numerous proposals of bills to update it.

Facing increasing pressure to take action on climate change and to decrease the country's overall dependence on oil, and thanks to the change in majority in the House of Representatives, the energy bill calls for a 40% efficiency gain for cars by 2020, with the new CAFE set to 35mpg (160g/km of CO_2). By comparison, in 2006, European manufacturers sold cars that produced an average of 160g/km of CO_2!

The energy bill imposes a 40% efficiency gain for passenger cars by 2020 with new CAFE set at 35mpg (160g/km of CO_2!)

In addition, at the end of March 2009, the Obama administration imposed the first increase in mileage standards for passenger cars. Cars must achieve 30.2mpg by 2011, slightly higher than the theoretical decrease in consumption to reach the 35mpg target in 2020. In addition, this represents no real constraint for the industry overall, as new vehicle fuel efficiency was already at 31mpg in 2008, according to the US Bureau of Transport Statistics.

This move would probably continue to weaken the Big Three US carmakers and benefit Toyota, Honda and Daimler, which are not far from this average, as they are already well exposed to more stringent regulations in Japan and the EU.

California

Going further than the federal government, the state of California is attempting to set tough new standards for auto emissions. While the US energy laws require 35mpg by 2020, California intends to raise this target to 40mpg by 2016. Following California's lead, as many as 16 states are considering adopting this stance on car emissions.

Although the Federal Clean Air Act allows California to enact stricter rules than US standards, the federal government, after intense lobbying by the car manufacturers, has decided to go against this initiative. As a result, California and 15 other states filed suit in the US court of appeals to overturn the federal decision. As of today, California still cannot implement these rules until granted permission from the US Environmental Protection Agency, in charge of these standards.

Japan

The Japanese government first established fuel economy standards for gasoline and diesel powered light-duty passenger and commercial vehicles in 1999 under its "Top Runner" energy efficiency programme. Fuel economy targets are based on weight class, with automakers allowed to accumulate credits in one weight class for use in another, subject to certain limitations. Penalties apply if the targets are not met, but they are minimal.

In December 2006, Japan revised its fuel economy targets upward, and expanded the number of weight categories from nine to sixteen. This revision took place before the full implementation of the previous standards because the majority of vehicles sold in Japan in 2002 already met or exceeded the 2010 standards. This new standard is projected to improve the fleet average fuel economy of new passenger vehicles from **13.6km/L in 2004 to 16.8 km/L in 2015 (circa 140g/km of CO_2),** an increase of 24%.

China

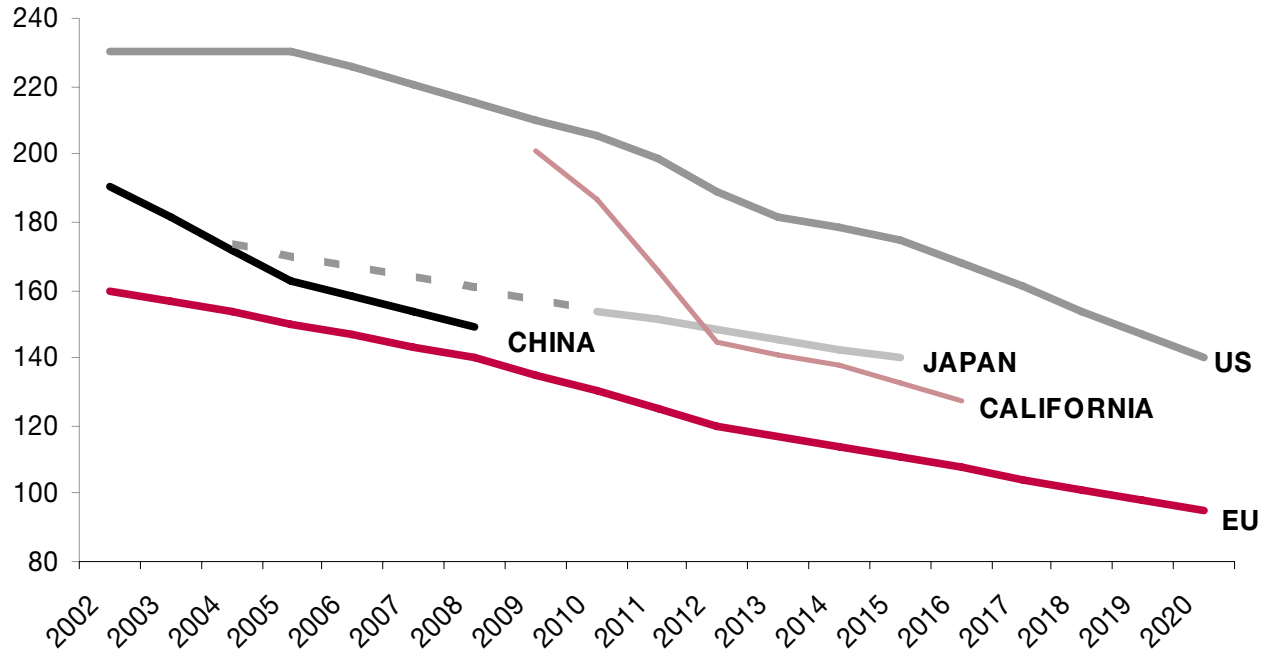
China introduced its first Fuel Consumption Limits for Passenger Vehicles in 2004, in which it sets the fuel consumption limit for passenger vehicles. The limits are divided into 16 categories based on vehicle weight, and are subjected to two phases of enforcement. For newly-certified vehicle models, Phase 1 started on 1 July 2005, and the second phase took effect on 1 January 2008.

For continued vehicle models, Phase 1 started on 1 July 2006 and Phase 2 took effect on 1 January 2009.

China also raised the consumption tax on large vehicles and cut the tax on small cars. The tax on small cars declined to 1% (from 3%) and that for large cars rose to 40% (from 20%), effective as of 1 September 2008.

Taking half the city's cars off the roads during the August Olympics, Beijing introduced traffic restrictions, banning cars from roads on one out of five weekdays in a system based on licence plate numbers. The first day of enforcement, up to 800,000 cars were taken off the road, but many junctions were still congested at peak hours. Shanghai followed with a slightly watered-down version of this ban.

COMPARISON OF EMISSION STANDARDS (g CO_2/km)



Source: Pew Center on Global Climate Change, CA Cheuvreux

IV— Stimulus plans and consumer shift: Pros and Cons

"Demand is driving the market towards bigger, more comfortable, and more powerful cars i.e. heavier and more consuming vehicles", claimed the industry, trying to explain why it failed to meet the voluntary ACEA target. Taking this claim into account, most European countries introduced, simultaneously with the new European regulation, fiscal incentives and burdens to influence demand towards more fuel-efficient cars. This is also an international trend that seems to bring encouraging effects with a clear distortion of demand.

What's new to influence demand?

EU green car tax plan

The EU Commission wants to scrap registration taxes and replace them with a restructured registration and circulation tax linked to how much a car pollutes. However this measure has encountered significant opposition from States, some of which – like Germany – believe that this is not something that should be dealt with at the EU level, but rather in a national framework.

France, which has already implemented this kind of measure (see bonus/malus below) along with the UK sought to ask the EU to reduce VAT on green products such as green cars. However, the EC refused to consider a VAT modification.

MESURES IN EUROPEAN COUNTRIES

AUSTRIA	A fuel consumption tax (Normverbrauchsabsage or NoVA) is levied upon the first registration of a passenger car. It is calculated as follows:
	- Petrol cars: 2% of the purchase price x (fuel consumption in litres – 3 litres)
	- Diesel cars: 2% of the purchase price x (fuel consumption in litres – 2 litres)
	Under a bonus-malus system, cars emitting less than 120g/km receive a maximum bonus of EUR300. Cars emitting more than 180g/km pay a penalty of EUR25 for each gram emitted in excess of 180g/km. (160g/km as from 1 January 2010). Alternative fuel vehicles attract a bonus of maximum EUR500.
	In addition, diesel cars emitting more than 5mg of particulate matter per km pay a penalty of maximum EUR300. Conversely, diesel cars emitting less than 5mg of particulate matter per km and less than 80g of NOx per km receive a bonus of maximum EUR200. The same applies to petrol cars emitting less than 60g of NOx per km.
BELGIUM	1. Tax incentives are granted to private persons purchasing a car that emits less than 115g CO2 per km. The incentives consist of a reduction in the invoice price of the following amount:
	- Cars emitting less than 105g/km: 15% of the purchase price, with a maximum of EUR4,540
	- Cars emitting between 105 and 115 g/km: 3% of the purchase price, with a maximum of EUR850
	2. The company car tax is based on CO2 emissions.
	3. The deductibility of expenses related to the use of the car (60-90%) is linked to CO2 emissions.
	4. The Walloon Region operates a bonus-malus system whereby new cars emitting 145g/km or less obtain a bonus (maximum EUR1,000 for cars below 105g/km) and cars emitting more than 195g/km pay a penalty (maximum EUR1,000 for cars emitting more than 255g/km).
DENMARK	1. The annual circulation tax is based on fuel consumption.
	- Petrol cars: rates vary from DKK520 for cars driving at least 20km per litre of fuel to DKK18,460 for cars driving less than 4.5km per litre of fuel.
	- Diesel cars: rates vary from DKK160 for cars driving at least 32.1km per litre of fuel to DKK25,060 for cars driving less than 5.1km per litre of fuel.
	2. Registration tax (based on price): An allowance of DKK4,000 is granted for cars for every kilometre in excess of 16km (petrol) and 18km (diesel), respectively, they can run on one litre of fuel. A supplement of DKK1,000 is payable for cars for every kilometre less than 16km (petrol) and 18km (diesel), respectively, they can run on one litre of fuel.
FRANCE	1. Under a bonus-malus system, a premium is granted for the purchase of a new car when its CO2 emissions are below 130g/km. The maximum premium is EUR5,000 (below 60g/km). A "super-bonus" of EUR1,000 is granted when a car of at least ten years old is scrapped and the new car purchased emits maximum 160g/km. A malus is payable for the purchase of a car when its CO2 emissions exceed 160g/km. The maximum tax amounts to EUR2,600 (above 250g/km). In addition to this one-off malus, cars emitting more than 250g/km pay a yearly tax of EUR160. The different thresholds of the bonus-malus system are strengthened by 5g/km every two years.
	2. The regional tax on registration certificates ("carte grise") is based on fiscal horsepower, which includes a CO2 emissions factor.
	Tax rates vary between EUR25 and EUR46 per horsepower according to the region.
	3. The company car tax is based on CO2 emissions. Tax rates vary from EUR2 to EUR19 for each gram for cars emitting 100g/km or less to EUR19 for each gram emitted for cars emitting more than 250g/km.
GERMANY	The Federal Government has decided to change the basis of the annual circulation tax as from 1 July 2009. It will consist of a base tax and a CO2 tax. The rates of the base tax will be EUR2 per 100 cc (petrol) and EUR9.50 per 100 cc (diesel) respectively. The CO2 tax will be linear at EUR2 per g/km. Cars with CO2 emissions below 120g/km will be exempt (110g/km in 2012-13, 95g/km subsequently).
ITALY	Purchasers of new cars emitting maximum 130g/km (diesel) and 140g/km (other fuels), respectively, receive an incentive of EUR1,500 if they have a car that is nine years old or more scrapped simultaneously. Higher incentives apply for alternative fuel vehicles (CNG, LPG, electricity, hydrogen).
NETHERLANDS	1. The rate of the registration tax (based on price) is reduced or increased in accordance with the car's fuel efficiency relative to that of other cars of the same size (length x width). The maximum bonus is EUR1,400 for cars emitting more than 20% less than the average car of their size (A label), the maximum penalty is EUR1,600 for cars emitting more than 30% more than the average car of their size (G label). Hybrid cars benefit from a maximum bonus of EUR6,400. Cars emitting maximum 95g/km (diesel) and 110g/km (other fuels), respectively, are completely exempted from this registration tax. Cars emitting more than 205g/km (petrol) and 170g/km (diesel), respectively, pay an additional tax supplement of EUR125 per gram emitted in excess of these thresholds.
	2. Cars with CO2 emissions up to 110g/km (petrol) and 95g/km (diesel), respectively, pay a lower annual circulation tax.
PORTUGAL	1. The registration tax is based on engine capacity and CO2 emissions. The CO2 component is calculated as follows:
	- Petrol cars emitting up to 115g pay [(EUR3.5 x g/km) - 329]. Diesel cars emitting up to 95g pay [(EUR10 x g/km) – 730]
	- The highest rates are for petrol cars emitting more than 205g [(EUR125 x g/km) – 20,766] and for diesel cars emitting more than 170g [(EUR168 x g/km) – 21,610].
	2. Purchasers of new cars emitting maximum 140g/km receive an incentive of EUR1,000 if they have a car that is ten years old or more
	scrapped simultaneously (EUR1,250 if the car is more than 15 years old).
SPAIN	1. The registration tax is based on CO2 emissions. Rates vary from 0% (up to 120g/km) to 14.75% (200g/km and more).
	2. Purchasers of new cars emitting maximum 140 g/km and costing maximum EUR30,000 can obtain an interest-free loan up to EUR10,000 if they have a car that is 10 years old or more (or has a mileage exceeding 250,000 km) scrapped simultaneously.
SWEDEN	1. The annual circulation tax for cars meeting the Euro 4 exhaust emission standards is based on CO2 emissions. The tax consists of a basic rate (SEK360) plus SEK15 for each gram of CO2 emitted above 100 g/km. This sum is multiplied by 3.15 for diesel cars registered for the first time in 2008 or later and by 3.3 for other diesel cars. For alternative fuel vehicles, the tax is SEK10 for every gram emitted above 100g/km.
	2. A premium of SEK10,000 is granted for the purchase of "environmentally-friendly cars":
	- Petrol/diesel/hybrid cars with CO2 emissions up to 120g/km
	- Alternative fuel/flexible fuel cars with a maximum consumption of 9.2 l (petrol)/8.4 l (diesel)/9.7cm/100 km (CNG, biogas)
	- Electric cars with a maximum consumption of 37KWh/100 km
UNITED KINGDOM	1. The annual circulation tax is based on CO2 emissions. Rates range from GBP0 (up to 100g/km) to GBP400 (petrol, diesel)/ GBP385
	(alternative fuels) for cars emitting more than 255g/km.
	2. Company car tax rates range from 10% of the car price for cars emitting up to 120g/km to 35% for cars emitting 235g/km or more. Diesel cars pay a 3% surcharge, up to the 35% top rate.

Source: ACEA

Scrapping measures

In addition to these fiscal schemes, many countries all over Europe have adopted scrapping measures to address the substantial losses posted by automakers and to stimulate demand. Not all of these are subject to environmental criteria. The one that has had the greatest impact is the German scrapping measure, as it offers the highest scrapping bonus. It was expanded further on 8 April from a global envelope of EUR1.5bn to EUR5bn (by mid-April, German car buyers had already made 1.2m applications for the bonus, equal to EUR3bn!).

SCRAPPING MEASURES IN EUROPEAN COUNTRIES

Countries	Criterion	Scrapping measure details
Austria	Over 13 years old	EUR1,500 for buying a new vehicle complying with EURO 4 standards
France	Over 10 years old	EUR1,000 for buying a new vehicle emitting less than 160g/km
Germany	Over 9 years old	EUR2,500 for buying a new vehicle or one less than a year old, complying with EURO 4
Greece	No age limit	Between EUR400 and EUR800 for scrapping a vehicle AND EUR1,500 to EUR3,400 for buying a new vehicle
Italy	Over 10 years old	EUR1,500 for buying a new vehicle complying with EURO 4 emitting less than 140g/km of CO_2 for petrol engines and less than 130g/km of CO_2 for diesel engines
Portugal	Over 10 years old	From EUR1,000 to EUR1,250 for buying a new vehicle emitting less than 140g/km of CO_2
Romania	Over 10 years old	EUR1,000 for buying a new vehicle
Spain	Over 10 years old or more than 250,000km	Interest-free loan under certain conditions

Source: Les Echos

Japan also introduced a scrapping measure on 10 April, with a bonus ranging from JPY100,000 to JPY250,000 for buying a low emissions vehicle (or a hybrid).

And overseas as well

US - New York: Approved by the New York City Council, the congestion charging system for New York now awaits approval at the State level. Set for introduction on a three-year trial basis, the scheme aims to reduce air pollution, traffic volume and to fund improvements in transportation as part of NYC's strategy for 2030. Car drivers will have to pay a flat-rate fee of USD8 and truck drivers USD21 in order to enter Lower Manhattan on weekdays between 6am and 6pm, and only USD4 or USD5.5 for journeys exclusively within the zone. This congestion charge is at the heart of Mayor Michael Bloomberg's policy to reduce CO_2 emissions by 30% by 2030, and must be approved by the New York State legislature before taking effect.

China – Beijing: Drivers of high-emissions vehicles, known as "yellow-label" cars, would be fined CNY1,400 (USD15) if found to be driving within the city's fifth ring road. This measure stands to take about 10% of the city's cars off the road (3.5m registered cars). The government also drafted a compensation scheme that will give drivers up to CNY25,000 (USD3,600) if they proactively give up their cars in 2009 (source: Reuters).

Japan: The effectiveness of the standards imposed on the industry is enhanced by highly progressive taxes levied on the gross vehicle weight and engine displacement of automobiles when purchased and registered. These financial incentives promote the purchase of lighter vehicles with smaller engines. For example, the Japan Automobile Manufacturers Association estimates that the owner of a subcompact car (750kg curb weight) will pay USD4,000 less in taxes relative to a heavier passenger car (1,100kg curb weight) over the lifetime of the vehicle (JAMA 2007).

Substantial effects, in the short run…

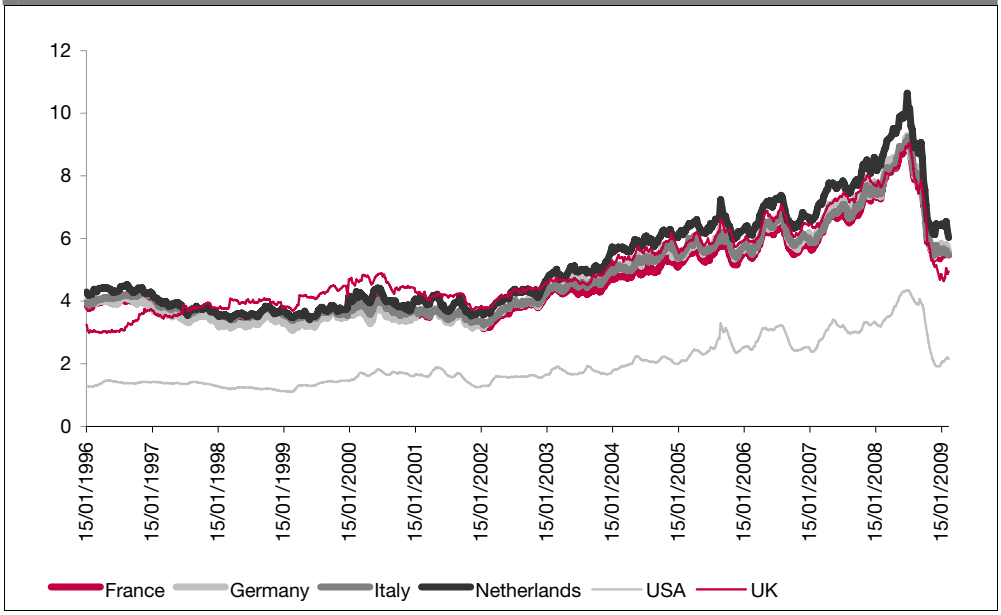
A look at car demand in NAFTA and Europe over the past few years shows the trend towards smaller vehicles, in NAFTA from full-sized light truck to sedans, and in Europe from higher to lower segments. The shift towards greener vehicles is clear in mature markets, at least in NAFTA and Europe. However, the reasons for this shift are less obvious, and it remains to be seen whether consumers are shifting to greener cars for good or for external reasons that could reverse.

The down-trading has accelerated with: 1) the rise in oil prices; 2) incentive measures; and 3) with the crisis, the stimulus plans, associated with green criteria, have resulted in a clear shift of demand.

The rise in the oil price

The price increase in itself does not deter consumers from large cars, as was the case in the early 1970s. However, the massive surge in the oil price over a short period of time created a shock that altered consumer behaviour.

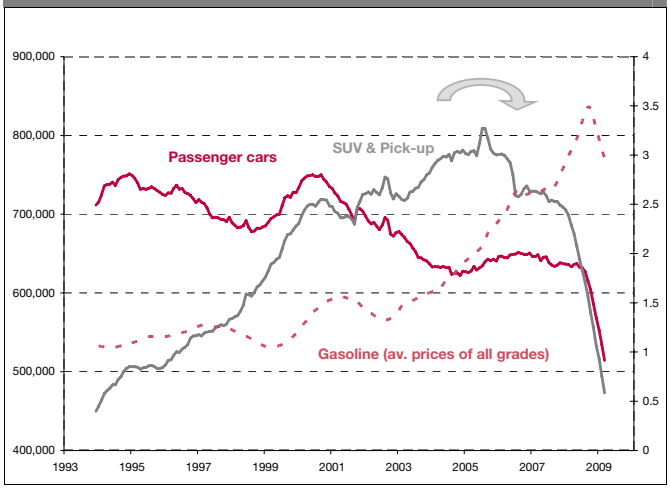
GASOLINE PRICES AT PUMPS IN EUROPEAN COUNTRIES VS. THE US



Source: CA Cheuvreux

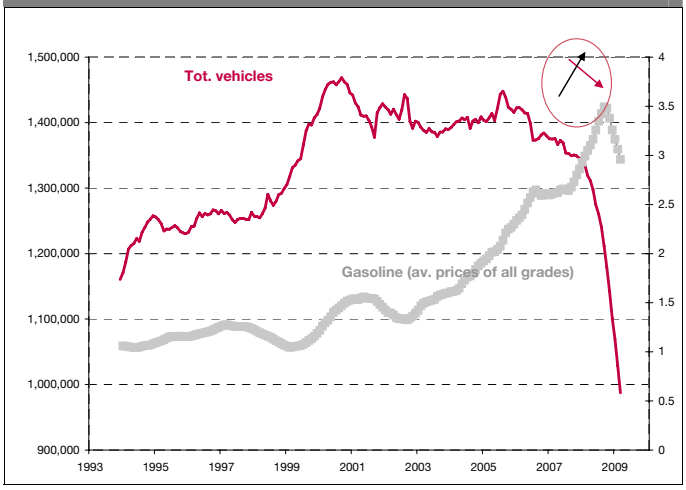
In the US, historically and for a long period of time, consumers did not take the fuel price into account when buying cars. However, this began to change when the price of oil rose continuously between 2004 and 2007. When gasoline prices went above USD2 per gallon, monthly sales of SUVs and pick-ups peaked at a record (up to 800,000 units per month) and began to fade. Simultaneously, monthly sales of passenger cars, which, to the contrary, had continuously declined over previous years, stopped their decline and rose again between 2005 and 2007. After 2007, with the acceleration of oil price hikes and the beginning of the economic downturn, we believe this triggered a kind of psychological threshold where consumers realised that the oil price clearly had an impact on their purchasing power and decided to integrate it into their consumption habits, either by delaying their purchase decisions or by buying more fuel-efficient cars. Demand for small cars rose by some 250% in 2008, while purchases of light trucks were down substantially. Such massive shifts cannot be attributed to model cycle effects alone. Moreover, US customers buy cars directly from the dealer's lot, hence changed buyer preferences are reflected immediately in monthly registrations.

CHANGE OF CONSUMPTION
MONTHLY VEHICLE SALES IN THE US



Source: CA Cheuvreux, DoE, Bloomberg

RECENT COLLAPSE OF SALES
MONTHLY VEHICLE SALES IN THE US



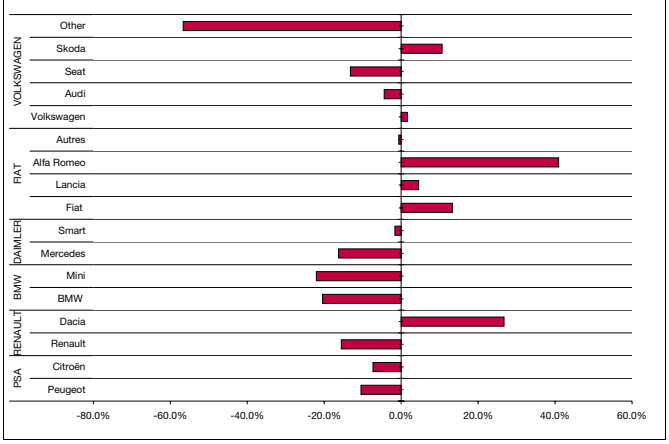
Source: CA Cheuvreux, DoE, Bloomberg

Incentives and stimulus plans distort demand

In France, the move already began in 2008 with "the bonus/malus" scheme, and was amplified in late 2008 with a scrapping incentive to accelerate the renewal of the entire vehicle fleet. Consumers' response to the scheme has been very quick and positive, especially as the State hinted that the tax on high-consumption vehicles would be annualised. In January 2009, vehicles emitting less than 120g/km of CO_2 represented 46% of the total market vs. 31% a year earlier.

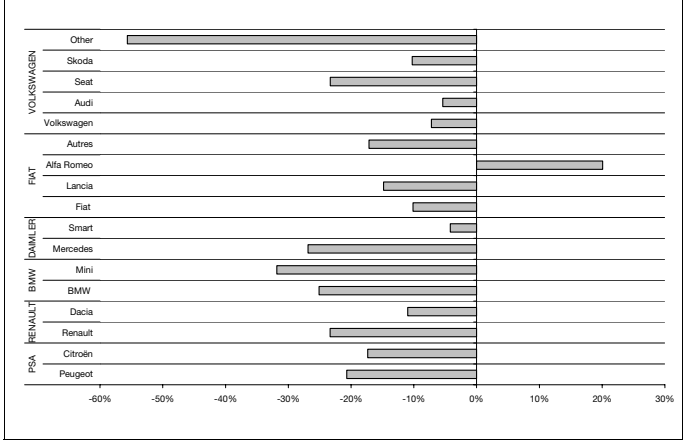
In Germany, the introduction of the EUR2,500 scrapping incentive for buyers of cars not more than a year old in exchange for the trade-in of a car nine years old or more caused a run on German car dealers. Basically all volume carmakers (VW group, Ford, Opel, PSA, Renault, Japanese/South Koreans) have reported about a massive surge in small and medium-sized car sales. The inclusion of new cars sitting on dealers' lots (display cars/daily registrations) helped the aforementioned carmakers to sell basically their entire inventory of small/mid-sized vehicles. Orders for new cars have surged, triggering the cancellation of reduced working hours in some cases (Opel/Seat). By the end of March, VW concentrated more than 25% of demands from the scrapping premium (with mainly the Polo, a new version of which is to be launched in July!). **The scrapping scheme is certainly of great help for ailing auto dealers, as they can reduce the working capital tied up in huge vehicle inventories.** It also helps automakers to reallocate models from other markets to Germany and markets with similar incentives.

VARIATION OF PASSENGER CARS REGISTRATION IN EUROPE MARCH Y-O-Y



Source: CCFA

VARIATION OF PASSENGER CARS REGISTRATION IN EUROPE JANUARY, FEBRUARY AND MARCH, Y-O-Y



Source: CCFA

Stimulus plans generate a massive shift in the mix and a negative effect on pricing that could last for the years ahead as carmakers will have no other choice but to maintain net retail prices at the same level as under the incentives

■ …but pressure on pricing for next year…

These moves have a profound effect on demand: 1) the first reaction is a shift towards small vehicles to make the most of the cash incentives. The motive is less to reduce pollution than to spend less, especially in a recessionary environment; 2) this generates a massive shift in the mix and a negative effect on pricing that could be lasting. Consumers grow accustomed to lower transaction prices and are unlikely to be willing to pay more when State-supported incentives end, generating another wave of net negative pricing effect for carmakers; and 3) it contributes to alter the image of the concept of mobility, with the personal car becoming more a commodity than an image-driven product. In addition, from an environmental standpoint, scrapping measures also have perverse effects, as consumers rush out to buy the former version, which is cheaper than the brand new version.

For 2010, the big question for the industry will be what car demand will look like once the government incentive programmes expire. Only a substantial recovery in consumer sentiment, and ultimately the economy, exactly when the incentives run out – likely in the course of H1-10 – would help the industry maintain higher levels of car sales. However, under current circumstances, the chances of such a turnaround in private consumption appear illusive. Hence carmakers may have no other choice but to maintain net retail prices at the same level as under the incentive schemes. In other words, automakers raise their incentives by EUR500-2,500 per car to avoid a collapse in car sales.

…impacting margins

In our view, consumers have not developed eco-friendly behaviour of their own free will, but rather as a reaction to the situation. A typical consumer will still desire a comfortable and attractive vehicle that usually comes with many options. However, when States implement scrapping bonuses of EUR1,000, as in France, to replace older vehicles (more than 15 years old) for the purchase of a low-consumption vehicle, the success is immediate. In 2008, the segment of vehicles emitting less than 160g of CO_2 rose to 80% of the total French car market, 100bp above the previous year's level. And since the start of 2009, demand for small cars in Germany has surged thanks to the recently-introduced EUR2,500 scrapping premium, with orders for Renault small models more than doubling and orders for Dacia's low-cost Logan multiplied six-fold.

The most surprising contrast was between both upper range automakers, with BMW performing very well last year in France, the market mostly affected by CO_2-related incentives (+4%) while Daimler faced an 11% decline. We believe that this gap in performance relates to BMW's better positioning on low emission technologies, dubbed Efficient Dynamics, with for example a 5-Series diesel emitting 136g of CO_2 and therefore avoiding the CO_2-related tax on high-consumption vehicles. Daimler, to the contrary, was still waiting for the final word from the European Commission and now seems indecisive as to which technology it should opt for, and has refused to jeopardise its operating results because of efficiency technologies that might not be fully supported by consumers.

Maintaining high margins has a price, however. Daimler's reluctance to offer low-consumption vehicles is more related to the incurred additional cost per car that consumers are not ready to pay for than to a technology gap. Arguably, BMW generated a 7.5% EBIT margin in 2007 (before the crisis), while Mercedes Cars achieved a 9.1% EBIT margin.

■ Subsidies absolutely needed to ensure the development of green cars

Subsidies will play a major role in bringing the Total Cost of Ownership for electric vehicles and plug-in hybrids down to an attractive level for the consumer

From a Total Cost of Ownership perspective (several studies have confirmed that TCO is a key criterion influencing buyers' decisions), the electric vehicle is expected to remain relatively unattractive to consumers out to 2020, unless its cost is subsidised. According to the BCG, at the expected battery cost of USD700 per kW, the electric car costs more than advanced internal combustion engine vehicles when oil prices are below USD280 per barrel. Only if the battery cost drops to a very low level of USD500 per kW will the electric vehicle become attractive at an oil price between USD100 and USD120 per barrel. These figures need to be handled carefully, considering the current level of innovation in batteries. Clearly, subsidies will play a major role in bringing the TCO for electric vehicles down to an attractive level for the consumer. This is why Renault is introducing EV in countries in which it has finalised an agreement with local authorities (at the city or country level) in order to guarantee these subsidies and to secure the development of charging infrastructures.

Several governments have understood this and have already announced subsidies:

For example, the French government announced in February that it would purchase, along with six companies (with massive fleets), 100,000 electric vehicles as from 2012. EUR370m was allocated to intensify R&D efforts on the technology and infrastructure. To encourage customers to buy electric vehicles, a EUR5,000 incentive will be given (for vehicles emitting less than 60g/km). The UK government also plans to subsidise electric vehicles and PHEV with incentives up to GBP2,000 per car.

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