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On the road again

A Financial and Extra-financial Analysis of the Auto Industry

- **Caught in the void ➔ fuel prices, carbon and pollution**
- **Charting new terrain becomes key ➔ alternative power trains**
- **Cost is king ➔ it determines the way forward**
- **Don't forget ➔ governance, BRICs, legacy costs and offshoring**
- **Toyota is our global champion ➔ other winners could emerge**

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This report follows a request from a group of asset managers working with the United Nations to analyse the environmental, social and corporate governance issues that may be material for company performance and to then identify potential impact on company valuations.

The United Nations Environment Programme Finance Initiative (UNEP FI) works closely with 160 financial institutions worldwide, to develop and promote linkages between the environment, sustainability and financial performance.

UNEP FI Asset Management Working Group (AMWG) explores the association between environmental, social, and governance considerations and investment decision-making. Asset Managers that have participated in this project have combined mandates of 1.7 trillion USD.

Asset managers:

ABN AMRO Asset Management Brazil	Acuity Investment Management
BNP Paribas Asset Management	BT Financial Group
Calvert Group	Citigroup Asset Management
Groupama Asset Management	Hermes Pensions Management
HSBC Asset Management	Insight Investment Management
Morley Fund Management	Nikko Asset Management
RCM (UK) (Allianz Dresdner)	Sanpaolo IMI Asset Management

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Investment Case

The rise in resource prices and particularly the exploding oil price is the hard lesson that the automakers need, to understand that current modes of combustion probably do not constitute **the long-term solution**.

The current awakening is undoubtedly being forced on the automakers because of increasing risks - both inside (cost structure) and outside (consumers) the value chain. Cost will be the key factor in bringing about change – for the automakers and consumers.

The industry must begin looking for alternatives. Automakers, oil companies, governments and consumers all need to start preparing themselves today for the reality of long-term high prices for black gold.

Fuel efficiency is a key issue – eco-efficiency and CO2 emissions are only a consequence – at least until FC motors are commercially viable. The rising gasoline price has put an end to the trade-off between the Big Three (**DCX, Ford, GM**), the US federal government and consumers. The Big Three will no longer be able to set the rules on fuel efficiency standards.

The technological transition will involve several stages and a range of technologies that will co-exist and compete with one another. It will involve questions of improving fuels (Flexfuel, Synfuel), combustion (ACE, H2) and of seeking sources for alternative energies (Batteries, FC). The long-term chances of the raft of new technologies will be closely linked to infrastructure developments.

New and emerging technologies will begin to play a key role within the next decade but cost-friendly FCs are unlikely to be available before 2015.

It is not surprising to see that the champions of today will certainly be the champions of tomorrow. They are the ones that thought ahead – strategic long term vision – and had the means of doing so (i.e. sufficient cash flow). The problem is there – having the available cash and resources today is based on the pertinence of past choices – and only the past winners can afford to invest in alternative technologies today (**Honda, Toyota**). On the road or on the road again?

Alliances between automakers are likely in order to reduce the costs associated with developing alternatives as well as building competitive advantages (**BMW-DCX-GM** partnership). However, there remains a major gap between effective press releases and tangible, cost-efficient and effective cooperation.

Among the future winners, **Toyota** ***comes up on top*** because it has never stepped back from its efforts with any of its wide range of hypothetical technologies of tomorrow – it has persevered with significant investments in R&D and large-scale launches of its alternative vehicles.

Competition for Toyota has come rather late, in our view, with some notable exceptions (**Hyundai, Honda, Mazda (Ford Group)**).

Most automakers are restricting their R&D to only one or two possible alternative technologies (**BMW, PSA**).

Some automakers are caught in a dilemma because they lack the necessary size to develop viable, long-term solutions by themselves (**BMW, PSA**) or because their choices lack visibility (**DaimlerChrysler, Nissan-Renault**).

We also have a group of automakers who will have great difficulties in the coming years because their current available resources are insufficient or being mobilised for other short-term emergences to prevent the whole house going up in flames. Fundamental restructuring is on the cards for these players who are disconnected from their markets (**FIAT, Ford, GM**).

Trucost analysis ***shows us that direct external environmental costs range from 1-3.5% of EBITDA*** - below 1% of EBITDA (**BMW, DCX, Ford, Honda, Porsche, PSA, Renault, Toyota**) to 2.1% (**VW**) and a high of 3.5% (**Fiat**). These costs are principally generated from GHG emissions and water use.

There is however no way that one can economically assess the future commercial performance of automakers and don't believe those who tell you that there is. There are simply too many possible hypotheses, too many macro-economic constraints, and too many uncertainties with regard to the technologies of tomorrow.

We note that a comparison of the automakers based on technological innovation alone is imperfect, especially given that a range of other factors influence comparative advantage over the long-term. Key issues include hidden costs associated with the production cycle, healthcare and pension liabilities, offshoring procurement and maximising cost advantages from the supply chain, the quality of a company's corporate governance and their positioning in the emerging national and regional markets of tomorrow (the BRICs et. al.). **Toyota comes out on top** of many of these issues in our view and is our global champion.

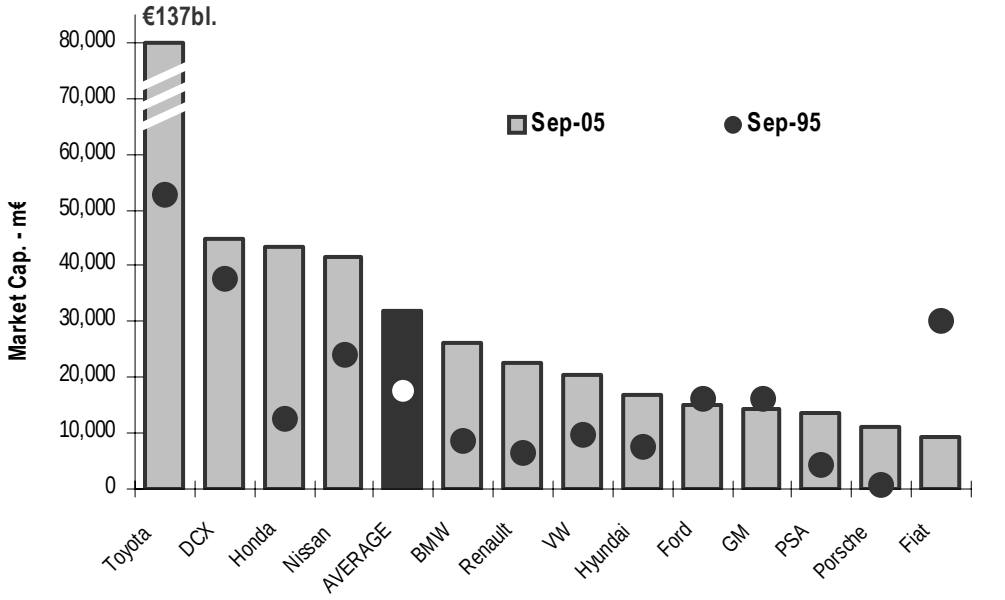
We have evaluated thirteen global automakers on a full range of financial and extra-financial issues. A summary table of our results is below and a sample company evaluation of Toyota – our global winner – is on the following page. We have undertaken **13 company evaluations for all of the automakers in our panel** which can be found at the page numbers listed below.

Overview of CM-CIC Securities / ESN evaluation of automakers

AUTOMAKER	HOME COUNTRY	CM-CIC / ESN EVALUATION	EVALUATION
BMW	Germany	🚗🚗🚗🚗	Pg. 152
DCX (DaimlerChrysler)	Germany	🚗🚗🚗	Pg. 153
Fiat	Italy	🚗	Pg. 154
Ford	USA	🚗🚗	Pg. 155
GM (General Motors)	USA	🚗	Pg. 156
Honda	Japan	🚗🚗🚗🚗🚗	Pg. 157
Hyundai	South Korea	🚗🚗🚗🚗🚗	Pg. 158
Nissan	Japan	🚗🚗🚗🚗	Pg. 159
Porsche	Germany	🚗🚗	Pg. 160
PSA (Peugot-Citroen)	France	🚗🚗🚗🚗	Pg. 161
Renault	France	🚗🚗🚗	Pg. 162
Toyota	Japan	🚗🚗🚗🚗🚗🚗	Pg. 163
VW (Volkswagen)	Germany	🚗🚗🚗	Pg. 164

Source: Industry sources, CM-CIC Securities / ESN estimates

Against all odds, the car sector as a whole has created value over the past 10 years



Source : Datatsream, CM-CIC Securities / ESN estimates

Toyota – our global winner

Number of vehicles produced *(millions)*	6.9
Global market share	11.6%
% of non-ICE models	~2%
Market share in non-ICE rear-wheel drive vehicles	~85%
R&D budget (€ billions)	5.6
Estimated R&D for non-ICE technologies	5 / 10%
Number of partly alternative models	10
Proportion of Diesel (Europe)	~36%
CAFE USA (average)	30.8
Market Cap. (€ billions)	137
EBITA / unit sold (€)	1,570
EBITA as % of sales	8.5%
(ROCE/Wacc x CE) – Liabilities (€ billions)	121
Reuters:	7203.T
Bloomberg :	7203 JP

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Zeronize & Maximise: the Sector Benchmark

Over the past five years, Toyota Motor has been one of the automotive industry's star performers in terms of market share capture, placing it ahead of Hyundai. Toyota's high margins, huge production facilities (the group is the world's second largest carmaker, alongside GM in first place and Ford in third) and hitherto excellent strategic vision should see the group move to number one position worldwide over the next five years on volume and perhaps margins too (the group is number two or three behind Porsche and Nissan).

Brands (cars): Toyota, Lexus, Scion and Daihatsu.

Key alternative models: HV = Prius, RX400h (a new model based on the GS450h coach concept was recently unveiled in Tokyo). Other alternative vehicles: Harrier, Kluger, HighLander, Estima, Alphard, Crown Royal Sedan, Dyna and Toyace

Toyota created the "alternative" market with Prius. The group launched the Prius, its first mass produced hybrid vehicle, back in 1997. This was a landmark event insofar as the Prius was neither a replacement model nor an environmentally-friendly version of an existing car. It took Toyota three years to establish a customer base, three years during which only 60,000 units were sold. Sales began to pick up in 2000, with 38,000 units shifted in that year alone. By 2003, that number had risen to more than 50,000. By the end of 2004, cumulative sales of hybrid models had reached almost 350,000 units, with Prius cars accounting for the bulk of this impressive number.

A million HV a year by 2010? Toyota will probably breach the one million mark in total cumulative sales by 2008. But one million hybrid vehicles *a year* would be equivalent to 11-12% of Toyota's total annual output, requiring at least four high volume models (Prius is likely to peak at 350,000 to 400,000 units a year, or triple the 2004 output).

Strength(s): 1) Toyota has been the instigator of most process innovations and many a product innovation over the past 20 years; 2) the group has not ruled out any form of technology; 3) Toyota puts long-term profitability ahead of immediate returns (the Prius model, for instance, is currently losing money).

Weakness(es): 1) an overly cosy relationship with its *kereitsu*; 2) Japanese-style governance prevails.

Next big step: The launch of the Lexus brand in Japan (probably including a hybrid version of the Lexus) in response to the bi-polarisation of the market along Premium / Access-Price lines.

Overall rating:

Introduction – SRI & EFIs (extra-financial issues)

For us, an SRI or EFI-oriented evaluation of the auto sector is about facts, figures, key drivers and above all – costs – but with an ultimate view to building more sustainable businesses in a more sustainable world.

A range of possible scenarios are on the table

Nothing is a given

One thing is certain – nothing is for sure when it comes to an analysis of the auto sector. Many different scenarios are possible, with vastly differing ramifications for the companies and the sustainability of the path and result.

In that vein, we do believe, for instance, that the strong development of SUV sales in some parts of the world (US and some developing markets) in the 1990s did not represent the most sustainability-efficient path with regard to fuel consumption, raw material consumption, or clean air standards. Investors should not forget that complexity is the master word in this area. Economic profitability can be reached by a variety of different means, everything of course depending on the customer's perspective – price, concerns, preferences, access, services, purchasing power, etc.

With these thoughts in mind, the following pages are not going to trace what the sustainable path for the automotive sector should be, but rather disclose the current position of the industry and its players with regard to the main stakeholders, drivers and trends actually at work and which could lead to different scenarios – at the national, regional and global levels. Of course, it is very likely that the truth lies somewhere in between, depending on the sustainable consciousness at work in clients' minds, stakeholders' desires, and government policies. As emerging markets overtake established Western markets, special focus needs to be placed on the countries that will emerge as the new potential Eldorado for the automotive industry.

Investment horizons

Our horizon – 10-15 years: 2015-2020

In this report, we will strive to set out the possible scenarios for the next 10 to 15 years. Why such a period? It is partly to get a better idea of the possible impacts of the increasing raft of new and breaking legislation and regulations (i.e. air quality standards, air emission standards, recycling and end-of-life vehicles etc.). Much of the current wave of legislation will come into effect from now until 2016 (California air emissions regulations).

Regarding climate change and GHGs, there is no real visibility beyond 2012. It is of course possible to draw an imaginary line until 2030 - EIA projection limits for oil & gas demand and productions, or 2050 and even 2100 in parallel with IPCC projections regarding climate evolution and GHG emission levels. In our view, SRI and EFI analysis is not about predicting the future but talking about investment opportunities in light of a broad, comprehensive context. We do not believe that it is relevant or insightful to go any further than 2015-2020, even though we will probably miss a large-scale implementation of the expected fuel-cell motor generation. Don't worry - we will get back to you on that one.

Our results

After reviewing the key facts, drivers, OEM's current and expected positions, the 10-15-year scenarios, we conclude with a joint financial and extra-financial evaluation of the automakers. This evaluation derives from an EV – DCF model, based upon the various assumptions explicated into each of our different scenarios.

Our panel of companies

13 leading global automakers

The report is focused on a financial and EFI evaluation of a panel of thirteen leading, global automobile OEMs (original equipment manufacturers) or automakers:

AUTO OEM	FULL NAME	HOME COUNTRY
BMW	BMW Group AG	Germany
DCX	DaimlerChrysler AG	Germany
Fiat	Fiat S.p.A.	Italy
Ford	Ford Motor Company	USA
GM	General Motors Corporation	USA
Honda	Honda Motor Co., Ltd	Japan
Hyundai	Hyundai Motor Corporation	South Korea
Nissan	Nissan Motor Co., Ltd	Japan
Porsche	Porsche AG	Germany
PSA	PSA Peugeot Citröen	France
Renault	Renault S.A.	France
Toyota	Toyota Motor Corporation	Japan
VW	Volkswagen AG	Germany

But don't forget other key actors

Suppliers & emerging market automakers

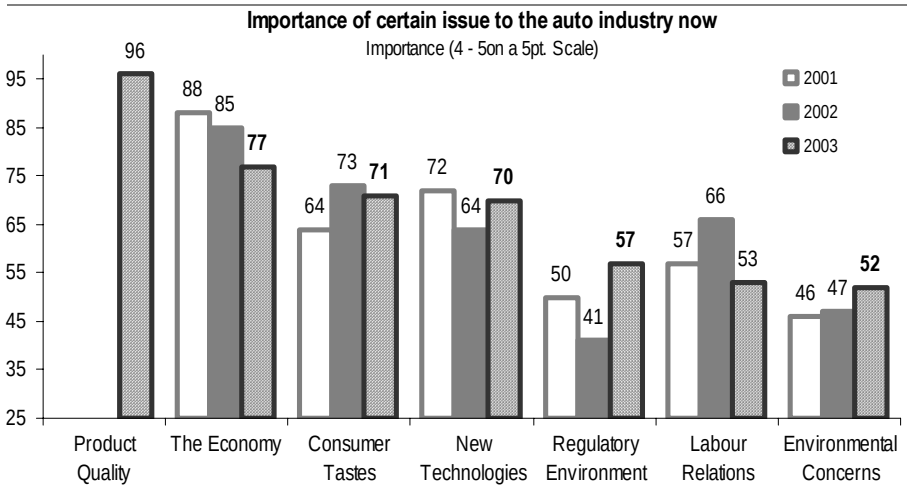
A number of other companies are also examined in the report insofar as they have an impact on our main panel. This includes a number of established and emerging developing country automakers. It also includes another market player who we regard as key to fully understanding the sector – the suppliers. They are facing similar opportunities and risks vis-à-vis offshoring to low-cost countries, R&D and cost pressures and in many ways are the key beneficiaries of some environmental regulation.

The state of the industry today

When asked their opinions on the near future of the automotive industry, sector executives continue to place their overwhelming focus on manufacturing quality as the number one issue. Both labour costs and environmental concerns are however on the rise.

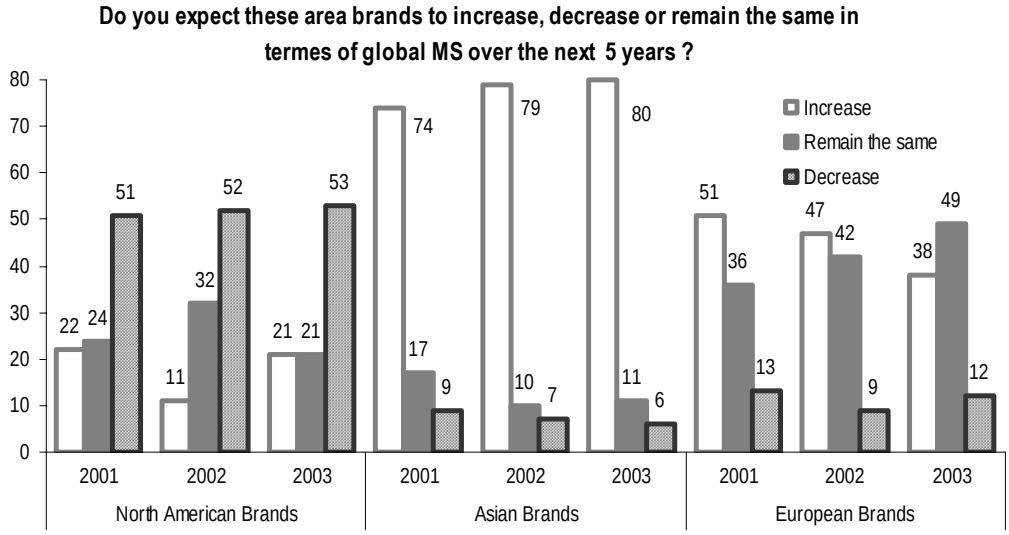
Product quality remains the #1 issue

Most important Issues ranked by the Automotive Executives - 2004



Source: KPMG Automotive Survey, 2004

Expected global market share change – 2003-2008 – Executives survey



Source: KPMG, 2004

Expectations of Asian growth

As can be seen, automotive executives have integrated a steady projected growth from Asian automakers into their qualitative valuations. This opinion is embedded on: a) car market growth in Asia; b) perception of manufacturing quality; and c) a better positioning regarding innovation & R&D of the Asian manufacturers.

A lot of pessimism in North America

Decline will continue

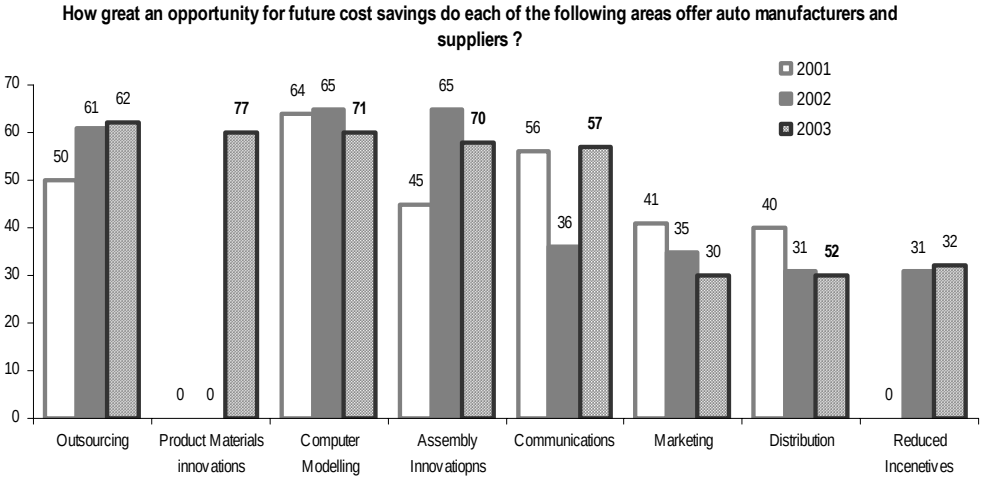
Some North American automotive executives were even more pessimistic than the average. From the supplier perspective, one North American Tier 1 executive noted, "Our volume with Detroit is holding steady, but as a percentage of our overall business, it's declining." Only half (50 percent) feel that U.S. makers will become "more efficient and more competitive" over the next five years, down slightly from 56 percent in 2002. Interestingly, North American executives were much more likely to expect a continuing decline in global market share for North American brands (68 percent) than non–North American executives (40 percent). The North American market will be a key automotive battleground, and for the time being outsiders appear to have an edge. "It's not a level playing field," said one North American Tier 1 executive." The domestic automakers are very old companies, with older workforces, pension costs, and healthcare liabilities."

Cost reductions: where are we headed?

Cost have been trimmed to the bone

Cost-saving has been one of the main topics addressed in the last 10 years by the OEMs. Today, it is no longer a given that cost-saving is the number one priority as a key driver for the automakers. This is partly because a lot has already been done, regarding reducing costs in supply chain, but also domestically with staff reductions and derived reduced labour costs.

Sources of expected cost reductions



Source: KPMG 2004 Report

Globalisation: mature markets

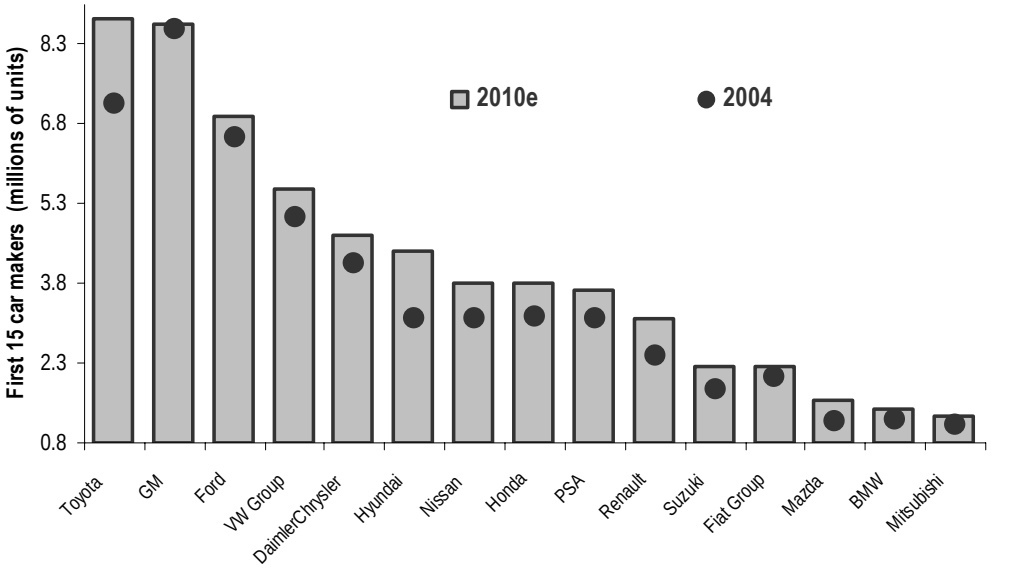
Asian players re seen as a major threat

Across the industry, executives are significantly more optimistic that future profitability will improve. However, substantial worry remains that American-based vehicle manufacturers (VMs) are facing a relentless erosion of market share by a swelling tide of attractive, less expensive Japanese and Korean cars and trucks. Among some of the views shared by auto executives on the sector's medium to long-term horizons were that:

- ***Manufacturing quality has improved while costs have declined***, thanks to advanced technology, yet quality remains the number one industry issue.
- ***Concerns about new regulations and the environment are rising***.

- ***Transplants in the United States are increasingly appealing sources of business*** for U.S.- based suppliers.
- ***The need to control costs is becoming a way of business life***; outsourcing—or the threat to outsource—is seen as an effective strategy.
- ***Further consolidation is expected throughout the industry***—for VMs, suppliers, and dealers.
- ***U.S. model mix will continue to shift away from cars***, with crossovers, SUVs, and pickups to grow faster and the minivan possibly staging a rebound.
- ***Globally, the car will prevail*** but all other vehicle types will also find buyers.
- ***Premium segments will continue to grow*** in share as long as current circumstances hold.
- ***Safety innovations are expected to continue to lead technological advances*** and garner the biggest investments from car companies.
- ***Fuel efficiency will jump in consumer purchase criteria.***
- ***Growth of sales incentives will level off.***
- ***Consumer loyalty will continue to decline across the board***.

Toyota may still be tomorrow's leader (in terms of volumes, at least)



Source : Industry, CM-CIC Securities / ESN estimates

Globalisation, another BRIC in the road

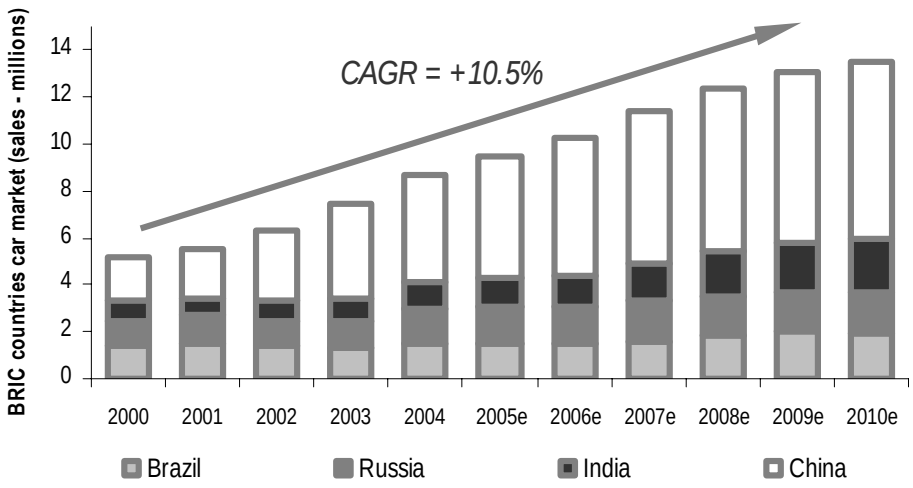
BRICS - SUMMARY	
▪ Rising purchasing power & emerging middle classes - 1 billion+ new buyers	
▪ Brazil is a flex-fuel success story. Developing countries & US will build on Brazil's bio-fuel success	
▪ Russia - least developed of the BRICs & domestic automakers are on the decline	
▪ India holds out huge untapped potential - middle classes & converting the 2-wheel drivers	
▪ Affordability is the key factor in the Indian market - subcompacts & compacts	
▪ Tata's People's car is one of the most innovative ideas in the sector - fortune at the bottom of the pyramid	
▪ China - most competitive market in the world: overcapacity & cut-throat competition	
▪ Success in China is based on choosing the right JV partner	
▪ Chinese market will consolidate & domestic players will come out the big winners in the long-term	
Winners	**- Country**: Brazil - Fiat, VW; Russia - too early to say; India - Suzuki & domestic players, Fiat (via Tata); China - domestic players, GM **- OEM:** Hyundai (China & India); Toyota (good position to build on in all major markets)
Losers	- Ford - late entrant to China & India - PSA – late starter on Brazil, Russia & India

Emergence of the BRICs

Source of growth and competition

The economic power of the rapidly growing BRIC countries – Brazil, Russia, India and China – is already far more important than it was a few years ago and their importance is only going to grow in the coming years. We believe that they have the potential to be a major source of growth and competition for the auto sector in the next 5 to 10 years and the major source in the longer-term. Their share of global growth is likely to continue to rise and push global growth rates above 4% – significantly higher than the last 20 years. It is for that reason that we view them both as a major driver and challenge for the global automakers (cf. our part on *Technological Transition)*

Projected BRIC passenger car sales to 2010



Source: Industry, Automotive News and CM-CIC Securities / ESN estimates

Emerging middle class

800-million strong and growing

A growing BRIC middle class is emerging in these countries and will continue to grow if the countries' growth continues. If one takes an income level of €2,500 (USD 3,000) as indicative of entry into the middle classes, in the coming 5 to 10 years, 500-800m people in the four countries are likely be entering the middle class. In the longer-term, these countries could have between 100-200m people with annual incomes of USD 15,000+.

New consumers buy lots of cars

300-400% growth

Newly emerged consumer classes buy cars. China's car ownership may quadruple in the next decade while India's may triple. In 20-30 years both countries could have more cars than the US, Japan or any major European market; Russia could also well emerge as the market leader in Europe. We do however take a more conservative stance given potential macroeconomic disruptions (cf. the Brazilian Real devaluation in the late 90's and its impact on the economy and domestic car market).

Financial & extra-financial impacts of their emergence

Pressure on the environment

The emergence of the BRICs and the developing world as a whole will have huge impacts across the financial an extra-financial spectrums – from increased demand for energy, oil and other commodities to pricing pressures to new consumer markets to environmental pressures. How these issues play out will of course be largely dependent on the attitudes of the leadership of the BRICs and the economic forces that will drive their economies.

Impacts for the auto sector

Opportunities and risks

For each of the BRICs, we have undertaken a brief overview of the respective markets – including sales and prospects, key drivers and main players (domestic and global), a positioning of the automakers in the markets as well as an analysis of some of this section of the report provides an overview of the four markets, their main players (domestic and foreign) and some of the developments and evolutions from these markets which will change the face of the sector as we know it – risks and opportunities - in the short and long term.

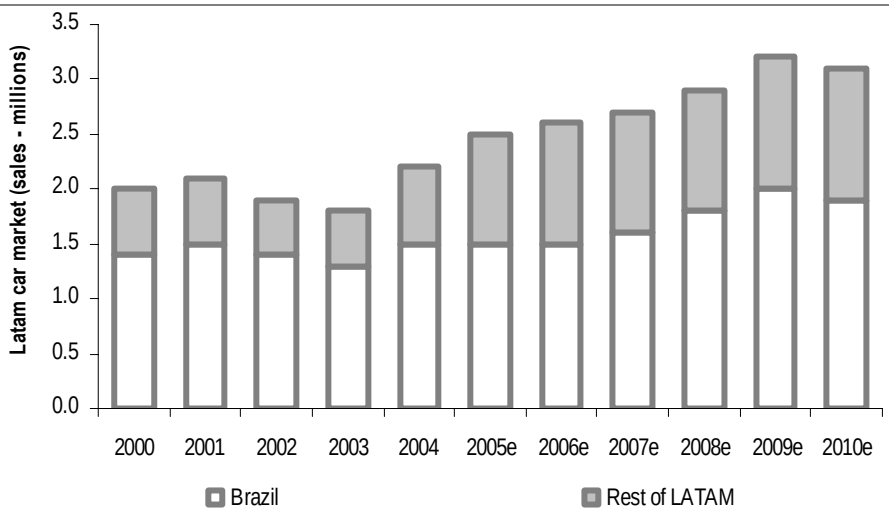
Brazil

Market overview

Largest Latin American market

Brazil is the largest auto market in the Latin American region – significantly larger than the second largest market, Argentina – with some 1.5 million vehicle sales expected for 2005. Brazil is a highly competitive automobile market with the focus on the low margin compact and sub-compact segments (B and C) – 1l cars accounted for close to 60% of domestic new car sales in 2004. The major players are also rapidly adapting their production and models to vie for a piece of Brazil's (so far…) unique but highly successful foray into flex-fuels.

Overview of Leading Latin American Markets



Source : Industry and Automotive News

Overcoming the disappointment of 2002-2003

Was hit by the regional crisis

Like the rest of the Latin American market – Brazil suffered from currency devaluation and economic crisis in the region. It had suffered from chronic overcapacity (as high as 40%) and falling domestic demand – with a 10% decline in national car registrations after the national bank raised interest rates to fight inflation. Sales actually fell in both 2002 and 2003 after rapid growth in 2001-2002.

Back in 2004 & full-speed ahead for the rest of the decade

4-8% growth

Market conditions have improved significantly since then. Interest rates have since been cut and remained low throughout 2004 – boosting consumer confidence and access to credit. This spurred a 15-20% increase in car sales in 2004 to some 1.5 million cars. Rising wage growth and confidence have further spurred sales for 2005 – by as much as 10%. Car exports have also reached a record high for 2005. We expect that sales growth will continue for the rest of the decade at between 4-8% – with Brazil accounting for two thirds of Latin America's new car sales.

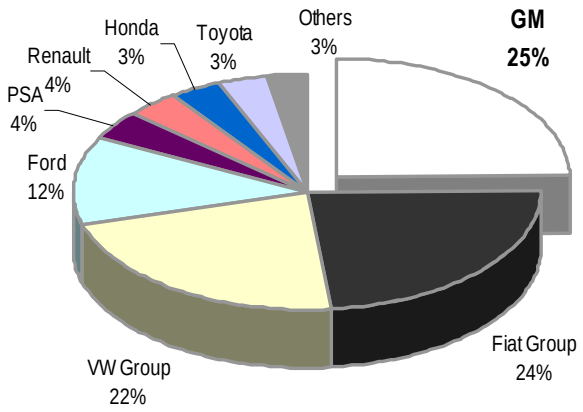
Brazil – key market drivers and risks

DRIVERS	RISKS
▪ Consumer confidence – sales and margin growth	▪ Possible slowdown in world demand for commodities
▪ Economic growth	▪ State of US economy - impact on Brazilian exports
▪ Growing use of credit to buy vehicles	▪ Dynamic between exchange rates & interest rates
▪ Flex-fuels – popularity of low-priced subcompacts, tax breaks	▪ Depressed economic prospects & consumer confidence
▪ Flex-fuel potential of LDC & developed markets	▪ Trade tensions with Argentina & Mercosur countries
▪ Hub for regional production	▪ Limited demand for higher-end models – preference for Mexico
▪ Export potential – Mercosur, Chile, Andean community	▪ Failure to invest in flex-fuels

Source: CM-CIC Securities / ESN estimates.

▪ Main Players

Main players in Brazil



Source : Industry

Overview of main players in the Brazilian market & their strategy (1/2)°

COMPANY	COMMENTS
BMW	▪ No domestic production & negligible sales ▪ Ended JV with DCX (Chrysler) – Mini engines
DCX	▪ Failed to make any impact with cars – domestic sales or export strategies; trucks are a success ▪ Abandoned assembly of completely knocked-down (CKD) kits of C class ▪ Phased out production of A-class & cancelled local production of its struggling Smart ▪ USD820m Juiz de Fora running at 5% of capacity – closure means repaying USD200m in subsidies
Fiat	▪ Brazil is their main LA Market – 20% of global sales; 90k exports planned for 2005 ▪ USD 120m loss in 2004 but expecting €116m profit for 2005 ▪ Investing USD 500 to update technology & launch new models – 1l compact & Idea minivan flexfuel ▪ Expects flex-fuel will be 80% of car sales by end 2005 (2004: 33%)
Ford	▪ LA division turned a USD 129m loss in 2003 into 140m profit in 2004 ▪ Ford has chosen not to compete with the other 1l subcompact car players ▪ Success is based on high-volume production of CVs, Fiesta & the entry-level EcoSport SUV
GM	▪ Sales for LAMEA div. rose 37%, market share by 17.4%; operating margin of 1% (USD 85m) ▪ Brazilian subsidiary is thought to have made a loss; 1Q 2005 46 (up from 1m in 2004) ▪ Investing in flex-fuels – partnership with Bosch & USD 383m in new investments ▪ Launched new flex-fuel models - 1l Celta & 6 other ▪ Expects flex-fuel will be 60% of car sales by end 2005 (2004: 26%)
Honda	▪ Main focus has been on motorcycles (€1.7 billion expected sales for 2005, 850k sold in BR) ▪ Cars are assembled using parts imported from Japan ▪ One of the only local manufacturers not to currently produce flex-fuels (along with Mitsubishi) ▪ Will begin flex-fuel production in 2006 – Civic & Fit using parts imported from Japan
Nissan	▪ See Renault
PSA	▪ Failed to take advantage of flex-fuels ▪ Ending supply contract with Renault for 206 model 1l engines (end 2005) ▪ Will not produce 1l engines itself but will continue to sell its 1.4 & 1.6l flex-fuel 206 ▪ Reduced engine sizes to take advantage of local market & tax breaks – cut price by 10%
Porsche	▪ No domestic production & negligible sales
Renault	▪ Failed to take advantage of flex-fuels & losing market share ▪ Medium-term plan for achieving a turn-around announced for end 2005 ▪ Nissan-like revival with a focus on investments in operations is expected (vs. restructuring) ▪ Plans to produce Megane by 2006 & low-cost Logan by 2007

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

Overview of main players in the Brazilian market & their strategy (2/2)°

COMPANY	COMMENTS
Toyota	▪ Achieved record sales for 1H 2005 (29k vehicles, up 21% on 2004) ▪ Failed to take advantage of flex-fuels – alcohol may not exceed 3% of fuel content in Japan ▪ Plans to market flex-fuel models by 2H 2006 ▪ Planning to invest in new compact car plant – goal is 10% Mercosur market share by 2010
VW	▪ Gol is best-selling model for 19 years despite growing competition; exported to other LDCs ▪ Good history of revamping & improving models incl. range of engine sizes ▪ Fox produced exclusively in Brazil for export to Europe ▪ Launched new flex-fuel models - 1l Fox & Gol ▪ Flex-fuel pioneer (active since 1993) – shifted close to 90% of sales to flex-fuels

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

▪ Brazil is an alternative fuel success story

Flex-fuels

The unique factor of the Brazilian auto market – both from a financial and EFI perspective in the short and long-term – is undoubtedly the growing dominance of flex-fuels. Flex-fuel technology allows cars to run on ethanol or gasoline or a mixture of both and was introduced to Brazil in March 2003 – a technology developed on the basis of an earlier generation of engines powered by ethanol.

An alternative fuel pioneer

30 years of experience with ethanol

Brazil has 30-years experience with alternative fuel vehicles dating back to the oil crisis of the 1970s – when the government launched an ethanol fuel programme aimed at reducing dependence on oil imports. By the mid-1980s, ethanol accounted for a staggering 70% of car sales. However, owing to lower oil prices and a shortage of ethanol in the 1980s, ethanol-only vehicles lost their appeal. By the 1990's the government had scaled back its ethanol subsidies and demand was further diminished. Importantly though, its infrastructure of ethanol filling stations remained intact.

They're back! A new generation of flex-fuel cars

Only visible difference is price

Since 1993, a new generation of flex-fuel vehicles with a single fuel system has gained a growing market share. These systems employ sensors allowing engines to adjust to gasoline and alcohol in any combination. Drivers can thus fill up on regular gasoline, fuel cut with 25% ethanol (the law in Brazil) or run their flex-fuels on straight ethanol. The only visible difference with flex-fuels is an auxiliary fuel tank that holds a small volume of gas to aid starts on cold days – a problem with older, ethanol models. The rise of the flex-fuels has been spurred by three key factors:

- ***Lower fuel costs*** – gradually increasing (USD 40) and now record oil prices (USD 65+) have increased gas prices, thus encouraging consumers to make the shift to ethanol which is currently selling at half the price of gasoline;
- ***Competitive prices*** – flex-fuels models do not cost any more than traditional gas-powered cars and producers are putting a wide range of new models on the market; and

- ***New tax breaks*** for ethanol flex-fuel car owners – a 2l car owners pays IPI[1] of 25% if it Is gasoline-powered vs. 17% if it runs on ethanol or a mixture; 1-2l ethanol or flex-fuel cars pay a further 2% less IPI.

Flex-fuels gain market dominance

Flex fuels – up to 75% of new sales

Flex-fuel sales reached 61.7% of new cars sold in Brazil in August 2005 – sales of gas-powered cars stood at only 32.0%, down form 68.3% only one year earlier[2]. The trend toward flex-fuel dominance of the market began at the start of 2005 – with the vehicles gaining 45.1% of total sales from January to August 2005 and probably well over 50% by the end of the year. They are expected to have as much as a 75% national market share of total new vehicle sales by 2006e[3].

Ethanol & flex-fuels vs. gasoline car sales

	2004	Market Share %	% Growth	2003
Alcohol	331.417	26.2	322.8	78.390
Petrol/Gas	932.028	73.8	-7.2	1.003.938
Total	1.263.445	100	-	1.082.328

Source: Industry sources in Automotive News

Strong likelihood of maintaining pole position for the mid to long-term

They are here to stay

The impact of future oil price trends will obviously be an important factor in the long-term success of flex-fuels in Brazil. However, we believe that flex-fuels have even greater potential in the Brazilian market: i) Brazil has the farming and filling station infrastructure in place – and existing local sugar players and international companies are investing USD 6 billion in new plantations and distilleries to further develop ethanol over the next five years; ii) Ethanol offers Brazil a significant export opportunity if automakers as well as other countries pick up the pace of adopting ethanol and flex-fuels – it has the potential to become the Saudi Arabia of ethanol; and iii) Oil price – domestic growth will only increase further if oil remains at its current levels (or higher).

▪ Should automakers be taking note of Brazil?

Exporting the flex-fuel model will not be easy

A number of automakers and other actors are pessimistic about the feasibility of ethanol and/or flex-fuels outside of Brazil – i.e. as a short or long-term complement or replacement for gasoline or other alternative fuels. The arguments on the nay side are strong: a) most countries lack the fuel and fill infrastructure – in the US, only 0.3% or 400-500 filling stations out of a total 180,000 are ethanol-friendly; b) significant farmland would need to be converted – for the US or EU to replace 10% of fuel with existing crop-science and technology would require converting up to 40% of crop land – with a knock-on impact on food prices; c) transport – ethanol can't be transported through existing gas pipelines because it sucks in grime and dirt; d) energy density – a litre of ethanol won't go as far as a litre of gas; and e) protectionist barriers – although Western farm lobbies are pushing biofuels, they are also pushing for agricultural subsidies: the EU currently pays farmers €45 for each hectare of "energy crops", giving farmers a strong incentive to keep cheaper imported ethanol out (i.e. ending Pakistan's special access in 2002). The US has a USD 0.50/gallon import duty on

[1] *Industrialised Products Sales Tax*
[2] *Sources: Anfavea*
[3] *Source: Sugar and Ethanol Sector Chamber.*

Brazilian ethanol. The existence of different biofuel standards in almost every EU country can also be seen as a subtle protective barrier.

Developing countries are moving fast on biofuels

Experimenting and investing in bio-fuels to reduce oil imports

A number of developing countries including the BRIC – i.e. the rapidly emerging markets and potential competitors of the future for the automakers – are either experimenting or moving towards the adoption of bio-fuels as a strategic axe for reducing their oil imports:

- ***China*** – has set itself a fuel ethanol target of 2.0 billion litres by 2010. It is constructing the world's largest fuel ethanol facility at Jilin (corn), and experimenting with cassava, sweet potato and sugar cane. In addition, it is closely studying Brazil's production methods and thought to be considering importing Brazilian ethanol;
- ***India*** – fuel ethanol production has reached 1.3 billion litres out of 2.82 billion litre target and 5% ethanol blending with gasoline has been made mandatory by the government;
- ***Indonesia & Malaysia*** – the world's largest palm oil producers are planning to significantly expand output, expecting 25% growth p.a. for biofuels; and
- ***Thailand*** – 10% ethanol blending was permitted in January 2005 and it is building over a dozen ethanol plants using cane and rice husks.

Competitive advantages for LDCs

For once, nature is on their side

It should be noted that many developing countries have a competitive advantage vis-à-vis Western countries for bio-fuel production – year-round growing seasons, lower-cost farm labour, more efficient production techniques (i.e. using parts of the plants as fertilizer and as fuel for distilleries). This means that they can usually produce bio-fuels cheaper than the USD/€ 50+ in the US and EU, get up to 5x more bio-fuel per acre of land and produce fuels using less fossil fuels.

10% of gas consumption could be replaced

Oil price will be a key factor

Optimistically but realistically, a number of developing countries – including Brazil, India and China of the BRIC – could replace 10%+ of their gasoline consumption. If the oil price remains high for a long period, this number could easily grow. As BRIC and developing country demand for cars grows, this will have significant impacts for the automakers.

US sees them as one of <u>the</u> alternatives for the future

Up to 30% of gas consumption could be replaced

The US in particular has embraced bio-fuels enthusiastically and appears to regard them as the biggest alternative fuel and the key transitional fuel before a future generation of fuel cells. The US Department of Energy believes that these new technologies can replace 30% of its current gasoline consumption by 2030 -- without cutting into food production or greatly changing land use. We believe that these are significant measures which the automakers should be sitting up and taking note of; we need to remember that Brazil caught them all by surprise – with significant market impacts for the laggards.

Ford leading the way among automakers

280k flex-fuels by 2008

To date, Ford has been the most pro-active on biofuels outside of Brazil, including its recent announcement that it will produce 280,000 ethanol-capable vehicles by 2008. GM and VW are hedging their bets on the potential for lower costs, greater volume and better eco-efficiency from the newer technology of using biomass, such as straw and stover (the dried stalks and leaves of cereal crops) as offering the greatest potential for lower costs.

High oil prices are influencing Western countries

US is embracing biofuels & EU has set challenging new targets

High oil prices are also serving as a major incentive for the western developed countries – the home countries and major markets of the automakers – to accelerate their ethanol and bio-fuel agendas forward:

- ***Canada*** – a number of provinces are passing laws requiring 5% ethanol blended gasoline by 2007;
- ***EU*** – has set a goal of obtaining 5.57% of energy from biofuels by 2010 (2005: 2%). This would require a five-fold increase in the production of biofuel crops – whether this would be a boon to developed or developing country farmers remains to be seen;
- ***Japan*** – has signed its first 15 million litre deal with Brazil (May 2005) with a goal of replacing up to 3% of its gasoline i.e. 1.8 billion litres. of alcohol p.a.; and
- ***US*** – already the world's second largest ethanol producer and the new Energy Bill stipulates that biofuel should account for 10% of US transport fuel by 2009 (i.e. 28 billion litres p.a). This will be a major spur for the already predominant corn-based ethanol – but also sugar-based ethanols in the southern states with USD 6 billion being invested in new ethanol plants.

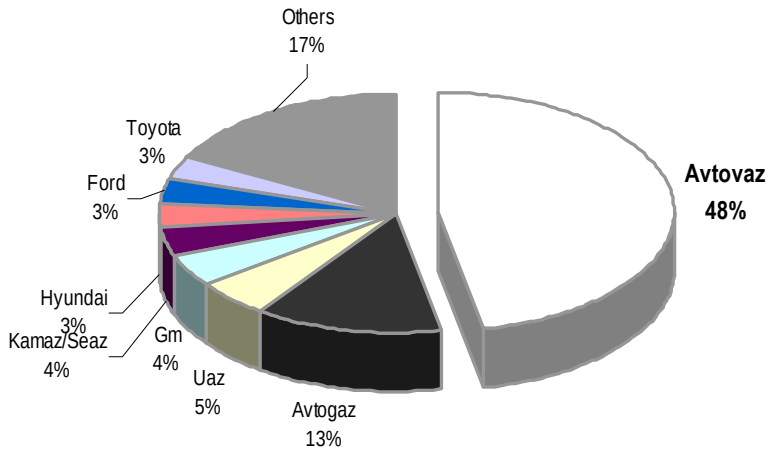
Russia

Market Overview

Strongest growth market in Eastern Europe

The Russian new car market had long been ignored by foreign automakers. However, since 2003, it has emerged as one of the strongest growth markets in Europe and the leader amongst the transitional economies of Eastern Europe. While vehicle penetration remains relatively low at only 156 vehicles per 1,000 people, registrations rose by 6% in 2004 and are expected to rise by 10% in 2005.

Main players in Russia



Source : Industry

Passenger cars (stock per 1,000 pop)

	2004	2005	2006	2007	2008	2009
Russia	155.5	161.9	168.5	175.6	183.0	190.9

Source: Industry sources, CM-CIC Securities / ESN estimates

2004 – sales boom!

Everyone is looking to buy foreign cars

In 2004, some 1.1 million new cars were sold in Russia. Sales are expected to grow to 2.5 million per year by 2010 (*Source: Union of Russian Car* Manufacturers). The biggest boom is in the foreign new car segment with sales for many brands experiencing triple-digit growth. Overall foreign car sales stood at 406,000 in 2004 (+83% on 2003) and are expected to pass the 520,000 mark in 2005 – 37% of total car sales. The seemingly unstopping demand for foreign cars and lowering of tariffs on components has made a number of international automakers consider opening new capacity or expanding existing plants in Russia.

Russia – key market drivers and risks

DRIVERS	RISKS
▪ Economy growing by 7% p.a. – energy & raw material prices	▪ Insufficient consumer demand (ex Moscow & St. Petersburg)
▪ Lowering of tariffs on components – 12% to 0 in some cases	▪ Uncertainty, protectionism, political risks
▪ Rising incomes & growth of consumer credit bridging price gaps	▪ Tariffs on imported second-hand cars
▪ Wealth of Russians is growing	▪ Capacity constraints for domestic producers
▪ Discerning consumers - foreign cars: status, cheaper lifetime costs	▪ Undeveloped infrastructure
▪ Urge to trade up to foreign cars	▪ Costlier materials driving prices up
▪ Only foreign players can meet demand for quality components	▪ Must set up full-cycle production to benefit from tariff reduction
▪ Domestic players need to cooperate with foreign automakers	▪ Must reduce volumes of imported components by 30% by 2009-10

Source: CM-CIC Securities / ESN estimates

▪ Main Players

Overview of main foreign automakers in the Russian market (1/2)

COMPANY	COMMENTS
BMW	▪ Targeting a 20% rise in sales to 6,000 units for 2005
Daewoo	▪ Sales for H1 2005 increased 81% to 28,896
DCX	▪ Considering a €100m plant near St Petersburg ▪ Said to be seeking assembly partnerships
Ford	▪ Expects to sell 60k in 2005 – incl. 25k produced in Russia (2000: 1,400 sold) ▪ Set up a USD150m factory near St Petersburg in 2004 – 1st mover advantage ▪ Aiming for 10% of the total local market by 2010
Honda	▪ Sells cars through official dealers ▪ Thought to be preparing to build a plant with a possible site by end 2005 ▪ Production would probably be in the 20-60k unit range – Accord, CR-V SUV
Hyundai	▪ Sales for H1 2005 increased 131% to 42,701; expects 15% total market share for 2005 ▪ Production at TagAZ plant – Hyundai models assembled & imported ▪ Success is based on combination of quality for low prices (USD 9k+)
Kia	▪ Recently switched its regional headquarters to Moscow from Warsaw
Mitsubishi	▪ Sales for H1 2005 increased 103% to 24,726
Nissan	▪ Jan to Sept 2005 sales up 73% to 33k; expects 50k sales for 2005 ▪ Sells cars through official dealers ▪ Reportedly looking at potential joint-ventures (eg. GAZ, Mahindra) & greenfield sites.

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

Overview of main foreign automakers in the Russian market (1/2)

COMPANY	COMMENTS
PSA	▪ Slow to take advantage of the market ▪ Dropped planned car sales target from 14k to 11k for 2005 ▪ Delays in launching new models and developing a dealer network ▪ Planning to roll-out of 206 as entry-level model & plans to develop dealer infrastructure
Porsche	▪ Six dealerships in Moscow; planning to open 4 in the regions ▪ Cayenne SUV accounts for 85% of sales
Renault	▪ Acquired a 76% stake in Avtoframos form the Moscow City Council ▪ Opened USD 250m assembly plant in April (Moscow) - 60,000 Logans p.a. ▪ Biggest project in the industry & its arrival is seen as a major landmark
Toyota	▪ Sales for H1 2005 increased 54% to 29,798 ▪ USD 143m assembly plant near St. Petersburg – 25k production by '07 rising to 100k p.a. ▪ Plans to increase production to 200k & start exports to Europe ▪ Reputation for quality is key to success – cars are relatively expensive
VW	▪ Failed to capitalise on the booming demand for new foreign passenger cars ▪ Has cut retail prices by at least USD 2k ▪ Looking to produce 200k units p.a. by 2009 – possible factory near Moscow ▪ Possible steel supply deal with Severstal – unique precedent

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

▪ Russian automakers on the decline

69% of sales but falling fast

Russian automakers continue to dominate the national new car sales market with 69% of total new car sales in 2004. However their sales have been on the decline since 2003 with consumers increasingly opting for the better quality, design and technology of foreign brands. As foreign automakers increasingly set up production facilities in Russia and bring their suppliers and intellectual property with them – the domestic automakers are expected to further decline.

Russian new car sales – domestic vs. foreign brands

	2004	%	2003	%	2002	%
Russian Brands	883,307	69	853,800	80	864,501	89
Foreign Brands	406,063	31	215,802	20	107,327	11

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

There is some hope for the Russian players

Links with foreign automakers

All is however not doom and gloom – major domestic players – such as AvtoVaz, Severstal-Avto, GAZ, Lada and UAZ – are taking measures to stem the decline:

- ***Increasing R&D and using foreign components*** – Lada's Kalina and Severstal-Avto's new UAZ Patriot SUV are two potential low-cost units that are reasonably well-made and may sell well;
- ***Assembly deals with the foreign players*** – Ability to attract partners with lower priced materials such as steel and cheaper labour (i.e. GM-AvtoVaz, Renault & Moscow city administration); and
- ***Tapping other less developed countries*** – with their rugged and inexpensive cars may allow them to develop a niche in such markets although this will require significant effort and investment.

Russia will be a source of growth but not innovation

Growth & cheap resources

We do not believe that the Russian automakers have the same bright future as the Chinese and Indian players – i.e. as major players outside of their domestic markets in the medium to long-term. The future of its domestic players probably lies in assembly deals with the foreign players – such as is happening with GM and AvtoVaz and Renault and the Moscow city council. Such deals represent their only hope of being able to continue producing low-cost vehicles that sell well. Such deals offer the foreign automakers opportunities to rapidly increase the amount of locally made components for its models assembled in Russia, as required if foreign assemblers want to benefit from 0% duties on imported components. Russia also offers the foreign automakers an abundance of natural resources, low duties and cheap labour – which will eventually persuade foreign players to set up shop in Russia and make it a major hub for Eastern Europe.

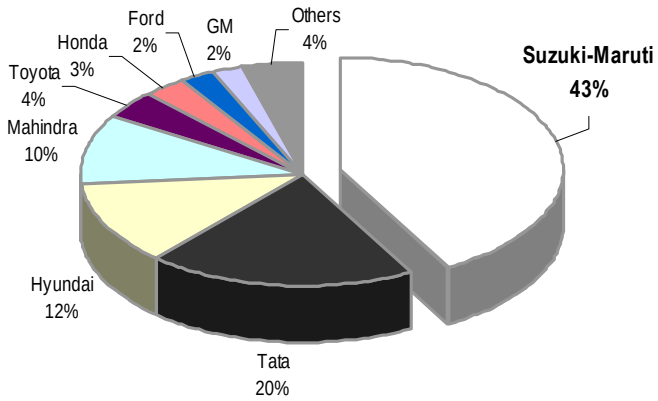
India

Market overview

World's fastest growing market

India has emerged from its long past – as a hugely inefficient automobile sector, with just two players and only one in 1,000 Indians able to afford a car – into the world's fastest growing major car market among the world's top-15 passenger car producing countries (Source: OICA). In 2004, passenger car sales broke through the important 1 million mark barrier as incomes rose and interest rates fell to 30-year lows. Car sales are expected to grow by 10-30% over the next five years.

Main players in India



Source : Industry

Growing middle class driving car sales

6th largest economy by 2020

Middle-class Indians are driving the industry in domestic sales and are likely to do so for the next five to seven years. Despite a relatively low level of GDP per capita, income measured by PPP (purchasing power parity) is estimated to be just over USD 3,000 and rising by 10% p.a. If India continues to grow at current rates, it could become the sixth-largest economy by 2020 and the third-largest economy in less than 30 years.

6-10 million potential car-buyers

As a result, we estimate that between six and ten million Indians are in a position to make a car purchase. The proportions are significantly higher in fast-growing urban centres such as Bangalore, Delhi and Mumbai. The fact that most of the sales have come in the last two years – when fuel prices and auto component prices have increased significantly is a good sign for the automakers. Similarly rural demand is also growing – with rural consumers accounting for over 10% of car sales by the end of the decade.

Affordability is the key factor

Rising incomes & consumer financing

Strong economic growth has helped to raise incomes and make cars accessible to urban middle-class consumers. Only two to three years ago, the average Indian household had to spend the equivalent of 15 months income for a sub-compact such as the Maruti 800 – this has now fallen to 12 months income. Rising incomes have played a part as has the introduction of consumer finance schemes. Banks and financiers are now willing to fund vehicle purchases for those with annual incomes of Rs 1 lakh p.a (EUR 1,853 if 1 EUR =

53.95 Rs). 80% of car sales are now funded through loans – aided by interest rates which have fallen to 7-9% from 14-16% five years earlier. A recent AC Neilson survey showed that 44% of Indian respondents intend to buy a new car in the next year with price being cited as the key factor.

This new affordability factor is one that we believe could be a major boon for Tata as the number of people with incomes over Rs 1.32 lakh could increase by nearly 14 times in the next decade (see below). Improving infrastructure is also playing a role in driving car sales – but cars appear to be spurring the roads rather than the other way round.

Compact and sub-compacts dominate the market

70% of sales

The focus of the middle classes is on low-priced fuel-efficient compact and subcompact cars with such cars accounting for up to 70% of sales and which we see as the biggest potential growth segment for years to come. One car in particular, the Maruti 800, with an engine size of less than 1,000cc, remains the biggest seller, with a market share of 15% in 2004 (down from 25% in previous years). Rs 3-5 lakh compacts are at the higher end of the aspirations of the middle classes. The market for higher-end, luxury and SUV models – priced above USD 20,000 – doubled in the last 2 years and now makes up close to 5% of sales.

Converting the 2-wheelers will further grow the market

6m buyers waiting to be converted

India remains dominated by 2-wheelers – motorcycles and scooters – which account for 6 million sales per annum and may account for sales of 10m by the end of the decade. Car ownership remains relatively low, even in comparison to other LDCs – at around 6 vehicles/1,000 people which will rise to an estimated 10/1000 by the end of the decade. As incomes of 2-wheel purchasers' rise, they will aspire to purchase cars, and this segment will become a massive opportunity for the automakers. One recent market study showed that 20% of 2-wheeler owners were planning a vehicle purchase in the next there years – the potential for growth is enormous.

Indian vehicle sales (by category)

CATEGORY	SALES 2003-2004	MKT SHARE 03-04	SALES 2004-5	MKT SHARE 04-05
Two Wheelers	5,622,741	77.6%	6,526,547	77.1%
Passenger Vehicles	989,560	13.7%	1,209,654	14.3%
Three Wheelers	356,223	4.9%	374,414	4.4%
Commercial Vehicles	275,040	3.8%	350,033	4.1%

Source: SIAM (Society of Indian Automobile Manufacturers)

Export potential is growing

7% of production but high duties are a barrier

India produced over one million cars in 2004, making it the ninth largest car producer in the world. Although most production was for domestic consumption, exports are forming a rapidly growing segment of car sales – 6.6% of production in 2004 (up 77%). Most exports go other developing countries in Asia and Africa, although as the quality of domestically produced cars improves, India's domestic players are beginning to target Europe. Exports remain inhibited by excise duties on cars which remain extremely high at 24% - even if they have been falling steadily from 40% only five years ago.

European and US players missing the boat

Market is dominated by the domestic players

European and US manufacturers have yet to develop a significant presence in the Indian market, which remains dominated by two of India's thirteen domestic producers – the Japanese-owned Maruti (Suzuki) and domestic player Tata Motors – who have 60% market share. They also have a 70% market share in the vital mini and compact car segments for which India is the world number 2 after Japan. The Asian players are along with GM positioning themselves for a major piece of this market. The Indian government's 2002 decision to allow 100% FDI in the automotive sector as well as low labour costs have and will continue to make India an increasingly attractive destination for production.

India – key market drivers and risks

DRIVERS	RISKS
▪ Low production costs & high number of skilled workers	▪ Widespread poverty & poor infrastructure
▪ Burgeoning middle class & professional population	▪ Rising interest rates
▪ 10m+ current potential car buyers	▪ Price hikes due to road taxes
▪ Interest rates at 30 year lows - growing use of soft loans	▪ Rising production costs from new emissions standards
▪ Potential to convert 40m+ two-wheel riders	▪ Product fatigue – model fatigue in compact car segment
▪ Export potential – hub for developing countries	▪ Danger that the government reverts to Nehruvian socialism
▪ Some countries favour shipments with tax breaks – Italy, Greece	▪ Excite duties remain high – 24% (down from 40% in 2000)
▪ Improving infrastructure	▪ Low margins under further pressure – rising material costs
▪ Potential of Tata's People's Car	▪ New emissions standards (Euro III) – rising production costs
	▪ Big discounts / price cuts – reduced margins

Source: CM-CIC Securities / ESN estimates

Auto players

Overview of main foreign automakers in the Indian market (1/2)

COMPANY	COMMENTS
BMW	▪ Confirmed USD23m assembly plant in Tamil Nadu – production (assembly) for Q3 2006
DCX	▪ Operations are profitable - Rs 45 Crore for 2004 on turnover of Rs 500 Crore ▪ No immediate plans to increase investments – focus is on China ▪ Heavy-duty *Actros* trucks to be launched for end 2005 ▪ Hub for components – plans to source €85m for 2005
Fiat	▪ Signed landmark MoU with Tata - analyse feasibility of global co-operation on development, manufacturing, sourcing and distribution of products, aggregates and components (09/05) ▪ Invested Rs 2,000 Crore in operations – 3 plants with 135k+ capacity ▪ Regional hub for R&D activities & for export activity
Ford	▪ Planning to double production from 27k to 50k pa ▪ Investing USD 100m to for "premium" model by end 2005 – world launch in India
GM	▪ Slow to develop in India although it has a claim to the market via its 20% of Suzuki ▪ Plans to increase its production capacity to 40-60k pa ▪ Re-launching Daewoo assembly unit of failed automaker – re-brand as Chevy Park ▪ Focused on larger cars ▪ Hub for components
Honda	▪ Allocated USD 31m to increase production (Surajpur plant) to 50k by 2005, 100k by 2010
Hyundai	▪ Number 1 foreign player ▪ India is regional base – hatchback production, R&D activities & for export activity ▪ Cars are well-priced – below Honda & Toyota and able to compete with Indian players ▪ Santro compact has became biggest selling low-cost model (2005), displacing Maruti 800 ▪ Accent in lower-medium & Sonata in luxury segments – latter is best seller in class ▪ Aggressive expansion plans – Sonata, new hatchbacks ▪ Investing USD 600m for expansion – +2k employees (2006) & new plant (2007)
Nissan	▪ Latecomer to the market relative to other Asian players ▪ Wholly owned USD1m subsidiary (Mumbai) began operations in June 2005 ▪ Country is a strategic market under its new 3-year business plan – *Nissan Value-Up*
PSA	▪ Expanding production in India ▪ Engine production agreement for Maruti ended
Porsche	▪ Sold out its allocated 100 within the first 8 months of operations
Renault	▪ Signed JV with Mahindra (49:51) – produce & sell planned 50k Logan p.a. by 2007 ▪ USD160m JV is strategic – 1st entry into the market & access to Mahindra's network
Suzuki	▪ See below

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

Overview of main foreign automakers in the Indian market (2/2)

COMPANY	COMMENTS
Toyota	▪ Expects to achieve break-even & to wipe out accumulated losses by end 2005 ▪ Invested Rs 1,500 Crore to establish 60k p.a. production facility (near Bangalore) ▪ Keen to establish 2nd production facility – further Rs 1,500 Crore investment ▪ Goal of 10% market share by 2010 (250k units), 15% by 2015 (600k units) ▪ Needs to finalise small car plans ASAP – feasibility study; may be a Daihatsu-type model ▪ Hub for components
VW	▪ Relative laggard to the market ▪ Skoda – double capacity to 60k (end yr), enhance R&D, increase use of local components ▪ Government inquiry underway into allegations of fraud, bribery & corruption – slush fund ▪ Has set back supposed plans USD900m to establish full-scale production by 2006 ▪ Original plan was to source 90% of components locally

Source: Company documents, Industry sources, CM-CIC Securities / ESN estimates.

India's domestic players

Tata & Maruti (Suzuki)

With some 200 different models on offer from thirteen manufacturers, India is the world's second largest car producer. The bulk of this production is controlled by 2 major players – Maruti-Udyog (Suzuki) and Tata Motors – who we believe could become major export players in the medium to long-term – particularly for other developing country auto markets.

Overview of main domestic automakers in the Indian market

COMPANY	COMMENTS
Maruti (Suzuki)	▪ #1 carmaker - accounts for 50% of all cars sold in 2004 (down from 68% in 1999) ▪ 3 plants with 3.5m production capacity ▪ Net profit rose by 45% year on year, resulting in a margin of 5.6% ▪ Followed a policy of offering the cheapest cars in each vehicle segment in which it operates ▪ Maruti 800 has long been the market leader - but sales have been sliding since 2003 ▪ Alto model is gaining greater market share – likely to become new best selling compact ▪ Strong positioning in compact & lower-medium segments ▪ 50% of cars are sold outside of top-10 metros – smaller cities, rural areas ▪ To produce its own diesels by end 2006 – ended engine agreement with PSA ▪ Only hub for small cars outside Japan – production & R&D for new cars ▪ exports cars through Suzuki – Alto to Europe ▪ Announced plans to invest Rs 6,000 Crore over 3 years ▪ Originally created as an SoE (1981) – JV w/ Suzuki (1982), full transfer to Suzuki (2002)
Tata	▪ Number 2 player in the market ▪ 5.2% profit margin for 2004 ▪ Produces compact & lower-medium cars and SUVs and HCVs, IT, components etc. ▪ Indica compact – first indigenously produced car; 4th best seller nationally ▪ Pune-based production facilities ▪ Signed landmark global MoU with Fiat (see above) – 1st of its kind by a domestic player ▪ Stands to gain from Fiat deal – retail network & accelerated export growth ▪ Possibility that Tata could produce Fiat products - Palio could shift to Tata portfolio ▪ Growth of Indica & shift of Palio – could greatly increase gasoline capability

Source: Company documents, CM-CIC Securities / ESN estimates.

Tata's "People's Car" – the model T of the 21st century?

Rs 1 Lakh car (USD2-3k)!

One of the most interesting developments in any of the BRIC countries in our view is the 1-lakh (100,000) Rupee car currently under development by Tata. The so-called *People's Car* would sell for USD 2,000 - 3,000 – making it the world's cheapest. Beating the odds will not be easy but if Tata succeeds, we believe that the car has the potential to do for the developing world what Henry Ford's mass production Model T did for America and what VW's Beetle did for Europe in their time.

From symbol of India's backwardness to symbol of its dynamism

First indigenously developed, & produced car

Tata Motors has evolved from an on-time symbol of India's automotive and economic backwardness into one of the developing world's most dynamic automakers. It entered the domestic market in 1995 through the acquisition of an old Australian Nissan assembly line and has since developed the idea of affordable cars for the rising domestic middle class. Its Indica sedan - a 4-door sedan with large rear seat and modern styling priced under USD 4,000 – is India's first locally designed, developed and produced car and an indication of how indigenous companies are using India's low-cost engineering skills to develop the car at 60% of the usual cost of launching new models. Tata has become the market leader in India for small-engined utilitarian mini-vans and trucks – credentials which place it in good stead for a people's car.

The People's Car – changing the rules of the game

Capture the source of greatest demand – low end of the market

The concept for the car is the brainchild of Ratan Tata, the group's Chairman, who is personally overseeing the production and progress of the prototype at Tata's Pune-based Engineering Research Centre. The idea is said to have come to him after having considered the reality of transport in India – "*You see 4 or 5 people precariously travelling on a scooter on slippery roads, in the monsoons, in bad weather and this is their only motor transport unless they can move to a four-wheel vehicle*."

Tata has thus set a goal of producing a car for the low end of the market – where the greatest demand is in India and developing countries – "*without producing a substandard car or without putting four wheels on a scooter, to develop a niche product, that has the safety and weather containment of a car, thereby addressing the need of people's transport for a family*." (*Source: Ratan Tata 2004, Tata website*). As Tata himself admits, this will require changing the rules of the game and the way that business is done.

Possible cost-cutting measures being considered by Tata

COMPONENT	MEASURES
Engine & transmission	▪ 2-3 cylinder gasoline engine – 600cc & 25-30bhp ▪ Delphi to supply engine management system – no indigenous suppliers ▪ Rear-mounted engine – save on constant velocity joints & avoid steering/frontal crash test ▪ No gears – save costs & increase ease of congested urban driving ▪ Challenge – cooling the engine as there is no air blowing on to the radiator fan
Body	▪ Combination of steel and plastic for its body ▪ Steel – will be costlier but will have greater acceptance (safety-concerned consumers) ▪ Use of industrial adhesives (vs. spot welding) – cost & weight savings ▪ Plastic is being considered
Interiors	▪ 4-seater ▪ Basic model may not have doors; higher end versions will have doors & windows
Production & supply	▪ Do away with traditional model - manufacturing in factory & distribution through dealers ▪ Production of basic components in Tata plants ▪ Use of independent assemblers - trained & equipped with assembly line & car kits ▪ Tata-franchisees & thousands of roadside garages – assembly & service

Source: Company documents, CM-CIC Securities / ESN estimates.

Can it be done? Can it be done profitably?

25% cut in production costs will be needed

The biggest challenge facing Tata will be to bring the prototype on to the market in a way that would make it profitable. Although the Rs-1 lakh moniker has taken hold in the Indian media, the reality is probably a car priced in the Rs 1 to 1.4 lakh and a few different models – with a base model priced around 1 lakh. Even at these prices, the car would be half the price of the cheapest "real" compact car on the global market – Maruti Udyog's (Suzuki) 800. The 800 which currently sells for Rs 2 lakh, costs an estimated 1.3 lakh to build. Maruti, hardly a partisan player, is on record as saying that no amount of value engineering can cut another 25% off of production costs.

Current small cars on offer in the Indian market

MODEL (MAKE)	ORIGIN	PRICE (RS)	DETAILS
Sitara (Habib)	Pakistan	92k	▪ Gasoline-engine, single cylinder, 170cc, Pakistan's "people's cart"
Oka (Kamaz)	Russia	351k	▪ Gasoline-engine, 2 cylinder, 749 cc, 35 hp; cheapest car in Russia
Aixam (Kinetic)	France	456 – 543k	▪ Diesel engine micro-car, 2-cylinder, 479 cc, 12.9 hp
C1 (Citroen)	France	513-667k	▪ Gasoline-engine, 3-cylinder, 998 cc, 55 hp
Forfour (Smart)	Germany	576k – 1.3m	▪ Gasoline & diesel engine, 3 cylinder, 1124-1493 cc, 68-177 hp
Sirion (Daihatsu)	Japan	630k	▪ Gasoline-engine, 3 cylinder, 1298 cc, 86 bhp
800 (Maruti)	India (Japan)	2m	▪ 1000 cc

Source: Company documents, CM-CIC Securities / ESN estimates.

Margins are small – cost targets need to be met

Tata's room for manoeuvre is thus tiny as the margins involved are so small. If Tata misses its cost targets by only a small amount, the car becomes like the 800. The 1 lakh base model would have to be produced at Rs 70,000 for it to be a financial success. Further questions also remain as to quality and emissions and safety standards – Tata says that all three concerns will be met. ***But without doors, is it really a car?***

India – the new Japan?

The new Japan for subcompacts

If Tata succeeds on all fronts – stripping away layers of distribution and manufacturing costs – Tata will have made the compact car a real affordable commodity for developing country buyers – triggering a huge demand across the industry. This could make the country to subcompacts and compacts what Japan was to the world a generation earlier. Tata estimates the current potential market in India alone at being at least 1 million:

1 million cars x Rs 30,000k per car = €553 million (1 EUR = 54.1710 INR)

Fortune at the bottom of the pyramid

In addition to the skyrocketing growth of this key market segment – Rs 1 lakh+ income p.a. at which financing becomes available – the country's annual six-million two-wheel buyers represent a further potential market. The People's Car's success could replicate the model T's success with the roads following the cars – in India and many other countries in the developing world. India could become the world's small car hub in five to seven years – just as Japan was a generation earlier – with the Indian government keen to develop this market, including through the elimination of excise duties which are currently as high as 24%. Tata has said that prototypes of the People's Car are up and running, that the structure of the car has been developed, and that the car will be out on the Indian market by 2008.

Tata – extra-financial responsibility furthers financial success

Record on SRI-EFI should make global players envious

We also strongly believe that Tata stands apart from many of its developing and developed world competitors in that it has successfully fused ferocious competitiveness with a pro-active approach to its employees. Ideas of social responsibility have long been embedded in the company whose early founders were strongly influenced by India's independence struggle and the Fabian Socialists. The question of values aside – this approach has been a win-win for both sides – employees receive full education and health benefits while Tata maintains excellent labour relations and dialogue with unions. There has not been a strike at its Pune car factory in sixteen years – a record many automakers should be envious of.

India – the next Brazil?

	DRIVERS / RISKS
Production	▪ World's top producer of sugarcane (along with Brazil) with 4m irrigated hectares with a yield of 70 tonnes/hectare ▪ 1 irrigated hectare can yield 6,000 litres of ethanol – energy equivalent of 4,000 litres of gasoline ▪ Sugar-cane is the best agricultural source of ethanol
Need	▪ If 5 million of the new cars were flex-fuel – would consume 8 billion l/pa of E85 (85% ethanol & 15% gasoline)
Benefits	▪ E85's energy content is 73% of gasoline ▪ Energy equivalent price of ethanol is Rs 14.70/l. (vs. Rs. 22/l. for gasoline, assuming oil is USD 60/barrel)
Challenges	▪ Producing 8 billion l./p.a. – would require switching 1m+ hectares to sugarcane with an impact on food production ▪ Sugarcane would only give a farmer Rs 88,200 p.a./ha. (vs. Rs 146,000 for refined sugar; vs 2-3x more for grains)

Source: CM-CIC Securities estimates

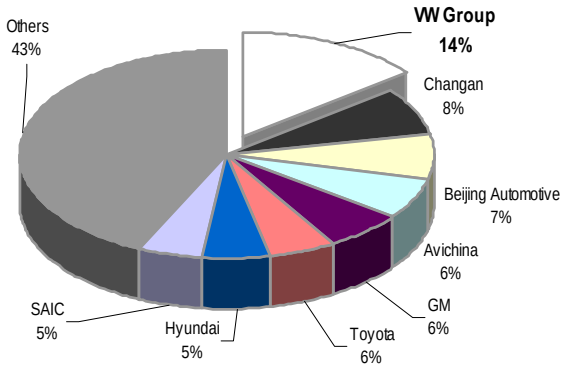
China

Market Overview

Car is driving the socio-economic transformation

It might have taken China 48 years to reach the 1 million car mark, but since that time, it has been nothing but up, up and away. We could go as far as saying that the automobile is steering the country's socio-economic transformation. China's output and its sales of motor vehicles both reached 5.1m in 2004, up 14% on 2003. Car production and sales represented 45% of both production and sales at 2.32m (*Source China AAM*). China is now the world's number three automobile market globally after the US and Japan and could overtake Japan by the end of the decade and even the US in another 15-20 years.

Main players in China



Source : Industry

2002-3 – the big breakthrough

75% growth

Although only 7-8 persons per 1000 on the mainland own a car, 50m Chinese (at a very minimum) can now afford a car and demand began to skyrocket since 2002 when it rose by 56%. This was followed by a 75% increase in 2003. The dramatic surge in these two years came after significant price reductions for domestically produced cars after China's WTO accession eased tariffs on imports – and cars became a feasible option for the growing and increasingly affluent urban, middle classes.

Slowdown in 2004 – competition & over-capacity

Market is overheating

Although growth and margins continue to rise significantly, there has been a slow down from the unheard of levels of 2002-3. This is down to a number of factors including growing competition and the fact that while supply already exceeds demand, both domestic and foreign automakers, are looking to double capacity by 2008. The domestic automakers in particular are expanding their capacity without any tangible evidence linked to demand.

Chinese government sets the rules of the game

JVs are compulsory

More so than any of the other major BRIC markets, the role of the Chinese government is key to understanding the market. The government's economic priorities in many ways determine the outlook for the domestic market. The government welcomes foreign automakers as long as they operate through JVs and take no more than a 50% share in the venture. It also

controls the banks – with a major impact on car sales. In 2002-3, it pushed investment into the sector and was behind the flood of lending to consumers to fuel demand. It has since applied the brakes to consumer credit growth in order to slow the overheating economy. One also needs to keep in mind that it is the government's stated intention to create a domestic "Big Four" who can compete in both the domestic and global marketplaces.

Most sophisticated market of the BRICs

Demand is growing for all segments

China is without doubt the most developed market of the BRICs, particularly in terms of the demand for all market segments – from luxury and SUVs down to sub-compacts. However the focus is increasingly on smaller, more fuel-efficient cars, which is the fastest growing market segment. Three of the top-sellers for 2005 are fuel-efficient models – Hyundai's Elantra – and Tianjin FAW Xiali Automobile Co.'s TJ7101U and Chery Automobile Co.'s QQ sub-compact.

Sales growth will continue for the rest of the decade

15% growth to 2010

Passenger vehicle sales are likely to continue their upward trend in 2005 and at similar growth rates of around 15% until 2010.

▪ Market drivers & risks

China – key market drivers and risks

DRIVERS	RISKS
▪ GDP expected to increase 4x by 2020	▪ Overheating of the economy
▪ Growing urban affluence & disposable income - +11.4% in 2004	▪ Massive oversupply – excess production capacity > demand
▪ Consumers embrace cars – symbols of successful lifestyle	▪ Government curbs vehicle financing - only 5-10% of sales (2004)
▪ Up to 450m with incomes of USD7k+ - 6k+ = car-buying potential	▪ Cost of producing cars remains high - components are imported
▪ 50-100m+ easily realisable vehicle potential	▪ Demand for high-end cars played itself out after 2002/3 boom
▪ Price cuts & cheap models - RMB100k/USD10-12k or less	▪ Cut-throat competition
▪ Auto sector is a major economic driver / pillar of the economy	▪ Growing Chinese automaker threat
▪ Expansion of domestic consumption as government policy	▪ Requirement to JV with local companies
▪ Government investing in road infrastructure – USD 44bn (2003)	▪ Choosing the right JV partners, suppliers, business models
▪ Cheap labour costs - 10% of the West	▪ Environmental impacts & energy consumption
▪ Potential for increased profits - upgrades in 2-3 years	▪ Chinese demand increasing steel & production costs
▪ Dropping vehicle prices – 2004 & 2005 price cuts	▪ Possibility China adopts ethanol / flex-fuel technologies

Source: CM-CIC Securities / ESN estimates

Auto Players

Overview of main foreign automakers in the Chinese market (1/2)

COMPANY	COMMENTS
BMW	▪ JV with Brilliance Automotive – makes 3 and 5-series cars; also imports cars for sale ▪ USD37m loss 1H 2005 despite 45% increase in sales; expects profit by end 2005 ▪ Upgraded production to better compete with players such as Audi ▪ Expanding dealer network from 45 to 60 for end 2005
DCX	▪ Chrysler JV with South East Motors Inc (a JV of Fujian Motor & China Motor Corp, Taiwan) ▪ DCX JV with Fujian Motor & China Motor Corp, Taiwan ▪ USD1.2bn plant with Beijing Automotive – will produce 25k Mercedes p.a. ▪ Mitsubishi Fuso to play an important part in market exploration & development ▪ Thought to be considering a venture that would export Chrysler cars to North America
Ford	▪ Late entrant into the market ▪ JV with local player, Jiangling Motors; Ford holds 30% & has an option for 7% by 2008 ▪ 1H 2005 sales of own brand products up 22% to 33k units ▪ Planning USD 1.5 billion investment in new Nanjing production facility – 350k units by 2007
GM	▪ 1H sales of 307,749 vehicles ▪ Plans USD 3bn in investments to double capacity to 1.3m cars by 2007 ▪ JV with local player, SAIC – SAIC-GM-Wuling Automobile Co ▪ Could sell more Buicks than in US by 2007; expects to sell 25% of Cadillac's by 2010 ▪ Deal with SAIC to develop hybrid & fuel-cell vehicles
Honda	▪ 1H 2005 sales of 117,761 vehicles; Jan to Aug sales up 34.8% ▪ JV with Guangzhou Automobile Group (50-50) ▪ Increased production by 22.2% in July 2005 alone ▪ Announced plans for new powertrain factory
Hyundai	▪ 3 JVs – Beijing Automotive, Guangzhou Automobile, Dongfeng (via Kia) ▪ All Hyundai brand cars are built at JV w/ Beijing Automotive – reduces problems ▪ 2 Chinese production facilities - 1H 2005 sales of 152,363 vehicles ▪ Aims to source 80% of components locally by end 2005 ▪ Aims to have 20% of market by 2010 (1H 2005: 11.2%); advanced 1m unit goal to 2008
Nissan	▪ JV with local player, Dongfeng Motor Co Ltd (50-50); folded 2nd JV into this one ▪ Missed its 2004 targets but expects to more than double sales for 2005 ▪ Begun production on USD 365m plant (Guangzhou) – start up early 2006; 360k engines p.a. ▪ Having a local source for engines will give it a major competitive advantage – no import tax ▪ Goal of 500k units by 2007 – would become 3rd largest market
PSA	▪ 2005 sales (Jan-Aug) of 94,871 vehicles, up 63%; likely to exceed 2005 115k target ▪ JV with Dongfeng Motor Corp. (Dongfeng Peugeot Citroen Automobile Co Ltd,) ▪ Introduced first family sedan flex-fuel model (compressed natural gas-gasoline) – 25k models ▪ Introduced measures to cost control and upgrade performance of products & models ▪ To launch auto financing in partnership with the Bank of China
Porsche	▪ Newcomer with 8 dealerships
Renault	▪ Latecomer to the Chinese market ▪ JV with Dongfeng - Dongfeng Motors Company Ltd. (DFL) ▪ Operations to begin in 2006 – production target of 150k by 2007; 300k in 2nd stage ▪ May also use heavy truck production to increase presence

Source: Industry sources, CM-CIC Securities / ESN estimates

Overview of main foreign automakers in the Chinese market (2/2)

COMPANY	COMMENTS
Toyota	▪ Late starter – moved cautiously, 2 JVs, resources spread over 5 plants & poor marketing ▪ 5 Chinese production facilities - 1H 2005 sales of 48,954 vehicles ▪ 2 JVs: FAW & GAG – engine parts, gas engines (300k), Camry (100k), exports to Japan ▪ Plans to develop mass market sales network for 2006 ▪ Considering 3rd production facility in Tianjon & 2nd in Guangzhou – 700k units by 2008 ▪ Aims to have 10% of market by 2010 (1H 2005: 3.9%)
VW	▪ 1H 2005 179,722 vehicle sales; profits fell to USD 280m in 2004; loss expected for 2005 ▪ Long-time market leader but market share has slipped to 15% 1H 2005 (2002: 50%) ▪ Remains 2nd largest market after Germany ▪ Revamped China management team incl. appointment of Winfried Vahland (VP, Skoda) ▪ Recently slashed prices on models by up to 14%; Jetta prices have fallen 33% in 3 years ▪ 2 JVs - SAIC & FAW – led to problems in joint sourcing, inefficiencies, rivalries ▪ Recently halved production target for 2008 to 900k from 1.6m ▪ Investments may be frozen or scaled back ▪ 10-12 new models specifically designed for the market by 2009

Source: Industry sources, CM-CIC Securities / ESN estimates

▪ China's domestic automakers – the giant awakens

Partners today, competitors tomorrow

China's domestic manufacturers have already emerged as partners for the global major automakers – whether they like it or not. In the short term, these partnerships will develop even further than they have to date. However, in the medium to long term, a new balance will have to be struck as the domestic players grow as dynamic players on the domestic and global stages. We believe that the Chinese manufacturers will emerge as the dominant players in the domestic market and one of the largest competitive global threats for the European, Japanese and US automakers - in the next ten to fifteen years. How this will ultimately play out will of course be dependent on a wide range of factors – not least of which will be rising geo-political tensions between the Chinese and the US governments in the coming years.

Consolidation is necessary

100+ domestic players

With over 100+ domestic manufacturers, a shake out of the highly fragmented domestic market is extremely likely. As it stands today, of China's top manufacturers, only three – SAIC (Shanghai Automotive Industry Corp.), FAW (First Automotive Works) and Dongfeng – produce more than 500k vehicles p.a. All three also currently have one or more JV's with foreign automakers. To some degree, the slowdown in the domestic market (relatively speaking, of course), increasing competition, declining prices and upward pressures on production costs, notably raw material costs, will squeeze margins for local players and through a process of natural selection, the leaders will emerge.

Stronger, more dynamic players emerging

New entrepreneurial companies

A new generation of dynamic, entrepreneurial and growing domestic automakers – such as Brilliance Automotive, Chery Automobile and Geely – is emerging. They have ambitious plans to increase their market share at home and abroad and are more competitively oriented than the first generation of corporate statist players.

Consciousnious of the clean car debate

Greener than you might think

Contrary to what many believe, the Chinese are wholly conscious of the relevant debates. Beyond the stringent new emissions rules, Chinese automakers are also pro-active – supporting taxes and measures to limit the use of cars and push smaller engines. They are also working on alternative propulsion models including hydrogen, mixed fuels and LNG. In our view, there is as much chance of the clean car revolution coming from Shanghai as is there is from Detroit.

Exports on the rise

The major domestic players will become exporters sooner rather than later. They are already exporting to other developing countries such as Iran and Sudan, and small numbers are making their way over to Europe. Other BRIC markets such as Russia are seen as major market opportunities by a number of the players. Exports are certainly something that the Chinese government is very keen to promote and its “invisible hand” will be needed as export-oriented production remains expensive given the need to import so many components.

Emergence of a new “Big 4”

Potential to replicate success of the Korean automakers

The Chinese government is keen to play a role in the development of domestic champions. It is keenly pushing consolidation and is supportive of the emergence and development of a “Big Four” – four major domestic champions that can compete effectively both in the domestic and international markets. And as we all now, what the Chinese government wants, it usually gets. Some may be sceptical but we need to remember that it was only twenty years ago that that Korean players such as Hyundai were sneered at. The Chinese automakers – spurred on by their government – can and will do what is necessary including developing, adapting and “borrowing” technologies to become competitive both at home and abroad. Global automakers beware!

Offshoring – is it a long-term solution?

OFFSHORING - SUMMARY	
▪ Benefits of offshoring assembly are limited - labour costs are only 10-15% of production costs	
▪ Number of hidden costs associated with offshoring assembly - local laws, quality, training	
▪ Offshoring assembly does however provide access to emerging markets - "Detroitski" (E. Europe)	
▪ Blue-collar workforce is shifting - 9% decline (1999-2004) & very little capacity created in the West	
▪ Key cost issue is procurement costs (up to 80% of total costs) - offshoring is a key cost advantage	
▪ Local sourcing is key - huge cost advantages	
▪ Lead is being taken by the auto-parts companies - value of imports is outpacing exports	
▪ Offshoring labour intensive activity does make sense for parts companies - 20-25% cost savings	
▪ Procurement is shifting east - E. Europe, China, India	
Winners	- PSA - sector leader in offshoring procurement & global sourcing
	- Hyundai, Toyota & VW - set up shop in "Detroitski"
Losers	- Fiat - laggard in offshoring procurement
	- Auto-parts companies that failed to take advantage of the 1st wave of offshoring

Up to 20% of US & European jobs could be shed

At a time when U.S. and European automakers are seriously contemplating shedding 20% or more of their domestic workforces, it comes as little surprise that offshoring is on the top of the auto sector agenda. Automakers, auto parts makers and autoworkers alike are grappling with the issue of whether they stand to gain or lose from offshoring – and the apparent siren song of labour costs that are five to twenty times cheaper than in their home markets.

It's not as simple as it seems

A broad range of factors and conditions need to be in place to win from offshoring

Understanding the phenomenon of offshoring is not as simple as it seems – and needs to be assessed against a broad background of issues. Despite what many believe, potential competitive advantages – or disadvantages – do not relate to labour costs alone. Other salient realities are at play including costs relating to transport and logistics, training, quality and import inflation to name but a few. Taking this full range of factors into account shows that offshoring of assembly is currently quite limited although the phenomenon can be a useful solution for some players and for some activities – notably procurement – when very precise pre-conditions are met.

Breaking down an automaker's costs

- **Labour costs – an important factor**

Labour - 15% of selling price and falling

Automakers are on the whole in agreement that labour costs – including non-wage labour costs – represent, on average, 15.5% of a car's selling price.[4] This percentage is on the decline, having fallen by 450bp in the past decade.

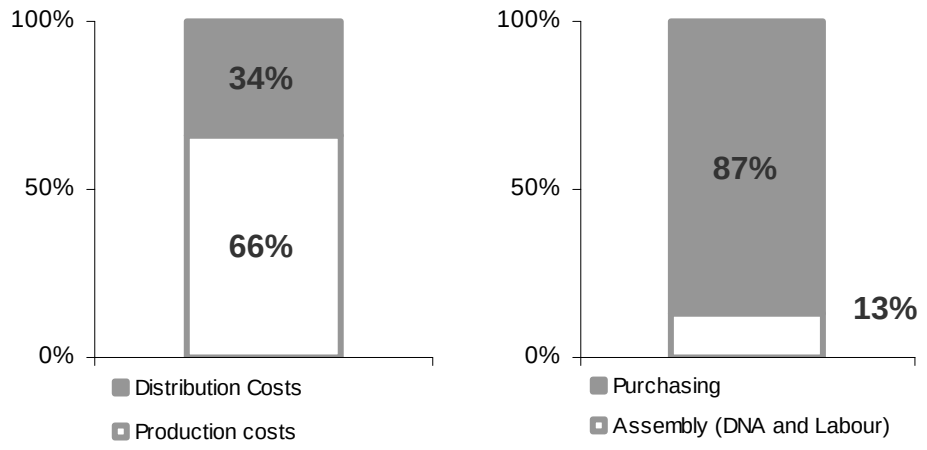
[4] Based on a sample of auto manufacturers: BMW, DaimlerChrysler, Peugeot SA, Porsche, Renault & Volkswagen.

Assembly – 5% of the selling price

• Assembly costs – another important factor

An automaker's total assembly costs – which largely comprise blue collar labour costs – represent only 10-15% of production costs (i.e. 66% of operating expenses) and 5% of the selling price to the dealer (pre-tax and after the "guaranteed" margin for dealers)

Assembly costs only represent 10-15% of production costs



Source: Industry sources, CM-CIC Securities / ESN estimates

• Procurement costs – the most important factor

Procurement costs – up to 80% of total costs

The overwhelming majority of production costs – some 80% – consist of procurement costs. These are the key cost variables and are at the heart of many of the recent restructuring plans announced by automakers, including DCX (Chrysler), Ford and Nissan.

Cost savings from assembly are marginal

Cost savings from assembly need to be put in perspective

Potential savings on assembly costs are possible but are marginal at best. Reducing the cost by 10% (ex-transition costs) would only add 46bp to an automaker's operating margin – whereas reducing procurement costs by 1% would add a similar amount (+48bp on average).

Automakers are looking for new areas for cost gains

Procurement costs have been cut to the bone in the West

Today, most of the major automakers have successfully cut their procurement costs in their key developed country production bases – US, Canada, Mexico and Europe – to the bone. There is some small margin for manoeuvre – for instance GM is planning a further USD 2 billion cut in payments for parts and materials in 2006. However, by and large, the automakers are now looking for gains in these markets through such areas as: i) quality – reducing costs relating to poor quality (upstream and during assembly) – and thus reducing guarantee costs; and ii) distribution – reducing costs relating to logistics, networks and build-to-order. Offshoring procurement to lower-cost countries has also emerged as one of the areas with the greatest potential for cost savings.

Assembly costs are only the 5th-largest cost for manufacturers

Rank	Automaker's network selling price	Generalist A (100)	Generalist B (100)
1	Suppliers	-46.8	-49.2
2	Publicity/Marketing	-20.5	-19.5
3	SG&A	-6.7	-6.3
4	Depreciation	-5.1	-5.3
5	*Assembly costs*	**-4.5**	**-4.7**
6	R&D	-3.9	-3.7
7	Guarantee	-3.3	-3.1
8	Upstream/downstream logistics	-2.9	-3.1
9	Energy materials	-2.2	-2.4
	Operating margin	**4.2**	**2.7**

Source: Industry sources, 5-year averages, CM-CIC Securities / ESN estimates

Offshoring assembly – the advantages

- ### Lower labour costs

Even if labour costs are a relatively small part of total costs – they do represent a potential cost savings for automakers. Automakers can cut capital intensity thanks to lower labour costs – fewer fixed assets and more employees to reduce hourly labour costs and to cut total production costs.

The table below illustrates the range of typical labour costs across a number of countries. Note that it does not show actual salaries and personnel costs paid by automakers in each country – industry players do not disclose such data, considering it strategic. However, we believe that the sample is pertinent in that it represents countries currently or likely to benefit from offshoring – both of assembly and procurement.

A Bengali worker costs 250x less than a Bavarian worker

The hourly labour cost in Eastern Europe is rarely above EUR1.5 per hour

In € or hours	Minimum monthly salary	Average monthly salary	Legal working week	No. hours per month	Min. hourly salary	Min. hourly cost
Slovenia	451.0	---	40.0	173.0	2.6	3.65
Czech Rep.	199.0	---	40.0	173.0	1.2	1.70
Turkey	189.0	---	39.0	169.0	1.1	1.53
Poland	201.0	---	42.0	182.0	1.1	1.49
Slovakia	118.0	---	40.0	173.0	0.7	1.03
Hungary	112.0	---	40.0	173.0	0.6	0.97
China	n.a.	73.9	39.0	169.0	0.4	0.75
Romania	75.0	---	40.0	173.0	0.4	0.64
Mexico	95.0	---	48.0	208.0	0.5	0.47
Iran	56.5	---	39.0	169.0	0.3	0.43
India	21.2	---	48.0	208.0	0.1	0.13

Source: Interex, ILO, CM-CIC Securities / ESN estimates

Median is in Eastern Europe: €1/hour

As might be expected, the median minimum salary is found in Eastern Europe – in Hungary and Slovakia – where it is possible to pay workers EUR1/hour.

German workers are more expensive – but that isn't news to anyone!

In € or hours	Minimum monthly salary	Average monthly salary	Legal working week	No. hours per month	Min. hourly salary	Min. hourly cost	In € or hours	Average hourly cost
France	1,154.0	2,151.0	35.0	151.7	7.6	10.7	14.2	19.9
Germany	n.a.	3,538.3	38.0	164.7	n.a.	n.a.	21.5	26.0
Italy*	n.a.	1,550.0	40.0	173.3	n.a.	n.a.	8.9	11.6
Spain	460.5	1,813.1	40.0	173.3	2.7	3.5	10.5	13.6
UK	1,105.0	3,120.0	48.0	208.0	5.3	5.8	15.0	16.5
USA	1,115.8	2,570.5	40.0	173.3	6.4	7.1	14.8	16.3

*Source: Interex, ILO, CM-CIC Securities / ESN estimates. *In Italy there is no guaranteed minimum wage for all workers as in other countries, but rather minimum collective pay levels negotiated by the social partners.*

• Lower labour costs for a long, long time

Eastern European salaries could be cheaper for up to 3 product cycles!

Even if salaries are rising in many of the countries where automakers have or are considering offshoring assembly, it will in some cases be decades before they reach Western European or North American standards. For instance, given the pace of salary increases in the Czech Republic, it will take them another 20-22 years to catch up with German salary levels. Theoretically speaking and all other things being equal – assembling cars in the Czech Republic would still be less expensive than in Germany for at least three model cycles. This is hardly insignificant.

Average growth of salaries and services in the industry

Countries	2002 vs. 2001
Lithuania	**+14.3%**
Estonia	+11.7%
Czech Republic	+11.6%
Poland	+9.9%
Latvia	+8.4%
Denmark	+4.5%
France	+2.2%
Germany	**+1.7%**

Source: Eurostat

• Lower taxes

Big tax differences in the EU

Automakers can generate greater profits in more favourable tax regimes than those generally applied in Western countries. If we take the case of the EU-15 (the EU's "existing" members) and the EU-25 (including "new" members) – we discover significant tax differences on corporate income – 21% for new member countries vs. 31% for the existing ones.

- **Access to growing markets**

New customers with growing purchasing power

As is explained in further detail in our section on the Globalisation and the BRICs, relocating assembly and plants to areas of cheaper labour often has the convenient – and potentially enormous – advantage of access to new customer bases with growing purchasing power (i.e. potential car buyers). In a number of cases – particularly China and increasingly India – this is becoming or will become THE main reason for offshoring assembly these countries. Whether jobs will be lost in the West owing to this shift remains to be seen and will also need to be balanced against the possibilities of job creation given the enormous potential for some markets such as China and India.

Automakers are moving further east

European players winning access to the eastern markets

Many automakers have already set up shop in Eastern Europe to gain access to their growing markets. PSA at Trnava (Slovakia) and Kolin (Czech Rep.), Hyundai-Kia at Zilina (Slovakia), and even Fiat at Tichy (Poland) are all examples of this. PSA has become the number two and three in most of central and Eastern Europe, Fiat has gained a leading position in Poland and Renault in Romania. Of course, VW also remains the unrivalled regional leader. Of course, not all of the growth has come through offshoring plants, VW and Renault have also bought out manufacturers with strong regional presence – Skoda and Dacia, respectively.

It should be noted that the Eastern European auto market is growing four times faster than Western Europe and is likely to expand by more than 900k vehicles over the next five years (5.7% CAGR) – the Western European automobile market is likely to remain sluggish.

Offshoring assembly – the hidden costs

Relocating assembly and plant at the drop of the hat is not the way to go. For some it might seem self-evident that VW would generate a gross cost saving of EUR250m p.a. by transferring 5,000 jobs from Germany to the Slovak Republic. But such simplistic analysis ignores the hidden transfer costs of offshoring assembly – quantitative and qualitative. These are potentially enormous and need to be carefully evaluated by automakers and analysts alike. This will also involve going well beyond the obvious costs associated with potential redundancies, asset depreciation, scrapping or transferring equipment and greenfield investments in new site and plant.

- **The costs of local laws & regulations**

Payroll costs are only one element in the equation

Payroll costs – including non-wage and retirement costs – are only one element of the equation for automakers. While minimum hourly labour costs may appear attractive and trade unions outlawed, it can be very difficult to lay off employees – such as in Iran. In Spain, minimum hourly labour costs are competitive in European terms (at EUR460, the minimum monthly salary is barely higher than in Slovenia) and union membership is very low (at 15%), but labour laws are very strict. It is difficult to hire staff on fixed-term contracts, it is both difficult and costly to lay staff off, and workers are sometimes inadequately qualified to meet even the minimum demands of prospective employers. Bear in mind that Michelin had to pay EUR 100,000 per employee in 2003-4 to restructure its Spanish plants.

Michelin paid €100k/employee to restructure in Spain

▪ Quality and training costs

Relocating assembly to lower-cost countries does not necessarily imply poorer quality. Quality often transcends geography. For instance, BMW's South African Rosslyn plant produces 3-Series of comparable quality to those produced in Munich and Regensburg. Conversely, Bosch (Pouilles), Valeo (ex-Sylea) and VW (Abrera Martorel) all suffered from quality glitches and low productivity problems in the EU – in Spain and Italy.

Car culture is an issue in the developed and developing worlds

Opening a plant in an area that has a strong car culture is a potential advantage but again is not as self-evident as some say. On the one hand, some critics argue that Chinese factory workers – "uneducated peasants with little if any previous factory experience" – will not produce quality cars at efficient rates. On the other hand, one of Nissan's most important US plants (Canton, Mississippi) – where it manufactures key models such as the Quest, Armada, Titan and Q45 – has huge quality problems because of poor training for new recruits, and despite the presence of 200 Japanese engineers.

Training needs to be a priority

However, generally speaking, it is still true to say that in a region where industrial and/or automobile culture is wholly or largely non-existent, training should be a major priority. Major investments in training are a win-win for employers and employees – with a knock-on impact on costs and quality standards.

Is assembly actually being offshored?

• Is the blue-collar workforce shifting?

Decline in domestic employee headcounts

One way to assess the extent of offshoring of assembly is to track the absolute numbers of domestic employees as a proportion of total headcount.

9% decline in the domestic workforces

Total domestic employee numbers for the automakers in our sample have fallen by close to 9% in the past six years. The proportion of domestic employees has fallen by 200bp in the same period, which is substantial. However, we have not yet seen the massive transfer of jobs to Eastern Europe, Asia and Latin America that some speak of. That said, it is virtually certain that any new capacity growth will be made in low-cost countries with competitive labour costs (see below).

Domestic workforce on the decline 1999-2004 – domestic employees & % of total employees

	1999	%	2000	%	2001	%	2002	%	2003	%	2004	%	'99-'04
BMW	68,848	59.9	68,905	68.7	72,863	75.7	76,143	75.2	78,569	75.3	80,005	75.5	3.0%
DCX	241,233	51.7	196,861	47.3	191,158	51.3	191,574	52.4	182,739	50.4	185,154	48.1	-5.2%
Fiat	122,730	55.5	112,224	50.1	95,199	47.9	87,789	47.1	73,553	45.3	71,329	44.4	-10.3%
Ford	173,045	48.8	163,236	46.6	165,787	46.2	161,868	46.2	130,174	46.7	122,877	44.5	-6.6%
GM (1)	217,000	55.5	212,000	54.5	202,000	55.3	198,000	58.6	190,000	58.3	198,000	61.1	-1.8%
Honda	60,400	53.7	61,300	53.6	61,600	51.1	61,900	48.8	61,600	46.8	61,064	44.3	0.2%
Nissan	n.a.	---	n.a.	---	n.a.	---	88,679	57.0	89,660	56.5	86,494	51.0	n.a.
PSA	115,500	69.7	117,900	68.4	123,700	64.3	123,700	62.3	124,700	62.4	127,950	61.7	2.1%
Porsche	8,712	100.0	9,320	100.0	9,752	100.0	9,971	98.3	10,299	96.3	n.a.		4.3%
Renault	73,897	46.3	77,406	46.6	77,401	56.7	78,180	59.1	75,401	57.7	76,183	58.3	0.6%
Toyota	n.a.	---	n.a.	---	n.a.	---	179,039	67.8	175,096	66.2	171,087	64.4	n.a.
VW	157,940	54.4	163,626	53.4	166,926	54.2	167,593	54.7	174,297	55.4	178,923	52.2	2.5%
Sector	1,239,305	54.2	1,182,778	52.6	1,166,386	54.0	1,424,436	56.2	1,366,088	55.9	1,359,066	54.2	1.9%

*Source: Company documents, CM-CIC Securities / ESN estimates. * Ford data is for Ford North America and excludes its Financial Services division for which no geographical data is disclosed. (1) Excluding GMAC.*

BMW and Porsche are special cases rather than exceptions to the rule

Quality (and not costs alone) is their key concern

The proportion of domestic workers is falling at most automakers, except at BMW and Porsche. In BMW's case the calculations are complicated by the sale of Rover, which led to a transfer of staff between 1999 and 2000. However, the key factor is that both BMW and Porsche are specialist manufacturers – although they need to curb costs, the overwhelming focus is on quality. This is the sole basis for them to justify charging a premium. Porsche and BMW have thus chosen to locate their new plants in Germany (even if it is in the former East).

Auto-parts companies are offshoring aggressively!

Although it does not garner the media attention of plant openings or closures by the automakers, the most aggressive offshoring of assembly efforts are undoubtedly being made by the auto parts makers. Plastic Omnium, Valeo, Beru, Delphi and Faurecia are opening far more plants in low-cost countries than the automakers. This is partly because they:

- are obliged to follow the automakers as they slowly shift production from their home countries and ramp up efforts to source locally in their new countries of implantation (See also section on Globalisation and BRICs); and
- have a reduced margin of manoeuvre (vis-à-vis automakers) as they work according to just-in-time management and can only locate their assembly plants at a maximum of two hours of transport.

We believe that this phenomenon will continue at an even more accelerated pace (see below).

Where is capacity being created?

A second way to assess the extent of offshoring of assembly is to track where new capacity is being created. One thing is for certain – it is not being created in Western Europe. Most new capacity has been created in Eastern Europe and Asia.

Only 2 cases of new capacity in W. Europe

We are only aware of two wholly new plants that have been opened in Western Europe in the past decade – Toyota (Onnaing) and DCX's Smart (Hambach) – and both are in France.

New Western capacity was the exception, not the rule

Both were "special" cases

Both cases are somewhat special in that the new plants were opened in two French *départements* hit hard by unemployment - the *Nord* for Toyota and the *Moselle* for DCX – and the automakers received substantial government aid. The Toyota case was a win-win for both sides – with the company needing to transplant production in order to avoid import quotas and to find a plant for its compact, the Yaris. The Smart has not had such a happy ending. The poor competitiveness of the Moselle plant and the fact that the micro-Smart was poorly received by buyers has raised doubts about whether DCX will maintain production at this plant, especially since it has just bought 100% of the NedCar plant in the Netherlands from MMC to produce the Forfour version of the Smart alongside the new Colt.

Closing plants is extremely difficult

Although it is not a zero sum gain, offshoring assembly often goes hand-in-hand with closing plant in the home country. This is very tricky and costly in terms of compensation packages for laid-off employees. Plant closures have generally only been tolerated in periods of deep crisis, such as those which Fiat, Ford and Renault have been through. To date, the Big Three have not closed any North American plants – they have merely shut a few production lines here and there or relocated staff. There are two main reasons for this:

- the position won by North American trade unions (UAW/CAW), which are protected by very strong multi-year contracts; and
- the one plant/one vehicle organisational structures at groups such as Chrysler (which is gradually changing as new vehicle generations are launched).

Ford & GM may change the rules

The most recent prospect of North American plant closures was recently avoided in Canada where the CAW and the Big Three managed to hammer out new deals which avoided closures, but involved serious concessions by both sides. However Delphi's recent Chapter 11 filing – and the difficult financial situations of Ford and GM - may however change the rules on closures (see also Legacy Costs). GM will probably close plants in Europe and North America in 2006. Its Rüsselsheim or Trollhätan plants in Europe would be the most likely candidates (*See section on Legacy Costs*).

Most plant openings are in fact in the East and China!

COMPANY	CLOSURES	OPENINGS	MENACED SITES
BMW	---	Leipzig (DE, 2005)	---
Fiat Auto	Arese & Rivalta (IT, 2002)	---	---
Ford	Dagenham (UK, 2001) Plensk (POL, 1999) Azambura (PT, 1999) Browns Lane (UK, 2005) [Jaguar]	---	Solihull (UK, 2005/6) [Land Rover]
GM / Vauxhall	Dagenham / UK / 2000 Linden, Baltimore, Lansing (US, 2005)	---	---
Hyundai	---	Zilina (POL, 2003) [Kia] TBD (CZ, 2008)	---
MG Rover	Birmingham (UK, 2005)		
PSA	---	Trnava (SLO, 2006) Kolin (CZ, 2005)	Ryton / UK / 2008e
Porsche	---	Leipzig (DE, 2002)	---
Renault	Vilvoorde (BE, 1996) Villaverde (ES, 2006)	Pitesti (RO, 2003)	---
Toyota		St Petes. (RU, 2007)	
Volkswagen	---	Bratislava (CZ, 2002)	2 to 3 plants (DE), / Brussels (BE) 2005-2008

Source: Company documents, CM-CIC Securities / ESN estimates. BE = Belgium, CZ = Czech Republic, DE = Germany, POL = Poland, PT = Portugal, RO = Romania, RU = Russia, SLO = Slovakia.

Offshoring procurement – where the focus should be

▪ Offshoring assembly is not enough

Offshoring *per* se won't reduce procurement costs

As stated earlier, most of the cost of producing vehicles consists of purchasing costs – acquiring raw materials, components, logistics and sub-assemblies. Offshoring assembly alone is thus not a panacea – if an automaker assembles cars in China or the Czech Republic, but continues to source the overwhelming majority of products in Germany or France, its comparative advantage is significantly reduced. Customs duties and logistic costs eat in or destroy this advantage. Offshoring will thus in the future be largely focused on procurement.

▪ Local sourcing is key

Sourcing offshore – could mean billions in potential cost savings

The potential disjunction between offshoring plants and local sourcing can have serious cost implications. It helps to explain why both PSA and Renault's plants in Brazil have taken so long to break even – their local integration rates are simply too low at under 50%. For VW, which make at least 85% of its of goods and services purchases in "high-cost" countries – at a cost of EUR60bn p.a. – offshoring a mere 3-5% of procurement would equate to cost savings of up to EUR3bn.

Auto parts makers are taking the lead

US Imports of auto parts growing by 10% p.a.

The auto parts industry has been taking the lead in the sector in terms of offshoring procurement. In 1997, the US auto industry including the aftermarket consumed USD186bn worth of auto parts for light vehicles with 22.8% of parts being imported. By 2002, consumption rose to USD207.5bn and the proportion of imports by 8% to 30.6%. (*Source: US Census, International Trade Commission*). This offshoring trend has continued with 10% annual growth rates for imports of auto parts.

Value of imports is outpacing exports

Less than a decade ago, imports and exports of key automotive components were relatively equal in the U.S. Today, the the value of imports has largely outpaced that of exports.

US imports and exports of key automotive components (all figures in USD)

KEY COMPONENT	EXP/IMP	1997 VALUE	2002 VALUE	2004 VALUE
Wiring Harnesses	Exports	1.5 bn	961 m	878 m
	Imports	4.3 bn	5.3 bn	5.4 bn
Engines (for MVs)	Exports	3.1 bn	4.9 bn	3.9 bn
	Imports	4.0 bn	6.0 bn	6.4 bn
Tires (cars & trucks)	Exports	1.3 bn	1.3 bn	1.4 bn
	Imports	1.8 bn	2.8 bn	3.9 bn
Brake Linings & Pads	Exports	69.9 m	52.8 m	75.6 m
	Imports	73.1 m	124.7 m	112.9 m
Seats (for MVs)	Exports	92.2 m	178.9 m	94.5 m
	Imports	182.1 m	161.8 m	136.8 m
All Motor Vehicle Parts	Exports	37.7 bn	39.5 bn	40.4 bn
	Imports	42.5 bn	63.5 bn	76.8 bn

Source: U.S. International Trade Commission; U.S. Census Bureau, Industry sources.

Lower cost labour countries winning a greater share of the pie

The size of the global auto component industry is likely to increase to an estimated USD1.9 trillion by 2015. Sourcing from lower cost countries is likely to be a growing part of this - increasing from current levels of around USD65bn to USD375-700bn depending on one's level of optimism. Electronics, fabric, fasteners, foam, stampings, switchgear and seats are all being sourced from low cost countries and we are already starting to see a number of these countries winning a significant market share of components – wire harnessing (Philippines, Honduras and Thailand), tires (South Korea), brake linings (Brazil), seats (Mexico) – and of course China for everything under the sun.

Geographical source of imports of key automotive components to the U.S.A.

COMPONENT	COUNTRY	1997 (%)	2004 (%)
Wiring Harnesses	Mexico	83.63	76.45
	Philippines	4.86	5.89
	China	1.08	3.24
	Honduras	0.35	2.98
	Thailand	4.33	2.74
	All Other	5.75	8.72
	Mexico	83.63	76.45
Engines (for MVs)	Canada	48.44	44.95
	Mexico	35.81	27.55
	Japan	10.49	14.09
	Germany	3.48	12.53
	United Kingdom	0.59	0.65
	All Other	1.19	0.24
Tires (cars & trucks)	Canada	46.36	26.40
	Japan	21.92	21.94
	Korea	7.03	12.83
	China	0.25	9.28
	Germany	2.93	3.99
	All Other	21.51	25.56
Brake Linings & Pads	Canada	42.02	32.11
	Brazil	8.86	24.71
	China	0.68	14.83
	Japan	8.34	5.09
	France	10.24	4.75
	All Other	29.86	18.51
Seats (for MVs)	Country	85.19	47.69
	Canada	2.50	14.18
	Mexico	3.36	11.91
	Germany	0.07	6.76
	China	1.34	5.43
	United Kingdom	7.55	14.02
	All Other	85.19	47.69

Source: U.S. International Trade Commission; U.S. Census Bureau, Industry sources.

COMPONENT	COUNTRY	1997 (%)	2004 (%)
All Imports	Mexico	30.46	29.21
	Canada	30.80	25.09
	Japan	16.73	18.70
	Germany	4.44	5.57
	China	1.46	4.49
	All Other	16.11	16.94

Source: U.S. International Trade Commission; U.S. Census Bureau, Industry sources.

Labour intensity is key

Parts are offshored if they are labour-intensive

The landed cost of sourcing parts from low cost countries can be up to 20-25% cheaper than sourcing at home with regard to US-based plants. Hence the huge proportion of imports for wiring harnessing – one of the most labour-intensive activities in terms of vehicle production and assembly. However, not every component has such potential for offshoring – if labour costs are only a small proportion of total costs (i.e. 3%) than it won't make much of a difference to an automaker whether the part is sourced from Delhi, Detroit, Düsseldorf or Dalian.

Valeo – a parts supplier that has long-anticipated the change

Valeo to offshore 70% of sourcing by 2010

Valeo has been increasing the proportion of its blue-collar staff in lower-cost countries (i.e. <EUR10/hour or less according to the company's definition) for some time – from 25% in 2001 to 46% at the end of Q2-2004. The next phase of its industrial restructuring efforts now consists of raising the rate of sourcing in low-cost countries to 70% by 2010 from just under 25% today. This process is taking time because of the company's need to train employees so as to safeguard quality standards.

Limits as to how far the parts companies can go

Despite these moves, as the above table shows vis-à-vis the US, sourcing procurement from low cost countries is not the norm as some would have us believe. Canada, Japan and Mexico continue to occupy far more prominent places than China (for now). It is also because of certain current imitations:

- ***Many components are too difficult*** – heavy, complex or large – to offshore efficiently and cost-effectively (i.e. axles, brake corner modules, door trim panels, engines, instrument panels, pickup truck frames, transmissions);
- ***Many low cost country suppliers*** lack the necessary, sophisticated distribution channels, customer relationships, engineering, brand management and sales capabilities; and
- ***Many of these countries and suppliers cannot yet*** do what Bosch, Dana, Denso and Valeo do.

PSA leads the way among automakers

PSA to source 45% of procurement in lower cost countries – up to €1.3bn in cost savings

PSA is in our view the leader among the major automakers in terms of active offshoring of procurement. Already well ahead of the pack on its platform policy, it is now making global sourcing a priority target for its industrial policy. The group aims to obtain between 25-45% of its procurement needs in lower labour countries by 2010 (2004: 10%). PSA estimates that it will offshore procurement in the region of EUR7bn-10bn with a resulting gross cost savings of between EUR800m and EUR1.3bn. The company is probably the only major automaker actively increasing local procurement (via its assembly in cheaper labour countries in Latin America, Eastern Europe, China and India) and importing parts manufactured in cheaper labour countries to Western Europe and the US for assembly.

PSA's goal – getting closer to the end client

Shipping a car costs PSA €1000 per vehicle

Our discussions with PSA showed us that it is looking to optimise local integration while remaining close to the end client – all without overlooking logistic costs.

PSA calculates the cost of shipping a car at an average of EUR1000 per vehicle. We estimate the range is between EUR500 – 1,500.[5] Opening a plant with 300k unit production capacity in Trnva (Czech Republic) would result in gross annual savings of EUR100m compared to opening the same plant in France. Assuming that PSA re-exported its entire production to the West, and taking additional logistic costs into consideration, it would still be in the black – EUR10m in our estimates. The cost savings *per se* would not make opening the plant in the East worthwhile. However locating a plant in Trnva also brings PSA closer to its future end clients. PSA's market share of the growing Eastern European auto market has risen from 5% to 13% in six years!

Procurement is shifting to China

Even engines

As auto players further their efforts to offshore procurement, the biggest push is and will increasingly be on China. China is currently a growing source for any and all auto components. The sole exception had been the engine but even that changed in 2004 when GM's Canadian assembled Chevy Equinox used a Shanghai GM-built engine.

GM's push on China

GM: USD4 billion by 2009

GM is probably making the biggest push of any major automaker for China. It currently brings in more parts to China than it exports. That will rapidly change as it plans to increase the number of auto parts it buys in China and uses in the West (US, Canada, Europe and Mexico) – 20-fold to an estimated USD4bn by 2009 (2003: USD200m).

China will become a political hot potato

While the shift to offshore procurement to lower cost countries will continue unabated, geo-political tension may play an important role in the medium to long term. China's huge trade imbalance with the US and the controversy over "lost" US auto manufacturing jobs is an issue which will come to the fore sooner rather than later.

[5] *Note that what is true for a generalist such as PSA is not necessarily true for a premium player. EUR1000 represents 7% of the group's average unit income and 2.5x of its operating result per vehicle. In BMW's case, they are 3% and 36% respectively.*

India will be next

USD10 billion by the end of the decade

India will be a major recipient of the next wave of procurement offshoring with many US players thought to prefer it to China or Brazil. DCX, Hyundai and Suzuki have been sourcing from India for a number of years – and plan to ramp up their plans to include components, engineering and technical services – as well as fully assembled vehicles for their global markets. Hyundai for one has made India its regional base while Fiat has just signed a Global MoU which encompasses sourcing with leading local player Tata. Other companies are considering moving procurement – Caterpillar, Cummins, Delphi, Fiat, Ford, GM, Navistar, Toyota and Volvo.

Procurement is on the increase

India exported components and services of USD800m in 2002 and USD1bn in 2003. This will grow by as much as 30% p.a. and lead to an estimated USD10bn worth of procurement offshoring for India by the end of the decade. However India still has progress to make if it is to ultimately rival China, including:

- ***Growth and acquisition of economies of scale*** – there are an estimated 400 component vendors, only 30 of which have revenues of USD 34 million+; and
- ***Improved availability***, infrastructure facilities and logistics

Offshoring R&D – where the focus will be

Grey matter will shift East

From an autoworker's perspective, perhaps the greatest threat in terms of jobs is surprisingly, with regard to white-collar workers, especially the sector's "grey matter" – those involved in R&D. Such activity is not linked to tangible investments as is the case with labour and assembly lines and the potential cost savings could be significant although this must also be balanced against the potential loss of know-how – R&D teams are not call centre staff.

Countries such as India are well-poised

As India's IT success shows, it could be well poised to replicate its software service success and become the auto design outsourcing hub for 3D modelling and plant engineering. Collins & Aikman, Dana, Delphi and Visteon all have engineers in India with Delphi having established a 300-strong engineering centre in Bangalore focusing on writing software for instrument clusters as well as on, ABS systems and engine controllers. The country is destined to become an auto engineering destination with a highly educated workforce and engineers on 20% of the pay and benefits of their US or European counterparts. As a further sign of things to come – in 1995 when the Society of Automotive Engineers admitted a new Indian affiliate, it had 200 members – by 2002, this had grown to 1,500 members and 4,500 student members.

Annual cost of an automotive engineer: 4x more in the US than in China!

Country	USD in thousands
US	140 – 180
Canada	100 – 130
France	120 – 160
Eastern Europe	60 – 80
India and Asia	35 – 55

Source: Renault-Nissan, GM and industry sources

Legacy costs – will they leave automakers with no legacy at all?

LEGACY COSTS - SUMMARY	
▪ Big 3 have an ageing workforce - average age of 45+ & up to 50% are eligible to retire in the next 5 years	
▪ Older workers cost 2-3x more than younger ones - healthcare costs	
▪ Wages are not the key issue - healthcare costs incl. post-retirement benefits are	
▪ Big 3 - UAW union agreements are under threat - major changes can be expected for 2007	
▪ Recent deal with GM shows that the UAW is willing to make painful concessions	
▪ Governmental healthcare reform could help the Big 3 - stepping up their lobbying efforts	
▪ Termination-based disclosure for pension obligations could cripple the Big 3	
▪ Worst-case scenarios - government bail-out or Chapter 11	
▪ European & Japanese players benefit from state-funded healthcare & pensions	
Winners	- European & Japanese - Younger non-unionised workforces & State aid for benefits
Losers	- DCX, Ford & GM - Huge healthcare & pension liabilities and obligations

The *Big Three* are facing a range of economic challenges – years of sliding market share, mounting losses, excess production capacity, competitive threats from foreign carmakers, and problems at key parts suppliers, to name but a few. At the same time – far smaller than they used to be – they face an ever growing cost base of historic or legacy costs relating to the healthcare costs and pension liabilities for their current and retired workforce as well as their dependents. These costs are in our view one of the largest single risks currently facing the sector – the Big Three in the short to medium term – but all developed country automakers in the longer term.

▪ Will they be Detroit's demise?

GM-UAW agreement is a huge beacon of hope

For the European and Japanese players as well as trans-Atlantic player DCX, legacy costs are not currently a major issue although they may emerge as one in the longer term. However for GM in particular – but as well for Ford – their ability to tackle the issue of legacy costs is a major risk which taken to its extreme would put their very viability as liquid companies into question.

Painful decisions need to be made by both sides

These companies as well as their trade unions must weigh up some very painful decisions that may determine who crashes and who survives in an overcrowded and competitive market. A number of possible solutions are on the table – but whether the companies and unions have the stomach to make decisions that will require painful concessions on both sides remains to be seen. GM's recent ground-breaking deal with the UAW on healthcare costs is a major glimmer of hope that both sides are willing to make sacrifices for the long-term good of both the company and its active and retired workforce.

The ageing workforce

50% of the workforce will be eligible to retire

The Big Three – and GM in particular – did a significant amount of their North American hiring in the mid-to late 1960s. These workers were hired in their 20s and have stayed on with the companies leaving them with a bulge of workers in their mid-50s. They are the immediate concern for the companies in terms of healthcare and pension cost increases for the short, medium and long-term.

▪ Age pyramid puts the big 3 at a disadvantage

It is estimated that one half of the United Auto Workers' (UAW) 620,000 active members – working at the Big Three and major US parts makers – are eligible to retire in the next three to five years. Given that the Big Three's workforce currently has an average age of 45, they have and will have fewer and fewer workers in the coming years. The workforce – for whom retirement looms large on the horizon – is also unlikely to vote for concessions on post-employment healthcare and pension benefits in the hope that it would strengthen the automakers' ability to create new jobs in the future.

▪ Older workers also cost automakers more

2-3 x higher costs

It is estimated that healthcare costs are two to three-times higher for males aged 50 to 54 than males aged 34. Older male workers – and the Big Three's blue collar workforce remains predominantly male – visit doctors more frequently, undergo more high-cost procedures and use more prescription drugs, according to health care experts.

▪ Changing demographics – things are only going to get worse

Because of the character of their workforce's age pyramid, companies such as GM will have increasing numbers of staff retiring in the next decade. It is estimated that by 2011, US Baby Boomers will begin to retire at a rate of one every three seconds. These retirements will of course entail pension and healthcare obligations for the workers and their dependents. However because of the growing life expectancy, these obligations are lasting far longer than previously assumed.

Nobody ever thought Big 3 workers would live this long

Age 109 & still going!

The fastest growing segment of the US population is the 85+ Age bracket which is up 38% in the last decade. In the mid to long-term, this will mean a growing number of workers who will be retired for longer than they worked. GM's oldest retiree, Ernest Pusey, is now aged 109 – he worked for GM for 32 years and has been retired for 47 years (Source: *GM*).

The social costs – economic decline comes at a huge cost

1.8% of jobs vs. 2.6% of compensation

In many ways, part of the Big Three's suffering is rooted in the fact that – back when they used to command 90% market share in the US – they negotiated with the unions to give their workers generous benefits – making their workforces the envy of workers the world over. Strong bargaining by the powerful UAW trade union ensured that these benefits have remained in place over the last generation. Today, it puts them at a major disadvantage against their European and Japanese competitors – both at home and abroad. Years of economic decline have resulted in an imbalance between these still generous benefits and the realities of the companies. Today, while auto manufacturing provides 1.8% of US private-sector jobs, it accounts for 2.6% of compensation – a 69% difference (*Source: Center for Automotive Research*).

▪ Wages are not the problem – benefits are

The key difference does not lie in wage differences. Union jobs at Big Three-owned plants pay around USD 26 per hour, which is only slightly more than non-unionised jobs at foreign-owned plants which are paid USD 24-25 per hour. However, the differentials swell when we examine compensation as a whole. Taking into account health care, cost-of-living adjustments and other benefits negotiated with the unions – the Big Three-owned plants pay an average of USD 55 per hour (over USD70 for GM) – compared to only USD 48 per hour at a Toyota-owned plant.

▪ Healthcare costs – the bill grows for the Big 3

Up to USD5.6 billion p.a.

The Big Three face skyrocketing health-care benefit costs for its aging workforce and pensioners. This costs each of them between USD 3 to 5.6 billion a year – an average of USD 1,220 for the Big Three and as much as USD 2,000 for GM – a major reduction of profit margins and costing more than the steel used to make many cars.

European and Japanese automakers have a major competitive disadvantage

In contrast, the US-based foreign automakers have younger workforces, do not have those costs, and thus have higher profit margins. Foreign actors only pay an estimated USD 450 per car for health care and Toyota as little as USD 200. European and Japanese players are not faced with the same challenges in their home countries as their respective home governments pay a significant part of their current and retired workers healthcare and pension benefits.

▪ Ageing and retired workforce – the healthcare bill grows again

1.83 million people

The Big Three are not only paying the healthcare costs of their active workers but for an estimated 1.83 million active workers, retirees, spouses, surviving spouses and other dependents in the US. The total cost to the Big Three in 2004 was USD 10 billion. This was a (yet again) staggering average of USD 9,000 per employee for healthcare. This is an estimated 50% more than the US corporate average! The automakers are also struggling to cope with health insurance premiums that keep growing every year – by almost 14% last year (*Source: Kaiser Family Foundation*). The bill keeps increasing to cover higher spending on hospital services and prescription drugs.

GM – America's biggest healthcare provider

GM, is undoubtedly the worst hit of the Big Three on healthcare costs, estimating that its bill will grow by about 10% this year to USD 5.6bn. This makes it the US's biggest private sector healthcare provider.

Overview of healthcare costs in selected regions (price paid per vehicle in USD, 2004)

COMPANY (SUBSIDIARY)	COUNTRY / REGION	COSTS PER VEHCILE
BMW	Germany	449
DCX (Chrysler)	USA	1,044
DCX (Mercedes)	Germany	419
Ford	North America	1,309
GM	North America	1,500
Honda	Japan	151
Toyota	North America	201
Toyota	Japan	97
VW	Germany	418

Source: A.T. Kearney Inc.

And don't forget pension obligations

800,000 retirees

The Big Three also have large unfunded pension obligations – albeit smaller than their healthcare obligations – of between USD 6.6 billion for DCX to USD 12.3 billion for Ford. This largely relates to the fact that they operate defined benefit plans for their employees in the US and other countries, whereby they are contractually committed – under collective bargaining agreements – to provide specified levels of pension benefits to retirees covered by the contract. The fact that they are paying out to some 800,000 retirees compared to less than a thousand for their foreign competitors in the US - puts them at a major disadvantage vis-à-vis their European competitors who are also greatly aided by the State in their home countries (see below). The Japanese automakers have domestic pension obligations roughly equivalent to the Big Three.

The autoworker perspective

Generous labour contracts

Guaranteed wages & benefits

For the unionised autoworkers in the US and Canada, collective bargaining has resulted in the Big Three guaranteeing generous wages and benefits. They also have guaranteed jobs – unionised workers cannot be laid off without incurring major costs. Even if they are sent home, they receive 90% of their take-home pay. At present, more than 10,000 laid-off UAW members are currently in the industry's "jobs bank" receiving pay and benefits. Their only obligation is to report for work each day, unless they opt for community service or retraining. These labour contracts also require the automakers to continue paying wages and pensions indefinitely to workers who lose their jobs. The key question is whether these high standards price UAW members out of an extremely competitive market – enabling domestic and international players to undercut them at will.

Are they willing to make concessions?

This leads to the key question of whether active and retired autoworkers in the US and Canada would be willing to accept a reduction in their healthcare and/or obligations. This is no easy challenge for the unions – any concessions they grant to one automaker will be demanded by all and union leaders also run the risk of open revolt among their members if they give too much away. The unions are unlikely to go easy on the Big Three and under pressure for cuts, will give something, but only what they feel is absolutely necessary.

Impacts of failing to concede are not pretty

Chapter 11 – the worst case scenario

Given the automakers' financial and competitive woes – by failing to concede, the unions risk hastening the loss of competitiveness and jobs to lower-cost rivals. The entry into Chapter 11 of a number of airlines and the teetering on bankruptcy of many auto parts makers – all big employers of unionised workers – has sent a sobering message to unions about their bargaining clout with financially troubled employers.

The UAW's position – dialogue but no renegotiation

Unwilling to re-open deals until now…

The UAW (*International Union, United Automobile, Aerospace and Agricultural Implement Workers of America*) is one of the largest unions in the US with over 620,000 active members (and 500,000 retired ones) – it is the representative union in the auto sector in the US. To date the UAW has expressed its willingness to work within the existing terms of national labour contracts to help the Big Three – and GM in particular – as much as possible. However, it has long been open and explicit that it will not re-open the contracts to negotiate their terms before they are due to expire. This is consistent with their long-standing position – the only time in the past that the UAW has reopened a contract with one of the Big Three was the federal government's bailout of the then truly near-bankrupt Chrysler in 1980 (see below).

Why the UAW isn't giving in (for now at least…)

We do not believe that the UAW is taking any more a recalcitrant position than some of the Big Three. The evidence shows that the union is wholly aware of the Big Three's realities – that they are besieged by healthcare inflation, pension liabilities and are losing market share – and thus jobs to Asian rivals. The UAW is open to dialogue and in some cases, negotiation and renegotiation (see below). However, they are quite legitimately (on a number of their arguments), unwilling to bailout the automakers for what they perceive as poor management choices. Moreover, as the recent US deal with GM indicates – the UAW is willing to go to its members for their approval for fundamental changes before 2007.

The UAW's arguments

Legitimate criticisms of company management

Much of the UAW's argument for the current state of the Big Three centres on government trade policies and currency manipulation by Asian countries – which are beyond our remit. It is also centred on criticism of the Big Three's management:

- ***Automakers problems are due to poor management choices*** – these include poor decisions about products, marketing and advertising strategies but above all – their inability to produce cars that Americans prefer;
- ***Automakers are simply crying wolf*** – they have not made a convincing case for a bailout – they continue to pay out large dividends, the equity in their stock is up, they have

a lot of cash in hand (GM: USD20bn and Ford: USD23bn) and they have no real intention of declaring bankruptcy; and

- ***Automakers are not sharing the pain*** – Executive pay remains high while automakers do not talk about reopening contracts when things are going well to give the workers more money.

Visteon – the UAW in a generous mood?

The UAW's position on auto-parts maker Visteon showed that it is able and willing to renegotiate contracts when a company is truly in dire straits. The union agreed in May 2005 to let Visteon hand 20 unionised factories back to Ford, its former parent company. The UAW further agreed to Ford's plan to buy out up to 5,000 Visteon workers and sell most of the plants to other auto-parts makers that are likely to pay lower wages. The agreement removed an untenable burden from the company.

The Big 3-CAW agreements

3 new deals for Big 3 in Canada

The CAW (Canadian Auto Workers) union was founded in the 1985 after the Canadian membership of the UAW decided to set up their own Canadian union. Since then, it has grown into the largest private sector union in Canada (260,000 members). It is the representative union in the auto sector in Canada with 42,000 autoworker members at the Big Three – although membership has fallen by over 10% since the last union agreement in 2002. The CAW has also gone further than the UAW in trying to reach a painful but realistic deal with the automakers (and vice versa).

The Canadian context

ISSUE	LEVEL OF RISK
Labour costs	▪ Higher than at (US) plants owned by Asian and European automakers; Chrysler estimates that they are CAD 8.81/hour more per Big 3 worker and are rising by 5.8% p.a. (vs. 2.4% at their foreign rivals)
Pension costs	▪ Similar to the US – a major expense and risk
Healthcare costs	▪ Not a major issue – they are only an estimated CAD 120 per vehicle produced in Canada (DCX) – with Canada's national taxpayer-funded healthcare plan keeping costs significantly down
Canadian dollar	▪ Rising CAD is a significant cost factor – risen to 85 cents to the USD from 65 cents in 2002 when the last wave of union agreements were signed by the Big 3
Trade policy	▪ CAW criticism of US & Canadian policies – give Asian automakers near-unimpeded access to the market and Asian policies which maintain tight restrictions on imports in Asia
Profitability	▪ Operations are profitable – even the troubled GM generated a CAD 500m profit in 2004

Source: Company documents, CAW, CM-CIC Securities / ESN estimates.

New CAW deals with Ford and Chrysler – and GM!

Over the course of September 2005, the CAW reached new three-year agreements with the Big Three that provide for a relatively significant contraction of their blue-collar workforces as well as the smallest wage and benefit increases in the notoriously aggressive union's 20-year

history. The deals are a far cry from the past when deals were characterised by signing bonuses, time off and other benefits – they show significant give-and-take on both sides.

Overview of concessions by both sides in the new agreements

CAW CONCESSION(S)	BIG 3 CONCESSION(S)
▪ Reduction of the blue-collar workforces – by 1,100 (Ford), 1,000-1,600 (DCX), 1,000 (GM); or 7%+ of the workforce over 3 years	▪ All layoffs through attrition and early retirement
▪ Limited wage increases – 1.4% in the 1st year, and 0.9% in each of the final 2 years plus a cost of living allowance	▪ Wage increases – (see across left)
▪ Measures to limit healthcare costs – caps etc	▪ Modest pension increases for current & former retirees – CAD 6.80/mo. for production workers & CAD 9.40 for skilled workers
▪ Abandon opposition to modular assembly	▪ Restructuring incentive for voluntary lay-offs – CAD 70,000 p.a. (USD 59,448)
▪ Implementation of factory efficiency measures	▪ Abandon plans to contract out services and close plants
▪ Avoidance of planned strike action by the unions	▪ New investments in factories – CAD 575m (DCX), CAD 200m (Ford), CAD 750m (GM)

Source: CAW, company documents, CM-CIC Securities / ESN estimates.

The GM deal – the most difficult of the three Canadian deals – was signed in late September after the company finally agreed to follow the long-established tradition of *pattern bargaining* – whereby a union reached an agreement on terms with one of the Big Three and then uses that as a template for the other two. In Canada, the CAW set the pattern at Ford followed shortly thereafter by DCX. It is worth noting that the deals received overwhelming acceptance by the union members – 95% at Ford - even though they offer the most modest gains in their union's history and allow for relatively significant layoffs. Key from the CAW's perspective was the avoidance of involuntary layoffs.

▪ GM-UAW's ground-breaking agreement

USD 15 billion reduction in liabilities

The most important development to date is however without a glimmer of a doubt, the recent agreement between GM and the UAW in the US (pending impending ratification and court approval). The deal will save the company USD3 billion p.a. on healthcare costs and will reduce post-retirement liabilities by USD 15 billion.

Probable impacts for UAW workers

EMPLOYEES	POSSIBLE IMPACT(S)
Blue collar	▪ Plant closings & 25k job cuts by 2008 – to be identified by end 2005 ▪ Higher payments for healthcare – up to 25-30% of costs (vs. 7% today) ▪ Premiums, co-pays, deductibles, prescription drug coverage – to be determined
White-collar	▪ No salary or bonus increases for 2005 ▪ Job cuts for 2006 ▪ Must pay 31% of healthcare costs – up from 27%
GMAC	▪ Possible fundamental changes if the finance operations are spun to a new employer

Source: CAW, company documents, CM-CIC Securities / ESN estimates.

Defined contribution revolution

VEBA will help to ease UAW's pain

One of the boldest measures in the agreement is the establishment of a defined contribution-based VEBA (Voluntary Employees Benefit Association) that GM will help fund (US 1 billion p.a. in 2006, 2007 and 2011) and the UAW will run. It marks a sharp departure from the defined benefit model that has been the bedrock of UAW agreements over the last decades. A defined benefit healthcare plan promises employees and retirees that specific medical needs will be met no matter how high healthcare inflation rises. The agreement partly mitigates the impact of reduced health coverage for individual hourly retirees and GM is considering further financial contributions based on its financial performance.

Credit needs to be given to the UAW

UAW made major concessions

Credit needs to be given to the UAW – who are frequently unfairly characterised by many in the industry. The UAW's President Ron Gettelfinger took a number of major risks in signing the deals – notably: i) asking his members to re-open the GM-UAW contract before its 2007 expiration; and ii) offering concessions on healthcare benefits – the most sacred of sacred cows for the autoworkers. This more than anything else shows how aware the unions are of the company's financial situation.

▪ GM & Canadian deals are a beacon of hope

The agreements by GM in the US and the Big Three in Canada show that the unions are keenly aware of the challenges facing the OEMs and that they are willing to temper the lofty expectations of members. The deals also show that both sides are capable of constructive dialogue and change with the new agreements also allowing for reductions in overall labour structural costs and increases in production efficiency – which we regard as vital to the Big Three's competitiveness and future.

How are the automakers positioned on legacy costs?

▪ Pension obligations

Pension obligations (2004 or end of most recent financial year)

Company	Pension obligations	Pension Assets	Funded Status
DCX	€34.4 billion	€27.8 billion	(€6.6 billion)
Fiat	€2.8 billion	€1.6 billion	(€1.2 billion)
Ford	$72.5 billion	60.2 (53.6)	($12.3 billion)
GM	$107.4 billion	99.9 (93.7)	($7.5 billion)
Honda	¥1,943 billion	1099.7 (989.4)	(¥843.3 million)
Nissan	¥1041.5 billion	¥377.2 million	(¥664.3 million/$ 6.3 bn.)
PSA	€3.87 billion	€2.78 billion	(€1.09 billion)
Porsche	Covered by provisions (€457millions as of 31/07/2004)		
Renault	€1.1 billion	€230 million	(€867 million)
Toyota	¥1450.7 billion	¥934.7 billion	(¥516 billion/$4.8 bn)
VW	€2.07billions	€2.45 billions	*The bulk is not funded but accrued for*

Source: Company documents, CM-CIC Securities / ESN estimates

Other post-retirement obligations – healthcare

Other post-retirement obligations (2004 or end of most recent financial year)

Company	Benefit obligations	Fund Assets	Funded Status
DCX	€14.4 billion	€1.6 billion	(€12.8 billion)
Fiat	(€1.3 billion)	-	(€1.3 billion)
Ford	$39.1 billion	$6.8 billion	($32.3 billion)
GM	$77.5 billion	$16.1 billion	($61.5 billion)
Toyota		Not material	
Nissan		Not material	
PSA		Not material	
Porsche		Not material	
Renault	€1.1 billion	€230 million	(€867 million)
VW		Aggregated with pensions	

Source: Company documents, CM-CIC Securities / ESN estimates

European automakers – well positioned for now

State pays the bulk of pensions

The European automakers are all well-positioned on legacy costs which are relatively negligible when compared to Ford or GM. Their main operations are in continental Europe where pension systems are generally publicly run (i.e. defined contribution schemes). The automakers' commitments are rarely funded and thus are only sensitive to changes in the parameters used to calculate them – labour factors, interest rates etc. – which are not particularly volatile in these countries. Their pension and other post-retirement benefits essentially only concern active employees – and not retirees and their dependents – a major advantage over the Big Three. These obligations are either wholly covered or represent low levels of financial risk exposure to benefit obligations:

- ***Defined-contribution plans*** – earnings-related payments, in accordance with local law, to the national State organisations responsible for paying retirees pension and health benefits based on capital built through employer and employee contributions. There is no actuarial liability for the companies concerning these pension arrangements;
- ***Defined-benefit plans*** – provisions for pension and healthcare on retirement (with payments determined based on a range of criteria including age, years of service, salary level and entitlement under the social security system). The levels of underfunding are relatively low – at or under €1 billion.

But the tide will also turn on Europe

Greying workforce

European automakers need to start preparing themselves now for the challenges of demographic change as their younger workforces age and the number of employees reaching the end of their working lives. The age pyramid question will begin to hit them over the course of the next ten years. They will be hit hard as the French and German governments are likely to engage in significant reforms to the retirement and pension systems over that time – resulting in longer working lives for autoworkers and greater monetary obligations for automakers. For the European companies, this also means implementing measures to

increase competitiveness, maintaining skills levels and working with older employees – sooner rather than later. The same applies to the Japanese automakers on their "home turf."

Japanese automakers – relatively well positioned

No material impacts

The Japanese automakers have higher unfunded pension obligations than the Europeans – running between ¥516 billion (Toyota) to ¥813 billion (Honda) – which is not all that different from those of Ford and GM. The Japanese automakers' pension liabilities for fiscal 2005 will however decrease compared to prior years due to the transfer to the government of the substitutional portion of certain employee pension funds. With regard to healthcare and other post-retirement obligations, the Japanese players are extremely well positioned with relatively immaterial financial risks either at home or abroad.

European and Japanese Automakers in the US – Exceptionalism?

No UAW and no union agreements

Foreign automakers in the US – Asian and European - are at significantly lower risk than the Big Three in terms of their potential exposure to legacy costs. This is for a number of reasons which sets them apart from the Big Three:

- ***Time is on their side*** – they only began operating their plants in the US in the mid-1980s and because they have much younger workforces relative to the Big Three. While the latter have to pay pension benefits to over 800,000 individuals, the foreign automakers are only paying them for less than a thousand workers;
- ***Non-unionisation*** – they have avoided union control of their US plants giving them much greater flexibility in their cost structure than the Big Three and allowing them to take action such as reducing plant capacity when needed. This is consistent with the approach of a number of the Asian automakers – particularly the Japanese – but does stand at odds to the union commitments of the European players (in Europe);
- ***Geography (and non-unionisation)*** – they have generally avoided locating in Detroit altogether - and the American Rust Belt in general, except for a first wave of Asian plants in the mid-West in the mid-1980's. The foreign automakers have located almost exclusively in the Southern States whose *weak union laws* do not require workers to join unions even if their plants are organised (i.e. freedom from the UAW and union agreements). Moreover, states like Alabama have spent hundreds of millions in incentives and tax breaks to attract new plants and create jobs in the relatively poorer states.

European and Japanese automakers move south

AUTOMAKER	PRODUCTION
BMW	South Carolina
Honda	Alabama
Hyundai	Alabama
Mercedes (DCX)	Alabama
Nissan	Tennessee, Mississippi [and Mexico]
Toyota	Indiana, Kentucky & Texas [and Mexico]

Source: Company documents

DCX – an unhealthy European, but the healthiest of the Big 3

1st to negotiate with the UAW

DCX's positioning – with €6.6 billion in unfunded pension obligations and €12.8 billion in other post-retirement obligations – stands out vis-à-vis other European players. However even then, its numbers including Chrysler, the smallest of the Big Three are by far the healthiest of the three Detroit-based companies. Chrysler has also taken advantage of a provision in its current UAW agreement to ask for relief if healthcare costs rise beyond certain limits – i.e. the cost of PPPs (preferred provider plans) rises above the cost of traditional plans.

Chrysler – first breakthrough healthcare agreement with the Big 3

Chrysler has used this provision to sign a new pact with the UAW (effective 1 April 2005) – that will save DCX tens of millions annually. The agreement requires some 35,000 Chrysler hourly workers and retirees to pay annual deductibles and/or co-payments of between USD 100 – 1,000 for healthcare that had been previously free (for the autoworkers but not the company). The change covers all workers in the company's PPO but not the hourly employees covered by the company's traditional healthcare plan (75,000) or those enrolled in the pre-paid HMOs (32,000) – those plans will continue not to require deductibles.

The deal is admittedly a first step – but it marked the first time that UAW workers are required to share the cost of healthcare with an automaker – a breakthrough in terms of union recognition of the company's problems. Chrysler is now looking to build on these gains and negotiate for the cost gains agreed between GM and the UAW in the US in October 2005.

Ford, unhealthy

Ford has the highest pension liabilities of all automakers – USD 12.3 billion. It also has the second highest healthcare obligations – USD 32.3 billion. Unless these obligations are contained, they could consume the bulk of its surplus cash generated in the coming years. This includes one-off and on-going amounts relating to its rescue of key parts supplier Visteon – which remains in difficulty and is in the midst of structural and strategic changes – with potential further cost implications for Ford.

Ford's revitalisation plan

Ford is currently preparing a new "revitalisation plan" – its second in less than four years – which as one might expect, will aim to streamline operations, strengthen its balance sheet and bring down costs. Practically, this will inevitably mean job cuts and plant closures. Ford has also been pro-active in ensuring that only eligible recipients benefit from its health programmes. Since the launch of pilot programmes in 2000, Ford has removed 50,000 ineligible people from its healthcare rolls – some 10% of active and retired employees and dependents. This represents a cost saving to the company of two to four hundred million per year in our view; it has a USD 3bn+ annual health care bill.

Ford hoping to follow GM

Ford is also in the midst of negotiations with the UAW to address Dearborn's healthcare costs and hopes to follow the recent GM-UAW deal and sign a cost-cutting agreement.

GM, the sick man of the auto industry

2.5 retirees for every active employee

GM – with 2.5 pensioners for every active worker – is without any doubt in the most challenging situation of any major automaker with regard to legacy costs, particularly its hugely under-funded obligations for retiree healthcare which stand at USD 61.5 billion!

Meltdown in the auto parts industry adds to GM's pain

Delphi goes into Chapter 11

Delphi – the largest US auto parts supplier – is looking to GM for aid of up to USD 6 billion to save it from filing for bankruptcy. Deep in the pit of junk bond status with total debt of USD 6 billion and pension liabilities of USD 14.5 billion, Delphi is looking to use the cash to reduce expenses by offering senior workers voluntary retirement packages as well as to pay for healthcare and pension obligations. As its largest customer and former parent company, GM has no other realistic choice but to consider the request for assistance. Under the 1999 spin-off agreement with Delphi, GM would be liable for some of its pension liabilities if it folds. It is also worth noting that auto parts makers have been the key target in the Big Three's cost cutting efforts – with parts comprising 70% of a vehicle's costs – and UAW agreements providing automakers with limited flexibility.

And GM's pain is UAW's pain

Delphi is currently negotiating with GM as well as the UAW. It is asking the union to cut wages from USD 27/hour to USD 10-12, eliminate a job bank giving full pay to 4,000 laid off workers, reduce health care benefits and give it the right to close or consolidate plants. Such measures could, according to industry sources save GM up to USD 1.4 billion p.a. in cheaper parts from Delphi. GM aiding Delphi would be welcomed by the UAW but any such aid would be opposed by the equity markets and 10% activist shareholder Kirk Kerkorian. The UAW is thus in an extremely difficult situation as – wages of USD 10-12 are the norm in the sector – and the deal remains better than any restructuring deal its workers would receive if the company filed for bankruptcy.

GM's ground breaking deal with the UAW

HUGE!

As GM's CEO Rick Wagoner told shareholders at the June 2005 AGM – it is "crystal clear" that the company needs to "*achieve a significant reduction in [its] healthcare cost disadvantage and [must] do so promptly*." A major step in this direction was achieved in October 2005 when the company signed a deal with the UAW which will:

- ***Trim USD1 billion off of its USD6 billion annual healthcare bill*** – the largest single cost-cutting initiative ever announced by the company. The key reform is that workers and employees will have to pay about 25-30% of their healthcare costs (vs. 7% today)
- ***Cut GM's commitment to cover healthcare costs by USD 15 billion*** over the lifetime of its workers – this is an impressive 25% reduction;
- ***Cut 25,000 hourly manufacturing workers by 2008***; and
- ***Continue cuts in the white collar workforce*** – as well as put a stop on salary and bonus increases for the year.

Other options on GM's table

Spinning off GMAC

In addition to available cash – some USD 20 billion – and normal mortality rates which will reduce the ratio of retirees to active workers, GM will also attempt to tackle legacy costs through the possible spinning-off of its profitable units. Key in this regard will be the likely sale

of the GMAC financial services unit – which sells automotive and commercial financing, insurance and mortgage products and real estate services. GM could probably raise USD10-15 billion by selling a controlling 51% stake in GMAC. This would improve the company's credit and make it easier and less expensive for it to borrow the billions it needs for loans to consumers and businesses – and make it a healthier company. Of course, the key unanswered question which arises – is whether GM can survive on its auto operations alone?

▪ US government raises the stakes on pension obligations

Termination-based disclosure would change the rules of the game

The Pension Benefit Guaranty Corporation (PBGC) – a US federal agency which insures employee pensions if a company fails to meet its obligations – contends that GM's US-employees pension fund is underfunded by USD 31 billion, in marked contrast to GM's estimate of a small surplus (for the US alone). The PBGC's assumption is made on a termination basis – i.e. the amount that GM would owe its workers if it were to terminate its pension fund immediately – whereas GM's assumption is on the basis of the fund being fully funded (i.e. the fund keeps going with employee contributions and cash from its continuing operations). GM argues that the PBGC's methods are not indicative of its ability to provide future retirement benefits and that it has contributed USD 56 billion to its pension plans over the last twelve years.

US automakers beware!

Regardless, this is a potentially worrying development for the Big Three as there is a move in the US for the PBGC's calculation method or similar methods to become the only method for measuring pension obligations. The US Senate is currently discussing a pension bill with termination accounting provisions – it has bi-partisan support as well as support from the Secretary of Labor. The US Congress is expected to pass pension legislation by the end of this year. If passed, this could have serious impacts for GM as well as Ford and DCX in terms of reduced liquidity and borrowing power.

Restructuring – what are the options on the table?

▪ Our solution – painful but realistic concessions by both sides

In our view the most realistic and least painful solution for both sides – pain is inevitable for both parties if it is to work – will be a raft of concessions by both the automakers and the unions as has happened with the recent deal with GM in the US.

The good old days are over for the UAW

And they know it – they are willing to make concessions

The halcyon union agreements of yesteryear when the unions demanded more and usually got it – are over. The good times can't keep rolling as the Big Three and GM and Ford in particular no longer have hegemony – and their market slide is only likely to continue to slide both to established Asian and European players – but to the BRICs and others in the longer term. They can and should thus be flexible in terms of workforce reductions, wage and benefit increases and efficiency efforts. We don't deny these will be painful – major retrenching is needed as the Big Three can no longer afford to keep up sales volumes through discounts and low-interest financing alone. The UAW also knows this – as the GM deal indicates.

But the big 3 are not Delphi

They can & must make concessions

However, in the same vein, neither Ford nor even GM, are in the same dire straits as Delphi. The going is definitely tough but not so tough that they cannot engage in the type of win-win concessions that they have demonstrated in their negotiations with the CAW, including:

- Layoffs and restructuring through attrition and early retirement;
- Incentives for voluntary lay-offs;
- Moderate and realistic wage and benefit increases; and
- Defined benefit VEBA plans.

However, there are a number of other possible restructuring options which could be adopted to tackle the growing risk associated with legacy costs.

A Chrysler-style bailout

Government loan guarantees?

One potential option is a Chrysler-style bail-out (1979-1980) where the US government provided automakers with loan guarantees in return for warrants and the autoworkers agree to make concessions. For the then near-bankrupt Chrysler, the government provided USD 1.5bn in loan guarantees and the workers agreed to make concessions equal to about USD 2 per hour -- to get the bailout package.

A short-term success?

On the one hand, it can be argued that the Chrysler bailout saved the company from ruin and led to a string of successes beginning with its K cars and eventual acquisition by Daimler. It also benefited the US government who sold the resurrected Chrysler's warrants off for a handsome profit. Finally, it can also be seen as a potentially useful example of effective cooperation and give-and-take for today's automakers and unions.

Or a long-term failure?

On the other hand, twenty-five years later, it can be argued that the bailout had a much more perverse legacy for today's players – in terms of today's realities of overcapacity in worldwide production and the unwillingness of automakers and unions to engage in serious, structural reform. These factors may help to explain why there is so little talk of a direct bailout and much talk of an indirect one whereby legacy costs are shifted to taxpayers.

Healthcare reform

Big 3 are stepping up their efforts

Another possible option – and one gaining increasing sway among automakers – is a fundamental overhaul of the national healthcare system. The Big Three are increasingly and openly challenging the US government and business leaders to push for broad reforms to the national healthcare system.

Reforms are under way

There have been some positive changes to date. The introduction of the *Medicare Prescription Drug, Improvement and Modernization Act of 2003,* provides federal subsidies to sponsors of retiree healthcare benefits equivalent to certain Medicare payments. Ford, for instance, estimates that the subsidy will reduce its 2004 healthcare expenses by USD 250 million.

Big 3 step up their lobbying efforts

The Big Three are increasingly pushing for government subsidies to help cover their rising healthcare costs. The (partisan) Automotive Trade Policy Council – partly funded by them – recently presented to every member of Congress the results of a study that seeks to show their contribution to the US economy and employment, as well as the cost differential due to pensions and healthcare costs. GM's CEO has gone one step further asking some 15 states for help in containing healthcare costs.

Creative options

CAFE - healthcare costs trade-off?

We believe that there are interesting potential options on the table. For instance US Senator Barak Obama is proposing legislation under which the federal government would pay for retiree's healthcare costs, in return for the automakers' agreement to increase CAFE standards by 3% until 2010.

▪ Chapter 11

Steel & Airlines have done it

The most radical option on the table – and one that automakers appear to be avoiding for the moment at least – is to follow the lead of the US steel and airline industries and file for bankruptcy and Chapter 11 protection.

The big winners – the automakers?

Chapter 11 was enacted by the US Congress to allow a company to reduce its debts and/or drastically lower its operating costs so it can return to being an economically viable company. That usually means that a company can dump its pension liabilities, slash its health-care benefits and void its union contracts as well as wages owed under them. The end result for the automakers – no more legacy costs!

The big losers – the unionised auto-workers?

The biggest losers in a Chapter 11-scenario would undoubtedly be the autoworkers, notably the unionised workers, who would stand to lose the iron-clad protection of their collective bargaining agreements as well as their health-care benefits and up to two-thirds of their retirement benefits. If the situation moves towards such a doomsday scenario, the unions and their members will be faced with a difficult trade-off – sacrificing a few hundred dollars a month in concessions now or many thousands in the longer-term. Chapter 11 restructuring deals would not even be able to buy one of the vehicles that they assemble.

Is Chapter 11 a realistic possibility?

Unlikely but possible

Declaring bankruptcy used to carry a social and reputational stigma risk that generally represented the ruinous end of a corporation. Nowadays, in a difficult and uncertain economic climate, it is simply regarded by many in the financial community as a just another management tool amongst others in the corporate arsenal. We do not believe that Chapter 11 is a possibility in the short or medium term. However, if the market share, market cap and profitability of GM and Ford continue to sink and the automakers and unions fail to agree on possible concessions – Chapter 11 remains on the cards and may well prove to be increasingly irresistible as time goes by.

Corporate governance – why is the German model being called into question?

CORPORATE GOVERNANCE - SUMMARY	
▪ Lack of international representation and balance on all the boards	
▪ True levels of independence leave something to be desired across the board	
▪ German governance is at risk - old boys' networks, cosiness, conflicts of interest, lack of shareholder focus	
▪ Signs of improvement in German governance	
Winners	None - an axe for improvement for all automakers
Losers	Porsche - Minority shareholders are not a concern & VW is not in their interests
	VW - Overly cosy ties between management, labour & the state

Room for improvement for all automakers

After having analysed the corporate governance of companies in the sector across a broad range of board and shareholder-related issues, we found a remarkable degree of similarities between all the global automakers – lack of internationalism on the boards of directors; extensive cross-directorships and old boys' network; and non-executives (and in some cases shareholders) who don't appear to be asking the difficult questions that need to be asked of their executives on financial and extra-financial issues, amongst other findings.

▪ An issue for all automakers but especially the Germans

Practices at German automakers pose a serious potential threat

We believe that these are serious issues for all of the companies in the sector. However, we have chosen to focus the bulk of our corporate governance analysis in this report on the practices of German automakers – while placing them in the context of practices in the sector – as we feel that their practices (as they currently stand) pose a serious threat to the long-term interests of shareholders and even the very viability of companies such as Porsche and VW.

Deutschland AG

For many years, shareholders and governance activists had been justifiably critical of German corporate governance, characterising the system as Deutschland AG – a web of old boys' networks, cross-shareholdings and "buddy-buddy" relationships between executives, the State, trade unions, works councils and employees.

▪ Co-determination – the heart of the German model

Consensus based model has played an important role in good employee relations

At the heart of the German governance model is *Mitbestimmung* or co-determination – the practice whereby trade union and/or employee representatives are given seats on a company's board of directors. Although similar systems exist in 18 EU countries and at other auto companies (i.e. Renault), nowhere are they as elaborate as in Germany. The system has traditionally played an important part of Germany's consensus-based socio-economic model and has – whatever naysayers may claim - helped to keep labour unrest at a minimum in a country where the unions wield incredible power vis-à-vis other European countries and the US.

Supervisory boards under attack

Large and unwieldy boards

One of the criticisms which arise with regard to the Supervisory Boards in German auto companies is the large potentially unwieldy size of their boards. BMW, DCX and VW have 20-members on this tier which places them at the top end of the sector.

Size of boards in the auto sector (number of members)

BMW*	DCX*	FIA	FOR	GM	HON
6+20	9+20	15	15	12	21
NIS	**PSA***	**POR***	**REN**	**TOY**	**VW***
9	3+14	6+13	18	13	5+20

*Source: Company documents, Boardex data. * X+Y (X = Management Board & Y = Supervisory Board)*

Lack of fruitful boardroom debate

Theatrical debates with a single-minded focus on saving German jobs?

In and of itself, this would not necessarily be an issue. However, when combined with their reputation for boardroom table debate which can best be characterised as time-wasting theatrics, size and effectiveness become serious concerns given the raft of governance, financial and extra-financial challenges facing these companies. One of the central criticisms of the employee representatives is their supposed single-minded focus on saving German jobs – to the detriment of other key issues – and even when a majority of their workforces and an ever increasing proportion of their current and long-term future sales are, and will be, based abroad. As we do not have the minutes of these meetings, we can not be sure of this, but at the least, we feel it is a serious issue for discussion.

Domestic workforce & sales of German automakers (2004)

	DOMESTIC EMPLOYEES / TOTAL	DOMESTIC SALES* / TOTAL
BMW	75.5%	27.0%
DCX	48.1%	15.7%
Porsche	96.3%	22%
VW	52.2%	27.5%

*Source: Company documents, CM-CIC Securities / ESN estimates. * Sales to 3rd parties*

Conflicts of interest abound

Potential conflicts everywhere you turn

Another one of the key justifiable criticisms raised about German governance and the auto sector is the raft of potential conflicts of interest which exist at a range of different levels – current and former executives; executives and union leaders and members; “sheep-like” Supervisory Board members; cross-directorships and cross shareholdings between major national companies.

Old boys’ networks and cross-directorships

Both management and supervisory boards in Germany and the auto sector are all too often characterised by cosy “old boys” networks *a la Deutschland*. Even if these links have been on

the decline for a number of years, we believe that they remain a concern. Our examination of the first and second degree links – board and non-board and quoted and non-quoted companies and organisations – that exist between the Supervisory and Management Board members of the German auto companies and major German banks is insightful in this regard. Note that this only involves quoted banks – and not the equally influential (but unquoted) Landesbank, let alone other major DAX companies.

Links between directors* of German automakers & banks

GERMAN BANK – AUTOMAKER	BMW		DCX		PORSCHE		VW	
DEGREE OF SEPARATION	1°	2°	1°	2°	1°	2°	1°	2°
Aaaeal Bank	0	2	0	1	0	2	0	3
Allianz	3	258	3	198	0	10	2	260
Bankgesellschaft Berlin	0	19	0	16	0	2	0	86
Bayerische Landesbank Giroozentrale	0	12	0	8	0	0	0	78
Bayerische Hypo-und-Vereinsbanken	1	86	3	54	0	5	0	76
Commerzbank	1	72	0	82	0	4	0	123
Deutsche Bank	2	135	1	51	0	12	4	154
HSBC Trinkhaus & Burkhardt	1	19	0	20	0	3	0	13
IKB DeutscheIndustriebank	0	37	0	50	0	4	1	90

*Source: Boardex Data. * Directors = Management Board and Supervisory Board members.*

We will be the first to admit that these types of links are not unique to German auto companies – as the two tables on French automakers and on multiple links between the non-Asian automakers illustrate below.

Links between directors of French automakers & banks

BANK - AUTOMAKER	PSA		Renault	
DEGREE OF SEPARATION	1°	2°	1°	2°
BNP Paribas	0	213	2	139
Crédit Agricole	0	21	0	48
Societe Generale	6	66	0	80

Source: Boardex data

Networks have a disproportionate influence in Germany

Networks have a significant impact on business strategy and shareholders in Germany

However, we believe that the web of German links across the DAX continues to have disproportionate influence in German automaker's governance arrangements and operational business strategies. To take but one example - we can see the potential fall-out from these networks with DCX – where Hilmar Kopper (Supervisory Board Chairman and former Deutsche Bank executive) – co-presided with Jürgen Schrempp (Chairman of the Management Board and Deutsche Bank advisor) over a five year decline in the company's share price. Schremmp's July 2005 resignation was marked by Deutsche Bank selling its 10% stake in DCX.

The networks exacerbate the potential risk that members will lack the necessary courage to put forward alternative views or challenge the thinking of the Management Board – to which they may have once belonged or sat together with its members, either at the automaker or another DAX company.

Overview of board networks (current/former common link & no. of directors linked to it)

	MULTIPLE LINKS BETWEEN DIRECTORS
BMW	▪ Allianz (2), BASF (2), Bertelsmann AG (2), DataCard Corp (3), Deere & Co (2), Gerling-Konzern (2), Lufthansa (2), Munich Re (2), Royal Dutch Petroleum (2), Siemens (2)
DCX	▪ Allianz (2), Bayer (2), EADS (2), Howard University (2), Judge Institute (2), Mannesmann (2), NAACP (2), Nortel Networks (2), Trilateral Commission (3)
Fiat	▪ Campari (2), Club Med (2), CONFINDUSTRIA (5), Cotec Foundation (2), Enii (2), Exor Group (2), I.F.I.L. (4), Italian Institute of Technology (2), Sequana Capital (2), SGS Holding (2), World Economic Forum (2)
Ford	▪ Conagra Foods (2), Council on foreign Relations (2), Harvard Business School (2), HSBC (2), National Gallery of Art (2)
GM	▪ Business Council (3), Catalyst Club (2), Council on Foreign Relations (2), Merrill Lynch (2), NYSE (2), University of Chicago (2), US Business Council (2), US Business Roundtable (2)
PSA	▪ Credit Natl/Natexis (2), Faurecia (2), Hermes Intl. (2), Immeubles et Participations de l'Est (2), La Française de Participations Financières (4), Paris Europlace (2), Société Foncière Financière et Participations (3), Valeo (2)
Porsche	▪ Deutsche Telecom (2), Novartis (2)
Renault	▪ L'Oreéal (3), Musée du Louvre (2)
VW	▪ Allianz (4), Degussa (2), E.ON (3); Hochtief (2), Metro AG (2), Munich Re (3), Salzgitter (2), Scania (2), Siemens (2), Suez (2), Thyssenkrupp (2)TUI (2), Veba (2)

Source: Company documents, Boardex data.

Executives stepping upstairs

We note the Chairmen of three of the four German automaker's Supervisory Boards are former executives at the same groups – while the companies view this as a guarantor of stability, it can, inevitably impose constraints on the new management teams (i.e. VW's commitment to the failed Phaeton). That said, this is also a potential issue for almost all of the automakers.

Is the chairman of the board a current or former executive of the same company

BMW*	DCX*	FIA	FOR	GM	HON
☑	☑	☒	☑	☑	☑
NIS	**PSA**	**POR***	**REN**	**TOY**	**VW***
☑	☑	☑	☑	☑	☑

*Source: Company documents, Boardex data. * Refers to whether the chairman of the Supervisory Board if a former member of the Management Board.*

Cosiness stifles effective decision making

Difficult decisions can be put off in order to maintain good relations and executives' hides

Amongst its roles, the Supervisory Board is responsible for hiring and firing Management Board members; meanwhile the Management Board has responsibility for controlling a company's employees. This raises fundamental questions – can a Management Board effectively control a company's employees given that its job also consists of keeping good terms with employee and union representatives who sit on the board and that hire and fire them. Obviously, the answer is often yes – it can work – but in some cases there may be the potential for implicit understandings and cosy deal-making between all involved – at board level and below. Instead of making difficult decisions on the issues of the day and for the

future – and there are many for the German automakers – executives may be inclined to put off change and curry favour with employees to the potential detriment of the company.

Complex web – employees, unions, management & the state

See below.

▪ True levels of independence

Independent directors could act as an important counter-balance

Given the tangled webs which sometimes exist at German automakers, we believe that bolstering true levels of independence on the Supervisory board is a major axe for possible improvement – with cross-directorships abounding between non-employee members of the Supervisory Board (as well as with employee representatives and Management Board members). The presence of more independent directors could play an important role in governance reform at the companies including as a counterbalance to the supervisory board's varying interest groups.

Independence levels are a concern

As the table below indicates, unlike their French, Italian and US counterparts, German companies do not provide an assessment of the independence of their Supervisory Board members. Excluding employee representatives from our calculations we have applied a stringent set of possible factors which could be see by some investors as potentially influencing objective, independent judgement. These include the current or recent exercise of executive functions, cross-directorships, links to major shareholders, potential conflicts of interest, and length of association with the company, amongst others.

Independence of board members in the auto sector – company & stringent evaluations

	BMW*	DCX*	FIA	FOR	GM	HON	NIS	PSA	POR*	REN*	TOY	VW*
By company	ND	ND	53%	73%	92%	10%	0	23%	ND	47%	0	ND
Stringent evaluation	20%	30%	33%	53%	67%	10%	0	7%	14%	27%	0	0

*Source: Company documents, Boardex data. ND = not disclosed. * Employee representatives have been excluded from the calculations.*

Application of such criteria shows that independence levels are a potential concern in all European automakers – levels are significantly higher among US players. In the case of the German automakers, our concerns over their low levels of independence are more elevated than other European players because of the fact that: i) many of the potential reasons to question independence link to the complex web of relations between directors; and ii) independence cannot serve as an important bulwark to counter-balance this web. It is thus a major axe for improvement.

VW – Oh what a tangled web we weave !

Over the course of 2005, VW has been hit by a string of broad governance-related scandals which are partly rooted in the company's complex web of management, government (local, state and federal) and employee interaction. This system has been a unique characteristic of the company for many years and we believe that it has brought all of the actors involved great benefits over many years. However, today it is both symptomatic and part of the fundamental governance problems that exist at VW with major potential impacts for efficiency, decision making and long-term financial success.

Bastion of strong trade unionism

90-97% representation makes IG Metall a powerful force

Unions at VW are an even more powerful force than at many other German companies. IG Metall, one of the largest German unions represents over 90% of the company's 179k German employees and 97% of its manual workers. The metal and engineering workers union also holds three seats on VW's Supervisory Board and its members dominate the company's extremely powerful works council. Relations between the company and IG Metall can be regarded as relatively good – with the sides having resolved a lengthy dispute agreeing on a labour contract that freezes wages until 2007 and saves VW EUR1bn p.a. on staffing costs (i.e. 15%).

Powerful works council – stronger than usual co-management

Strong powers of VW's works council leave room for potential abuse

VW's works council also has an even stronger role than at most German companies – including, of course its members' presence on the Supervisory Board. Its main 50,000 employee strong Wolfsburg plant works council has close to 70 company paid employees with many seconded to work solely on work council business. They work closely with senior VW executives in a position akin to company managers.

Power over wages

As VW has an in-house wage agreement – rather than participating in Germany's more common pan-industrial collective bargaining systems – its works council members have elevated powers associated with their role in negotiating wages. This further exacerbates the *potential* for conflicts of interest between workers and management – *if* works council employees cosy up to management and lose sight of the interests of their fellow employees.

Strong & cosy ties between management, labour and the state

Strong SPD links to VW are another form of old boy's network

The ties between management, employees, unions and the State at VW have always been stronger than at other German companies and an area of potential concern:

- ***the traditionally SPD (left)-leaning State of Lower Saxony*** has long had a major shareholding in the company (18.2% at the date of this report) as well as a presence on the board (i.e. current *Ministerpräsident* Christian Wulff);
- ***ex-Chancellor (SPD) Gerhard Schröder served on the company's Supervisory Board*** in his former capacity as *Ministerpräsident of* Lower Saxony and tended to prefer pro-car policies earning him the nickname "Auto-Kanzler" (car chancellor);
- ***Works council members are often senior IG Metall*** members as well as being active in the SPD and local politics; and
- ***a special VW law, preventing hostile takeovers by limiting the voting rights of any single shareholder to 20%***, which effectively gives Lower Saxony control through its minority stake. The EU has repeatedly asked Germany to scrap the law, saying it violates laws on freedom of investment.

There was also significant controversy this year when it turned out that six regional and national parliamentarians – all SPD members and all former employees of VW – had continued to receive and pocket salaries from VW after they had moved into full-time politics. VW has since halted the practice and disclosed a list of close to 400 elected representatives – most at local council level – that had been on its payroll.

String of scandals re-open governance debate at VW

Allegations of prostitutes and bribes hit employees - extreme but worrying cases

The debate over these inter-relationships and their impact on the effectiveness of VW's governance arrangements re-opened in mid-2005 after a number of serious allegations including bribes for senior employee executives and works council members to support company decisions:

- *executives* are said to have looked the other way while union and works council members (including the company's most senior HR executive, Peter Hartz) allegedly misused company funds (via a slush fund) for free trips, gifts for spouses, samba lessons, viagra and Brazilian call-girls paid for as company expenses;
- executives (working under Hartz) set up bogus companies - ostensibly to build dealerships - and channelled undisclosed company funds into them;
- Executives allegedly bribed union members on the Supervisory Board to secure votes for building a controversial new factory in India (controversial in terms of the offshoring and job loss debate, even if it was meant to supply the Indian market); and
- Skoda's HR manager, Helmut Schuster (a former employee director at VW) is said to have asked the government of Andhra Pradesh in India to transfer €2m to a (since disappeared) company claiming to represent VW in India, in order to secure the company's investment in the State;

A string of senior figures resign

Some of VW's most powerful figures resign

The scandals have resulted in a number of senior figures resigning from their positions including: i) Klaus Volkert the former chairman of VW's works council and one of IG Metall's most powerful figures; and ii) Hartz – who was coincidentally or unsurprisingly (you decide) – a close friend and political adviser of ex-Chancellor Schröder and somewhat ironically, the architect of his labour reforms and VW's unique 4-day work week model.

Replacing Hartz – the cycle continues?

It is interesting to note that negotiations over Hartz's successor took place between the premier of Lower Saxony (a major shareholder) and the chairman of the IG Metall trade union. While this would typically be business as usual in a system rooted in co-determination, the web of inter-relationships and scandal at VW, raise serious but justifiable questions as to whether the web of actors involved have become too closely intertwined for the company's long-term good – and we are also talking about its employees.

Will VW's governance sink a leaky ship?

The key issues arising from these incidents is whether the incestuous web of back-scratching at VW is symptomatic of a fundamental governance problem and whether it will continue to put the company at risk. We believe that VW is at an important stage where its governance can still be reformed – and operate free of the vested interests of certain groups – and ultimately aid everyone's goal of jobs and prosperity. On the other hand, continued inaction can and will lead to more of the same, to everyone's loss. Porsche's recent stake is a further complicating factor (see below).

Speedy reaction by VW

Independent inquiry has been launched

VW should at the very least be praised for its speedy reaction to the scandals. Soon after the Hartz-related bribery and kickback allegations broke, the company appointed KPMG to launch an independent inquiry and present the results to a specially established sub-committee of the Supervisory Board that includes Ferdinand Piëch as a member. The final report is due in Q4 2005 although it currently remains unclear whether it will be disclosed. The company's legal department also alerted and is now working with German state prosecutors who are investigating criminal breaches for a number of foreign employees. The measures should be welcomed although we are reticent whether a sub-committee of the Supervisory Board – given the context - is the most objective actor to take difficult decisions on the executives and employees involved. Separate governmental investigations are also underway by Indian authorities.

Was management complacent?

A key issue which the investigations will need to answer is whether top management had any prior knowledge of the incidents and if so, what they did or failed to do as a consequence. A big question will obviously be whether Hartz was directly linked to the allegations – this would at the very least raise serious issues as to reform of governance practices at VW. Knowledge and inaction on the part of such figures as former CEO Ferdinand Piëch through to current CEO Bernd Pischetsrieder – neither of whom have been implicated in any way or form – could lead to a major housecleaning at VW.

Scandal can sometimes be healthy

We believe that the scandals could bring about a long needed reform of governance practices at VW. These changes could in time have the effect of eliminating the culture of mutual back scratching – notably between the state, management and labour – and ensure the development of stringent systems of checks and balances and internal controls:

- ***Reforming the co-management system and devolving the powers*** of senior employee executives and works council members and ensuring that stringent controls are in place over strategic decision-making;
- ***More active involvement by Management Board members*** – particularly Pischetsrieder – in taking difficult decisions at the company including with regard to HR practices such as shift patterns. We do note that he holds the largest number of board-level mandates of the companies in the panel below, which may cause potential time and commitment issues in this regard.

Board positions held by the CEOs of a sample of automakers

BMW	DCX	FIA	FOR	GM	POR	PSA	REN	VW
3	4	3	2	2	3	4	4	5

Source: Boardex data.

- ***Reforming the state's role in the company*** – this includes eliminating the golden share which tacitly endorses Lower Saxony's role in the company's ownership and management structure and removing politicians from all levels on the Supervisory Board. This could help to balance the goals of keeping jobs in the region with growth and profits (nationally and internationally); and

Independent directors could act as an important counter-balance

- ***Bolstering true levels of independence on the Supervisory board*** – which we believe are a major axe for possible improvement – with cross-directorships abounding between non-employee members of the Supervisory Board (as well as with employee representatives and Management Board members). The presence of more independent directors could play an important role in governance reform at VW including as a counterbalance to the supervisory board's varying interest groups.

Possible concerns over independence of VW's supervisory board members (ex-employees)

DIRECTOR	STATUS	POSSIBLE CONCERNS
Dr G Cromme	Board member	▪ Cross-directorships (Allianz, E.ON; Hochtief, Siemens, Suez, Thyssenkrupp, Veba)
Dr M Frenzel	Board member	▪ Cross-directorships (E.ON, Tui)
Dr H Gaul	Board member	▪ Cross-directorships (Degussa, E.ON, Veba)
W Hirche	Board member	▪ Link to shareholder (Federal Minister of Economy; FPD Party Chief Lower Saxony)
Dr K Liesen	Board member	▪ Cross-directorships (Allianz, Government E.ON, Thyssenkrupp, Tui, Unilever); 18 year association
R Oetker	Board member	▪ Cross-directorships (Degussa)
Prof Dr F Piëch	Chairman	▪ Controlling shareholder of Porsche, a major VW shareholder; former VW executive
Lord Simon	Board member	▪ Cross-directorships (Suez, Unilever)
Dr H Von Pierer	Board member	▪ Cross-directorships (Degussa, Hochtief, Munich Re, Siemens, Thyssenkrupp)
C Wulff	Board member	▪ Cross-directorships & link to shareholder (Prime Minister, State of Lower Saxony; Head, CDU)

Source: Boardex data, Company documents, CM-CIC Securities / ESN estimates.

Porsche's stake in VW – the web thickens

Porsche announces 20% stake in VW

In September 2005, Porsche, the world's most profitable auto company announced that it planned to take a 20% stake in VW to prevent a possible takeover of VW that could threaten the two companies business ties and strengthen the independence of Porsche, a family-owned company. The acquisition by Porsche would give it, the state of Lower Saxony and VW itself (via its treasury shares), a combined majority stake of 51.2% in VW. The plan adds to the concerns over the state of German corporate governance, raising concerns of a return to the old way of doing business, in which the shareholders came low on the list of management priorities, if on the list at all.

▪ Porsche – powerful cars but poor governance

Porsche has long been regarded as one of Germany's most successful companies, inside or outside of the auto sector. However, the company also has some of the poorest corporate governance practices in its home country and the auto sector. This has gone largely ignored by many shareholders and analysts alike as the company has been a strong profit centre while its national and international counterparts have struggled. We believe that the VW stake may be the incident which brings the company's poor governance to the forefront.

Lack of transparency

Poor disclosure

Porsche is one of the poorest performers in terms of disclosure for shareholders, analysts and stakeholders. For instance, it has long only reported earnings on a bi-annual basis (which ironically could have appeal for those truly committed to long-termism) and with regard to remuneration – with CEO Wendelin Wiedeking having long battled against disclosure of executive remuneration.

Lack of shareholder culture

Shareholders are at the bottom of the priority list

Porsche's quoted preferred shares don't confer holders any degree of control over the company because its voting shares are exclusively held by members of the Porsche and Piëch families (who coincidentally also have a strong presence on the Supervisory Board). This has played a major role in relegating shareholders' interest to the bottom of the list of company priorities. As CEO Wendelin Wiedeking himself recently told *Die Welt*: "Yes, of course we have heard of shareholder value. But that does not change the fact that we put customers first, then workers, then business partners, suppliers and dealers, and then shareholders."

Lack of independence

Low levels of independence are a concern

Employee shareholders aside, one can only make an argument for the independence of one member of the Supervisory Board – raising serious questions as to whether the necessary checks and balances, notably objective and independent oversight over the Management Board are in place at Porsche. This concern is further compounded by the widely held belief that the strings at the company – including over Wiedeking – are in fact pulled by Ferdinand Piëch.

Possible concerns over independence of supervisory board members (ex-employees)

DIRECTOR	STATUS	POSSIBLE CONCERNS
Dr H Piëch	Board member	▪ Member of Piëch family, which with the Porsche family controls 100% of voting rights
Dr F Piëch	Board member	▪ Member of Piëch family, which with the Porsche family controls 100% of voting rights
Dr W Porsche	Board member	▪ Member of Porsche family, which with the Piëch family controls 100% of voting rights
Prof F Porsche	Hon. Ch.	▪ Member of Porsche family, which with the Piëch family controls 100% of voting rights
Dr F Porsche	Board member	▪ Member of Porsche family, which with the Piëch family controls 100% of voting rights
Prof Dr H Sihler	Chairman	▪ Length of association (12.8 years) & cross-directorships with Management Board members
Dr W Zügel	Board member	▪ No major concerns

Source: Boardex data, Company documents, CM-CIC Securities / ESN estimates.

▪ Porsche & VW – in whose interest?

Business interests

Porsche is making a business case for the deal

Porsche has said that its "planned investment is the strategic answer" to the risk that the so-called "VW Law" will be repealed and VW taken over by investors who might not have the company's long-term interests at heart. This in turn would have impacts on Porsche – as VW is a strategic partner – as a development partner (i.e. hybrid technology), business partner (i.e. developing and co-manufacturing of the Cayenne) and as a supplier (VW supplies 30% of Porsche's sales volume). The business partner arguments are valid but the rationale is flawed. All of these relationships are guaranteed by contract and would be virtually impossible for any new VW owner to change. Moreover, a player of Porsche's calibre would have little trouble finding a new business partner. The potential rationales must be sought elsewhere.

Family ties

A common grandfather unites both companies

One of the main concerns is that Porsche is in fact driven more by historical family sentiment than financial logic. Both it and VW trace their ancestry back to Ferdinand Porsche, the father of VW iconic "people's car", the Beetle. Porsche's ties to VW have also been maintained by Professor Dr. Piëch, who sits on both companies' Supervisory Boards, and is the grandson of Ferdinand Porsche. In total, three Porsche family and two Piëch family members also sit on Porsche's Supervisory Board.

German national interests

Porsche's CEO plays the nationalism card

Another potential driver is the defence of German national socio-economic interests and what some might regard as the protection of its model from the perils of unbridled international capitalism and its "locusts" (although Ferdinand Piëch might not go so far). Wendelin Wiedeking, Porsche's CEO, has himself invoked the national angle, saying that a "German solution" was essential to guard VW against a possible hostile takeover by short-term investors. We analysed whether this was due to the lack of international representation on Porsche's board – but Porsche has one of the highest levels of non-nationals at 26%, although we do note that the five non-nationals are all Austrian. Lack of board-level "representativeness" is a potential sector-wide concern.

Proportion of non-nationals on auto companies boards

BMW*	DCX*	FIA	FOR	GM	HON	NIS	PSA	POR*	REN	TOY	VW*
8%	31%	20%	13%	17%	0	33%	6%	26%	17%	0	9%

*Source: Company documents, Boardex data. CM-CIC Securities / ESN estimates. * Management and Supervisory Boards evaluated collectively.*

These are global companies – not German companies

We also note the fact that the idea of German national interests is something of an ironic misnomer given the growing internationalism of the companies particularly with regard to sales but increasingly, workforces.

Links between the auto companies directors

83 2nd degree links between Porsche & VW

It is worth noting that the complex web of relationships between the German automakers – 83 second degree links between Porsche and VW's directors – certainly may have facilitated the deal. The network of common links would probably be even higher if Porsche was as transparent as other automakers on directors' biographical information. But as the table of links between directors at the four companies below shows – this may be a potential factor to watch if other automakers choose to build and travel down the "national" road.

Links between directors* of German automakers

AUTOMAKER – AUTOMAKER	BMW		DCX		PORSCHE		VW	
DEGREE OF SEPARATION	1°	2°	1°	2°	1°	2°	1°	2°
BMW	-	-	0	60	2	5	0	83
DCX	0	60	-	-	0	5	0	68
Porsche	2	5	0	5	-	-	1	12
VW	0	83	0	68	1	12	-	-

*Source: Boardex Data. * Directors = Management Board and Supervisory Board members.*

Porsche & VW – the potential governance failures

Number of potential governance concerns arise

Whether Porsche's motivations lie in one of these factors or a mix of them, the governance implications do not bode well for the state of the German automakers. The following are only a few of the plethora of concerns which have arisen:

- ***Potential concentration of power of power in Ferdinand Piëch***, who effectively pulls the strings at Porsche – both as a director and as a shareholder – and as the chairman of the Supervisory Board at Porsche;
- ***Potential conflicts of interest which could arise from Piëch*** exercising an active role at both companies as well as if Porsche is given any seats on VW's board; and
- ***Reality that 80% of investors*** (ex-VW, Lower Saxony & Porsche, assuming they voted together) would be needed to vote out Piëch at VW.

In some ways, Porsche's stake is something of a catch 22 both from a business and governance perspective - Porsche's investment makes sense if it can actively contribute to VW's turnaround and share price revival. However, even a 20% stake – without the support of the company itself and the State of Lower Saxony – is not enough to exercise any degree of effective control over VW.

There is light at the end of the tunnel

From our perspective, the issues which have arisen at both VW and Porsche are not a justification for an assault on the German socio-economic and governance model which many have chosen to make it. The model has brought jobs and prosperity with minimal social unrest over a number of decades – that is nothing to sneeze at and clearly this is not a case for throwing the colloquial baby out with the bathwater.

Need for improved governance

VW & Porsche show the need for better corporate governance

The incidents are however in our view, indicative of the need for better corporate governance in Germany and among the German automakers – just as Enron, WorldCom and Tyco were in the US, Parmalat was in Italy and Shell was for the oil and gas sector. A new balance needs to be struck by these companies which recognises and is responsive to the interests of both stakeholders and shareholders. Porsche seems to be the exception to the rule – a one-off return to the old ways of Deutschland AG – rather than the new norm and there appears to be some positive recent developments in this regard.

Positive developments at BMW

BMW's 1st share buyback

For the very first time, Quandt-family controlled BMW returned part of its significant cash pile back to shareholders through its first share buy-back – a symbolic but important recognition of shareholders' interests.

Positive developments at VW

VW 's Supervisory Board begins to assume its role – better late than never

One extremely positive development at VW (in addition to those already discussed) – showing that the Supervisory Board is not the sleeping giant that it has often proved itself to be – is that it commissioned JP Morgan for a report advising it on the governance implications of Porsche's stake. The board chose to take external advice even if it was under no legal obligation to do so. As the report undoubtedly suggests – Porsche's stake results in potential

conflicts of interest and Porsche's representatives should not sit on VW's board. At the very least, Ferdinand Piëch, as a shareholder of Porsche should resign from his post as VW's Supervisory Board chairman. A number of VW's Supervisory Board Directors (including the illustrious Dr Cromme of corporate governance report fame – see below) are said to be in complete agreement; even the Premier of Lower Saxony, initially supportive of Porsche's stake, has openly criticised Porsche's attempts to influence the VW board.

An important move towards the goals of the Cromme Report

We believe that these moves mark an important step forward in VW, VW's Supervisory Board and even Lower Saxony moving towards the underlying goals of the German Corporate Governance Code (*Cromme Report, 2003*) – namely, that the Supervisory Board has responsibility for corporate governance and the interest of shareholders. The Board's key motivation in soliciting the report does really appear to be corporate governance standards and guarding against potential conflicts of interest which might exist between the two boards and the two companies – welcome developments indeed.

▪ Positive developments at DCX

DCX chooses not to play by the old boys club rules

DCX has chosen not to go down the same road as Porsche and rejected the possibility of a cross-shareholding in VW – only days after Porsche's 20% announcement. This had followed allegations of an old boy-style deal with VW swapping 10% of its shares for the 6.9% of DCX held by Deutsche Bank. DCX is also said to be considering a switch to *SE* (*Societas Europaea*) status – which would allow it to adopt a unitary board structure and reform the status of employees on the board without necessarily jetting all of the positive aspects of co-determination.

▪ Still some way to go

Reforming governance in the German automakers and addressing sometimes novel concepts such as shareholder value across the board will be an evolutionary process. It will continue to remain a challenge, particularly as companies such as DCX and VW face difficult economic situations and poor profit margins which can facilitate a "by any means necessary" type of mentality. The combination of financial challenges and poor governance is undoubtedly one of the factors that is behind some of the scandals that we have seen.

Possible transitional measures

Professionalising the Supervisory Board in the ways of good governance

However there are certain transitional steps that we believe can be taken to bridge the gap and improve governance practices at the automakers. These will include taking measures to build up and spread a corporate governance-oriented culture at the level of the Supervisory Board – such as greater training in risk maangement, more Chinese walls, regular rotation of jobs among employee representatives and a greater focus on independence – at board level and via third party whistleblowing procedures, amongst others. It is also probably time to vest the Supervisory Boards with certain powers relating to internal controls. These are currently in the domain of the Management Board – devolving such powers would help to responsibilise the Supervisory Board and allow it to exercise a more effective oversight role.

Environment: more stringent regulations

Tightening Environmental Regulations

The web of environmental legislation and regulations is tightening in Europe, the US and Asia. We have included a full summary of the relevant regulation (see below) and have focused on a few in greater detail in the body of the report. In our view, when it comes to the issues of CO2 emissions and legislation, the Auto Sector is a fundamental part of the problem and a major part of the potential solutions.

▪ Europe – do it voluntarily or we will legislate

120g CO2/km by 2012

The European Commission (EC) has set an objective of average CO2 emissions for new vehicles of 120g CO2/km by 2012. The EC deliberately chose not to go down the path of regulating this objective when the major automakers associations – ACEA (European Automobile Manufacturers Association), KAMA (Korea Automobile Manufacturers Association) and JAMA (Japan Automobile Manufacturers Association) – agreed to voluntarily reach the target. This happy marriage between the EC and the OEMs was based on mutual trust and a 10-year honeymoon period has since ensued. The EC was however quite clear that divorce would be on the cards if the automakers failed to reach the target – tight regulation based on fiscal incentives for leaders and taxes for the worst polluters.

Automakers go back on their promise

ACEA & JAMA won't meet targets

However, recent reports released by both ACEA and JAMA (2003) signalled that after extensive research they "see no possibility to achieve this target in a cost-efficient manner by technical measures." In their papers, they argue that although it is technically feasible to achieve the European target, the associated costs would be prohibitive. They also point to potentially significant market distortions and negative impacts on the European economy. ACEA nonetheless gave an indication that a 5% reduction of CO2 emissions between 2008 and 2012 – i.e. to 133g CO2/km – was feasible through improvements in vehicle technologies.

EU to launch its own assessment

Incentives and penalties are on the cards

The EC has since launched its own assessment into the 120g by 2012 target and is expected to present its findings to the European Council and Parliament in late 2005. One possible solution that the EC might realistically propose is a carrot and stick approach – incentives and penalties.

Intense lobbying on all sides

We expect to see a strong lobbying effort between the Commission and the major automakers and their regional, industry associations. It should be noted that the EU has explicitly stated that it will reach its goal in a sustainable way (*Three Pillars of Gothenburg*).

Main Regulations applicable to OEMs in US, Japan and EU

Regulations	Products	Region	Status	Comments
Clear Skies and the Global Climate Change Initiative	CO2, SO2, NOx, Hg	USA	Clear Skies legislation was reintroduced in the US House of Representatives and the US Senate on February 27, 2003	▪ This would cap SO2, NOx and mercury emissions from power-plants and sets up or expands the emissions trading framework for these pollutants. There are no mandatory reductions of carbon dioxide (CO2) but a voluntary strategy to cut the greenhouse intensity of the American economy by 18% over the next 10 years.
The Clean Air Act (CAA) 1970	General Air Pollution	USA	Current	▪ EPA regulates air pollution from area, stationary, and mobile sources, establishes National Ambient Air Quality Standards (NAAQS), directs states to develop Statewide Implementation Plans (SIP's) for compliance. A Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act was prepared to help firms handling chemicals
The Climate Stewardship Act	GHGs	USA	The bill did not pass in October 2003 but will be brought back up for a vote in the Senate in 2004	▪ The first comprehensive plan for reducing U.S. emissions of heat-trapping gases that contribute to global warming. The CSA sets mandatory limits on emissions from relevant sectors of the economy and encourages an increase in energy efficiency and clean renewable electricity generation.
CERCLA or Superfund 1980	Liability - Clean up	USA	Current - Amended (The Superfund Amendments and Reauthorization Act (SARA) 1986)	▪ The Comprehensive Environmental Response, Compensation, and Liability Act creates “Superfund” to clean up uncontrolled or abandoned hazardous-waste sites, provides for cost recovery from responsible parties.
The Clean Water Act (CWA) 1977	General Water Pollution	USA	Current	▪ It gives EPA authority to set water quality standards for all contaminants in surface waters, to set technology-based effluent standards, and outlaws pollutant discharges from point sources into navigable waters without a permit. It also deals with methods of disposing of wastewater sewage sludge at landfills.

Regulations	Products	Region	Status	Comments
42 USC - Energy Conservation Standards for Buildings Acts		USA	Current	▪ Reasonable energy conservation features must be incorporated into new commercial and residential buildings receiving Federal financial assistance. Voluntary performance standards for new residential and commercial buildings. To encourage and facilitate the implementation of energy conservation and renewable-resource energy measures with respect to dwelling units, non-residential buildings, and industrial plants.
The Pollution Prevention Act (PPA) 1990	General Pollution	USA	Current	▪ Reduction or elimination of pollution across all environmental media: air, land, and water.
The Resource Conservation and Recovery Act (RCRA) 1976	Hazardous Substances	USA	Current	▪ Hazardous waste being generated, transported, stored, treated, or disposed. The act primarily covers ongoing waste management at active facilities. EPA oversees "cradle-to-grave" control of hazardous waste
National Environmental Policy Act of 1969 (NEPA)	Environment	USA	Current	▪ NEPA is the basic national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy.
42 U.S.C. - Energy Policy and Conservation Act	Energy	USA	Current	▪ To impose rationing, to reduce demand for energy through the implementation of energy conservation plans, to increase the supply of fossil fuels through price incentives and production requirements, to provide for improved energy efficiency of motor vehicles, major appliances, and certain other consumer products... The “Energy Policy Conservation Act,” enacted into law by Congress in 1975, added Title V, “Improving Automotive Efficiency,” to the Motor Vehicle Information and Cost Savings Act and established CAFE standards for passenger cars and light trucks. The Act was passed in response to the 1973-74 Arab oil embargo. The near-term goal was to double new car fuel economy by model year 1985.
Amendments of the Climate Change Policy Law (Kyoto Protocol)	CO2	Japan	Current	▪ The Government of Japan has approved (June 2004) the Bill on Amendments of the Climate Change Policy Law. The purposes of the amendments are to provide a statutory framework, through which Japan could achieve the 6% emission reduction commitment under the Kyoto Protocol and become a party to the Protocol.
Climate Change Tax	CO2	Japan	Current - Reformation	▪ An interim report on Tax for addressing climate change by Central Environment Committee (June, 2002) recommended a step by step approach and the “greening” of the existing tax in 2002 - 2004. An energy tax reformation for addressing Climate Change is on its way.
Air Pollution Control Law No. 97 of 1968	SPM, NO2, SO2, CO, O	Japan	Current - Amended in 1996	▪ The Air Pollution Control Law provides for stations in several parts of the country to monitor for nitrogen dioxide, suspended particulate matter , sulfur dioxide, carbon monoxide and photochemical oxidants.
Motor Vehicle Exhaust Emission Standards	CO, HC, NOx, PM	Japan	Current	▪ These standards are sorted by vehicle categories (Gasoline /LPG, Diesel motor vehicles, wheeled motor vehicles) and they set limit values for each pollutant (carbon monoxide, hydrocarbons, nitrogen oxides, particulate matter)
Law Concerning the Promotion of the Measures to Cope with Global Warming	Global Warming	Japan	Current	▪ Defining the responsibilities of the central government, local governments, businesses and citizens to take measures to cope with global warming.

(117/98)

Regulations	Products	Region	Status	Comments
Energy Saving law 1979 No.49	Rational Use of Energy	Japan	Current - Revised 1983, 1993, 1997 and 1998	▪ This law was enacted for the purpose of contributing to the sound development of the national economy by setting up necessary measures for the national use of energy by factories, buildings, machinery and equipment, and other necessary measures, etc. for promoting comprehensively the rational use of energy in order to ensure the effective use of fuel resources which will meet the economic and social environment of energy at home and abroad.
Water Pollution Control Law No. 138 of 1970	Water Pollution	Japan	Current - Revised in 1995	▪ The purposes of this Law are to prevent the pollution of water by regulating effluent discharged by factories or establishments into the Public Water Areas, thereby to protect sufferers by setting forth stipulations regarding the responsibilities of the proprietors of factories or establishments to compensate the damage in cases where human health is damaged by polluted water or wastewater discharged from factories or establishments.
Regulatory measures vs. Air Pollutants Emitted from Factories and Business Sites	Dust, SOx, Cadmium, Chlorine, Fluorine, Lead, NOx, Nenzene…	Japan	Current - Latest Amendment on April 10, 1998	▪ Emission standards for each substance.
National Effluent Standards	Hazardous substances, Cd, CN	Japan	Current	▪ They are made up of two categories: the standards for protecting human health (24 substances including cadmium and cyanide) and the standards for protecting the living environment (16 items).
Fundamental Law for Establishing a Sound Material-Cycle Society No.110 of 2000	Natural Resources	Japan	Current	▪ A Sound Material-Cycle Society means a society where the consumption of natural resources is minimized and the environmental load is reduced as much as possible, by restraining products, etc. from becoming wastes, etc., promoting appropriate recycling of products, etc.
Fourth Daughter Directive on Heavy Metals in Ambient Air COM(2003)423	Hg, Cd, As, Ni, PAHs	EU	Commission Proposal	▪ To establish a target value for the concentration of benzo(a)pyrene in ambient air so as to avoid, prevent or reduce harmful effects of polycyclic aromatic hydrocarbons on human health and to determine common methods and criteria for the assessment of concentrations of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

Regulations	Products	Region	Status	Comments
Environmental Liability Directive 2004/35/CE	All activities	EU	Current - 3 years to implement the directive.	▪ Operators of certain (potentially) risky activities who cause environmental damage, by fault or negligence, will be held responsible for restoring the damage caused, or made to pay for the restoration. The Commission intends to put the polluter pays principle into practice. The scope of the Directive is wide ranging but concessions were made to insurance companies that they would not be compelled to cover the costs of environmental clean-up operations.
Energy Performance of Buildings Directive 2002/91/EC	Residential & Tertiary sector	EU	To be transposed by 4th January 2006	▪ Development of a methodology to calculate the integrated energy performance of buildings. Minimum requirements on the energy performance of new buildings and on the energy performance of large existing buildings that are subject to major renovation. Energy certification of buildings. Regular inspections of boilers and air conditioning systems in buildings and an assessment of heating installations where the boiler is more than 15 years old.
The Air Quality Framework Directive (96/62/EC)	SO2, NO2, NOx, PM10, Pb, O3, PAHs, C6H6, Cd, As, Ni, Hg	EU	Current	▪ This Directive covers the revision of previously existing legislation and the introduction of new air quality standards for previously unregulated air pollutants, setting the timetable for the development of daughter directives on a range of pollutants. Plans and programmes have to be drafted by each Member State.
The Solvents Directive (99/13/EC)	VOCs	EU	2001-2007 - Amended by Directive 2004/42/CE	▪ The purpose of the Directive is to reduce air pollution by reducing releases of volatile organic compounds to the environment and to require safer substitutes for solvents known to be carcinogens, mutagens, etc.
The Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EEC)	CO, SO2, NO2, NOx, VOCs, Metals, As, Dust, Asbestos, Cl, F, CN, Persistent hydrocarbons, biocides…	EU	2007 - Amended by Directives 2003/35/EC and 2003/87/EC	▪ IPPC concerns highly polluting industrial activities, as defined in Annex I (energy industries, production and processing of metals, mineral industry, chemical industry, waste management). It lays down measures designed to prevent, or where that is not practicable, to reduce emissions to air, land and water from these activities, including measures concerning waste. The Directive requires the monitoring of emissions. Proposal was made by the European Commission for the establishment of a European Pollutant Release and Transfer Register.

Regulations	Products	Region	Status	Comments
End of Life Vehicles - ELV (European Parliament and Council Directive 2000/53/EC)	Vehicle (including components and materials) which is waste	EU	2007	▪ This Directive lays down measures which aim, as a first priority, at the prevention of waste from vehicles and, in addition, at the reuse, recycling and other forms of recovery of end of life vehicles and their components so as to reduce the disposal of waste, as well as at the improvement in the environmental performance of all of the economic operators involved in the life cycle of vehicles and especially the operators directly involved in the treatment of end-of life vehicles.
First Daughter Directive (99/30/EC)	SO2, NO2, NOx, PM10, Pb	EU	Current - Amended by Commission Decision 2001/744/EC	
Second Daughter Directive (2000/69/EC)	C6H6, CO	EU	2005-2010	▪ It establishes limit values for concentrations of benzene and carbon monoxide in ambient air, and a requirement to assess concentrations of those pollutants in ambient air on the basis of common methods and criteria, as well as to obtain adequate information on concentrations of benzene and carbon monoxide and ensure that this is made available to the public.
Third Daughter Directive (Ambient Air Ozone) (2002/3/EC)	O3	EU	2010	▪ The Directive sets target values and long term objectives for ozone.

Source: Trucost, various governmental websites

Europe – consumer-related measures fall on deaf ears

All Member States have implemented Directive 1999/94/EC13 on the availability of consumer information on fuel efficiency and CO2 emissions. However according to the EC, preliminary results are disappointing showing that: the Directive's effectiveness appears to be low, with no visible, significant changes in consumer habits, to date.

Dutch exception

This has led some to doubt the efficacy of such measures. However, in the Netherlands, refund systems have been place since 2002 – with wide consumer acceptance and a "remarkable" impact on vehicle purchase decisions. Whether this system will be adopted by other countries is something to watch.

US: tectonic dynamics: a moving Federal State vs. leading and rebel states

US: CAFE standards – at a standstill since 1990!

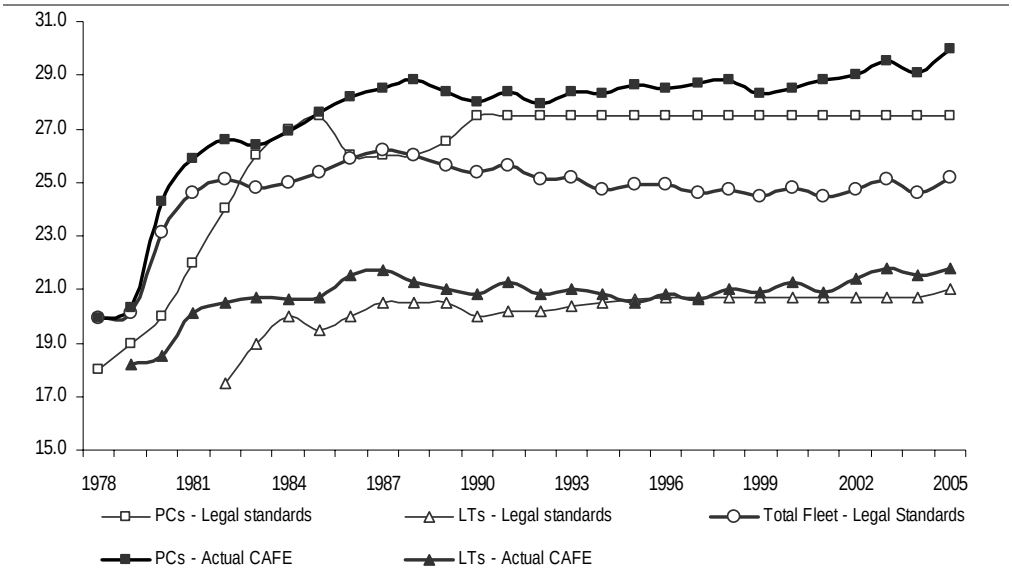
Stuck on 27.5 mpg

First enacted by the US Congress in 1976, the purpose of CAFE – Corporate Average Fuel Economy – is to reduce energy consumption by increasing the fuel efficiency of new cars and light trucks. Congress set an initial goal of doubling the 1974 passenger car CAFE by 1985 – to 27.5 mpg. It set fuel economy standards for a number of the intervening years (MY = model year):

MY 1978 (18 mpg) → MY 1979 (19 mpg) → MY 1980 (20 mpg) → MY 1985 (27.5 mpg)

After 1985, Congress provided for the continued application of the 1985 27.5 mpg standard for passenger cars, but devolved the authority to set higher or lower standards. From MY 1986 through 1989, the passenger car standards were actually lowered. In MY 1990, the passenger car standard was upped again to 27.5 mpg, and it has remained at this level since. Regulating CAFE is the responsibility of the NHTSA (the National Highway Traffic Safety Administration), which sets fuel economy standards for cars and light trucks sold in the US and the EPA (Environmental Protection Agency), which calculates the average fuel economy for each manufacturer.

Evolution of minimum CAFE standards and CAFE performance



Source: EPA2004

Two-fleet rule for cars – domestics vs. imports

75% domestic content rule

CAFE has a statutory "two-fleet rule" for passenger cars. Manufacturers' domestic and import fleets must separately meet the 27.5 mpg CAFE standard. For passenger cars, a vehicle is considered as part of the "domestic fleet" if 75% or more of the cost of the content is either U.S. or Canadian in origin, irrespective of its manufacturer. If it does not meet this standard, it is considered an import. The data shows that the CAFE performance of imports is very similar to US OEMs – with "foreign" automakers having significantly improved their performance to compete and in many cases out-compete in the US. This may be one reason that more stringent CAFE standards have not been passed.

Light trucks – slight improvements

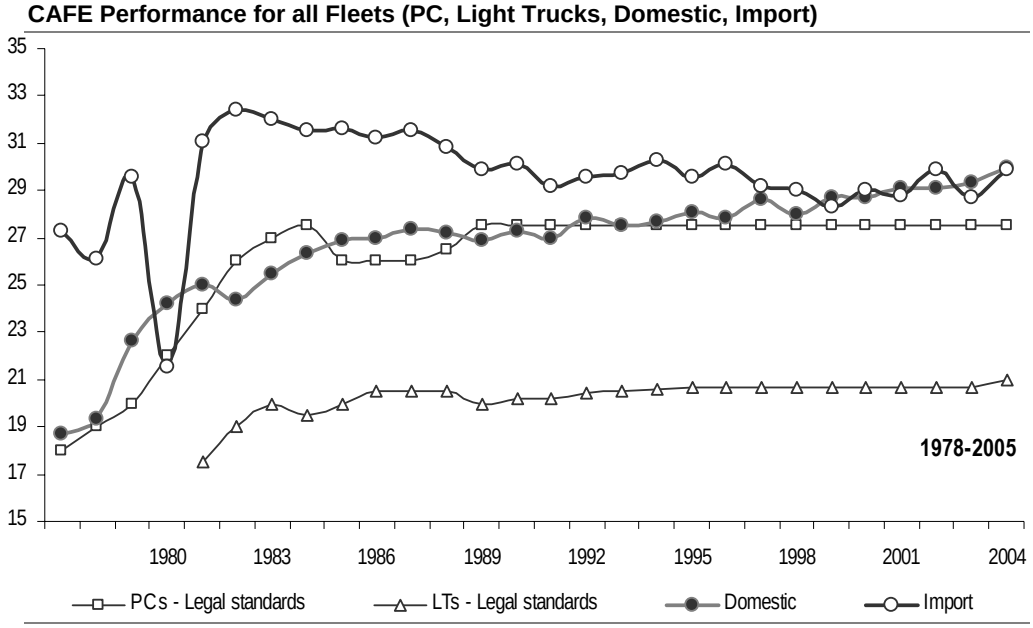
More movement than cars

For light trucks, the CAFE standard was progressively increased until 1996, when it was frozen at 20.7 mpg. The freeze was lifted by Congress on December 18, 2001. On March 31, 2003, the NHTSA issued new light truck standards:

MY 2005 (21.0 mpg) → MY 2006 (21.6 mpg) → MY 2007 (22.2 mpg)

The NHTSA is also currently proposing new standards for MY 2008-2010 with the introduction of a new system where manufacturers would have the choice of complying with traditional standards (Unreformed CAFE); or ii) a transitional period (MY 2008-2010) and move towards a reformed CAFE, under which each manufacturers' obligations would be based on target levels of average fuel economy for vehicles of six different categories (based on the range of its footprint in square feet). Individual manufacturers would be required to comply with a single fuel economy level that would be based on the distribution of its production among the footprint categories in each particular model year.

CAFE Performance for all Fleets (PC, Light Trucks, Domestic, Import)



Source: EPA2004

Penalties for CAFE non-compliance

$5.50 per 10th MPG under target x total volume

The penalty for failing to meet CAFE standards recently increased from USD 5.00 to 5.50 per tenth of an mpg for each tenth under the target value x the total volume of those vehicles manufactured for a given model year. Since 1983, auto manufacturers have paid more than USD 500 million in civil penalties. European manufacturers are regularly penalised, paying CAFE penalties ranging from less than USD 1 million to more than USD 20 million p.a. Asian and domestic US manufacturers have never paid a civil penalty to date. A full list of CAFE penalties paid by the automakers covered in this report (1983-2003) can be found in the Annex.

▪ CAFE isn't working any more

Regressing rather than progressing

Recent CAFE tendencies have been rather negative, as the EPA itself pointed it out in its October 2005 commentary. There are huge gaps between different vehicle segments with regards to fuel efficiency, and all in all, the situation has deteriorated over the course of the last year.

Fuel economy is actually getting worse in many classes

CAFE actually appears to be worsening in a number of classes, with the largest drop anticipated for compacts, which went from an average 25.84 mpg in 2004 to an estimated average of 24.63 mpg in 2006. The next largest decrease is expected to come in the large car segment, which could drop from an estimated 19.98 mpg to 19.70 mpg. Surprisingly for some, SUVs are expected to marginally increase their fuel economy as a class, from an estimated average of 18.72 mpg in 2004 to 19.27 mpg in 2005.

European and Asian hybrids & diesels – top the CAFE list

Toyota's Corolla was the only gasoline-only car to make the list of the ten most fuel-efficient 2006 models, which was otherwise dominated by hybrids and diesels. Honda's Insight hybrid was in first place, with 60 mpg city and 66 mpg highway, followed by Toyota's Prius hybrid with 60 mpg city and 51 highway. VW grabbed four of the top ten spots with diesel versions of its Beetle, Golf and Jetta models.

Ford was the only US automaker to make the top ten with the hybrid version of its Escape SUV. Ford also took top honours for its mid-sized Focus station wagon in that segment, and with the Ford Ranger as the most fuel-efficient pickup truck. The automatic version of DaimlerChrysler's Dodge Ram 1500 pickup truck, with an 8.3-liter engine, had the worst fuel economy of any vehicle rated, getting 9 mpg in the city and 12 mpg on the highway.

Fuel Economy by Select Classes

EPA Class	2005	2006	Δ
Subcompact	23.38	23.87	0.49
Compact	25.84	24.63	-1.21
Midsize	22.69	22.66	-0.02
Large	19.98	19.70	-0.28
Small station wagons	25.27	25.20	-0.07
Midsize station wagons	22.38	22.50	0.12
2WD Pickup	18.54	18.48	-0.06
4WD Pickup	17.12	17.03	-0.09
Minivans	20.21	20.19	-0.03
2WD SUV	19.52	19.90	0.39
4WD SUV	17.92	18.63	0.71

Source: EPA 2005

▪ CARB – California introduces mandatory zero-emissions targets

In 1990, the California Air Resources Board (CARB) made its first major step with regard to emissions targets – moving to stimulate development of zero emission vehicles (ZEVs) – cars, trucks and buses – that produce no tailpipe or evaporative emissions. The Board adopted a requirement that 10% of the new cars offered for sale in California in 2003 would have to be ZEVs.

1473 – CARB moves again

Not even the Terminator can stop the CARB!

Long anticipated, the CARB passed a stringent and ground-breaking new law in 2004 which essentially regulates mpg on new cars in California – 31mpg by 2009 up to 48mpg in 2016.

Consumers do care

Californians support CARB & are willing to pay for it

A recent survey released by the Public Policy Institute of California (PPIC) found that 86% of Californians believe global warming will affect current or future generations and that 54% lack confidence in the environmental and energy programs of the federal government and want the state to act on its own to address the problem. Accordingly, 77% favour CARB 1473, 83% favour requiring automakers to significantly improve the fuel efficiency of cars, and 73% support the policy even if it increases the cost of buying a new car.

Automakers go on the attack on CO2 emissions – endangering California's legislation

Automakers in a fight over Fed vs. State powers

Automakers are suing to block California regulators from adopting the world's toughest carbon dioxide emissions standards. The widely anticipated lawsuit was filed in U.S. District Court in Fresno by 13 California car dealerships and the AAM (Alliance of Automobile Manufacturers). The Washington-based trade group represents nine automakers, including BMW, DCX, Ford, GM, Toyota and VW. The suit seeks an injunction to halt California from enacting a plan to reduce carbon dioxide and other greenhouse gas emissions by 30 percent by 2016. The regulations are set to be phased in beginning in 2009. The lawsuit contends that only the federal NHTSA has the authority to set fuel economy standards.[6] State regulators

[6] Under US law, the NHTSA is responsible for establishing and amending the CAFE standards; promulgating regulations concerning CAFE procedures, definitions and reports; considering petitions for exemption from standards for low volume manufacturers and establishing unique standards for them; enforcing fuel economy standards and regulations.

sidestepped the issue by regulating carbon dioxide emissions, not fuel economy. But the AAM argues that "carbon dioxide and fuel economy are synonymous," noting that the EPA uses carbon dioxide emissions to gauge a vehicle's fuel efficiency.

China – catching up & taking the lead

Only 19% of new US cars meet China's 2008 standard!

Recognising it as a growing concern for the national economy and the sector, China has introduced its first fuel-efficiency standards for passenger cars, moving to control soaring oil consumption and ensure foreign automakers share their latest technology.

Stringent new fuel efficiency standards

The standards, which set requirements for how much fuel a car can use every 100 kilometres (62 miles), have been under discussion for years. China's new fuel economy standards require 32 different car and truck weight-based classes to achieve between:

19 1 38 mpg by 2005 → 21 & 43 mpg by 2008

As things currently stand – only 79% of US new cars sold and 27% of U.S. light trucks sold currently meet China's 2005 standards. Even fewer meet China's 2008 standard – only 19% of new cars and 14% of trucks sold.

China adopts the Japanese model

Per model standard (vs. per average fleet)

It is important to bear in mind that China adopted the Japanese rule of emissions standard per model – and not the US per average fleet system. China's new standards prescribe a maximum level of fuel consumption for every vehicle within each weight class, meaning that every automobile produced in a particular weight class has to meet the fuel economy standard set for that weight class. The US system, on the other hand, only demands that car and light truck sales averages meet fuel economy standards for each class. In China, if the automobiles do not meet the prescribed standards, they simply cannot be sold.

Automakers push for changes to the law

Initially some OEMs opposed the new regulations, fearing the added costs of compliance. They are also urging China to force suppliers to clean up the substandard diesel and gasoline fuel now sold throughout the country, complaining that bad fuel ruins high-tech engines. The new standards could also oblige foreign OEMs to boost their investment plans for China because they may have to modify some vehicles due to be introduced in the market. Whether they have the resources to do so, remains to be seen.

China moving forward on hybrids

New national standards

The Standardization Administration of China announced in July 2005 that a set of national standards on hybrid vehicles will be published and implemented in October 2005. These standards will become the testing benchmarks for certification of hybrids for sale in the domestic Chinese market. The China Automotive Technology and Research Center (CATARC) has recommended developing technical regulations for hybrid technology as a key step to broad commercialisation.

Europe – continues to lead the way

Emissions targeted in the next decade

	2010-2012 Objective		Improvement (from 1995)
	g/km	mpg	
Japan	125	44	23%
Europe	120	46	40%
US	201	27,5	0%
California	156,8	35,3	22%
Canada	-	-	25%
Australia	-	-	18%

Source: EPA, CARB, ACEA, JAMA, CM-CIC Securities / ESN estimates

Diesel and Auto Pollution: still an issue

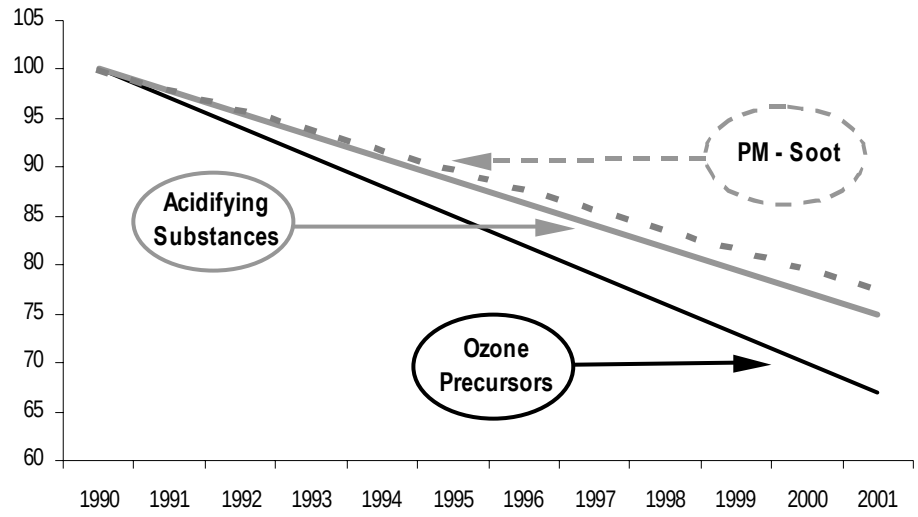
Some progress on pollutants

Nox, Sox, VOC, PM

Exhaust innovations & fuel quality

SOX and NOX pollution has declined, thanks to the progress made to date – both for gasoline and diesel engines.

Decline in transport emissions of harmful air pollutants (31 EEA member countries)



Source: EEA Term 2004

Reductions in emissions of particulates (PM10), acidifying substances (NOX, NMVOCs) and ozone precursors (SOX, NOX, NH3) mostly come from innovations in exhaust gas treatment in road vehicles and improved fuel quality. EU standards for automotive emissions and fuel quality (reduced sulphur concentration) have also had great effect.

Human health: a growing body of evidence on atmospheric pollution

Converging studies throughout the world

Up to 1m deaths p.a.

According to World Bank (Nov. 2003), between 500,000 and 1 million premature deaths worldwide each year are a result of severe air pollution. In France, a never-published report in April 2004 estimated that death toll due to pollutant emissions overreached 9,000 every year, i.e. more than deaths due to road accidents. In an article to be published in Epidemiology, American and Canadian scientists found out that chronic effects related to PM emissions (PM<2,5 µm) were much more damaging than previously estimated. In Los Angeles, Ca., a slight increase of 10 µg/m3 of PM in the atmosphere raised the risk of death (by all causes) by 11-17%. Researchers from several institutions including the University of Southern and McMaster University (Canada) found a bond stronger between the exposure to the fine particles and the ischaemic cardiac disease (caused by the contracting of the arteries).

Particulate matter (PM) – what is it?

- Airborne particulate matter (PM) consists of many different substances suspended in air in the form of particles (solids or liquid droplets) that vary widely in size.
- The particle mix in most cities is dominated by fine particles (less than 2.5 micrometers in diameter) generated by combustion sources with smaller amounts of coarse dust (between 2.5 and 10 micrometers in diameter).

PM – diesel's dark side

The smaller the PM, the more toxic the impact.

The smaller the PM, the more toxic they are for human health (lungs, heart, nose), with different disease-impacts ranging from asthma to lethal cardiovascular pathologies. According to some studies, life expectancy in Europe has decreased by 8 months (2 years in the most industrialized parts) because of PM. And to complicate things, the smaller the PM, the more difficult it is to eliminate them. 19% and 22% of PM2.5 and PM10 respectively derive from Diesel ICE, despite regular decreases.

Clear regulatory framework

EU Directives

Strict limits on the level of emissions of these pollutants – as is the case for other atmospheric pollutants – are set out by two EU directives dated 22 April 1999 (directive 1999/30/EC) and 16 November 2000 (directive 2000/69/EC). Emissions of particulates with diameters of less than 10 microns are capped at the following levels (expressed as yearly averages, decreasing in a linear fashion over time):

2004: 41.6 µg/m3 → 2005: 40 µg/m3 → 2010: 20 µg/m3.

Big issue for diesel engines

As one can see with the three target levels, the relevant Directive not only sets out a limit on average annual emissions, but also foreshadows a linear reduction in the period to 2010 (50% reduction between 2005 and 2010). This will in time be the big issue for diesel engines, which are among the main causes of these pollutants (traffic accounts for up to two-thirds of emissions in large urban centres, and one-third on average), mostly combustion residues. It should be noted that the progressive reduction also applies to other atmospheric pollutants (NOx, NO2, SO2, black smoke, lead, benzene, O3), but that PM are the only ones to be cut as drastically (along with benzene). This in time could pose a real danger to the development of the benzene market (environmental constraint), while at the same time constituting a real

source of opportunities for carmakers and parts makers able to deliver those technologies that could be used to meet the targets.

Tougher environmental constraints on PM by 2010

Need for PM filters will grow

Not only is the yearly limit to be halved between 2005 and 2010 (from 40 to 20 µg/m3), but any excesses in relation to the limit will also be more severely capped. The need for high-quality particle filters will be heightened by the fact that European Directives set a limit on the number of times limits can be (allowably) exceeded every year, and the limits are set to become increasingly restrictive here as well. In 2004, 35 excesses capped at 55 µg/m3 were allowed; in 2005, 35 excesses will again be allowed, but this time they will be capped at 50 µg/m3; by 2010, only seven excesses will be allowed, and they will be capped at 50 µg/m3. Thus, the maximum number of excesses will be divided by 5 in the space of five years!

Increasing pressure on government from stakeholders

Environmental NGOs take the initiative

Local authorities will be required to put into place information – and more importantly prevention and action – programmes in the event of the limits being broken. It was on the basis of these limits that a Munich resident took action against the state of Bavaria, on the grounds that the 50 µg/m3 limit had been broken 36 times by mid-March 2005! Environmentalists are keen to force governments to put pressure on carmakers and to ensure that diesel cars are equipped with effective particle filters. Environmentalists are not opposed to diesel engines (as opposed to gasoline) in that they emit less CO2 than normal gasoline engines (due to the big difference in fuel consumption).

Europe: Maximum number of excesses

Year	Annual average	Number of excesses allowed per year
2004	41.6 µg/m3	35 excesses of 55 µg/m3
2005	40 µg/m3	35 excesses of 50 µg/m3
2010	20 µg/m3	7 excesses of 50 µg/m3

Source: EU

Japan: limited progress on Nox & Sox

Emissions levels for pollutants

g/km	Period	Mass of carbon monoxide (CO)	Mass of hydrocarbons (HC)	Mass of nitrogen oxide (NOx)	Combined mass (HC + NOx)	Mass of particles
EURO III Petrol	2002-2005	2.3	0.2	0.15	-	-
EURO III Diesel	2002-2005	0.64	-	0.5	0.56	0.05
EURO IV Petrol	2005-2008	1	0.1	0.08	-	-
EURO IV Diesel	2005-2008	0.5	-	0.25	0.3	0.025

Source: ACEA, CM-CIC Securities / ESN estimates

Diesel's future remains uncertain outside Europe

Big reductions are needed

Euro standards are vehicle-based and different from the legal minimum requirements on clean air defined by another set of Directives. Euro III standard required a maximum of 0,05 g/km . Euro IV is now the rule for any new model launched in Europe, and for all vehicles later in 2008. It already drives the OEMs to reduce twice the emissions level (0,025g/km). In the meantime, the US has set a very stringent threshold of 0,006g/km, i.e. 4 times less! And this standard does not take Sox (sulphur emissions) into account. In that vein, we conclude that: a) Diesel still has a future but not without a high-quality Particulate Filter (PF); and b) it is very unlikely that Diesel will become a big hit in the US. Customers as well as OEMs would rather opt for improved classical ICE, gasoline-hybrids, hydrogen ICE and fuel cells on the long term.

Not all bad news from the US – low-sulfur diesel

97% less sulfur

It is definitely clear that OEMs will not move on Diesel in the US if they remain uncertain about the risks of future human-health litigation! However, the good news from the US is the introduction starting 2006 of a new cleaner Low-sulfur Diesel replacing conventional diesel. The new fuel will contain 97% less sulfur than conventional diesel – sulfur will be reduced from 500 parts per million (ppm) to 15 ppm (ultra-low sulfur fuel, or ULSD). Low-sulfur diesel fuel is cleaner-burning, producing less particulate emissions in both older and new engines. It will also allow the use of improved exhaust treatment devices to reduce emissions of particulates and smog-forming nitrogen oxides (NOx). These devices can be "poisoned" by the sulfur in conventional diesel fuel. But in our opinion it might be too late for Diesel, given the growing mood for alternative-fuel motorisation.

New technologies – the clean car miracle?

New technologies - SUMMARY	
▪ The range of possible, tested and road-ready technologies is broadening by the day	
▪ Number of choices: advanced ICE, Hydrogen ICE, gas/diesel hybrids, fuel cells, flex/bio-fuels, electric/gas	
▪ Different prices, different levels of maturity, different perspectives	
▪ Much depends on the development of appropriate infrastructure	
▪ US market is the preferred testing ground; oil prices are key	
Winners	- Diesel: PSA
	- Hydrogen ICE: Ford, Mazda, BMW
	- Gasoline Hybrids: Toyota, Honda, Ford
	- Diesel Hybrids: nobody
	- Flex Fuels: GM, Ford
Losers	- Renault (putting all its eggs in Nissan's innovation basket); VW

My way or the highway?

No 1 solution

In our view, there is no one solution when it comes to new and emerging technologies. Rather there are a range of potential solutions with different time-frames for development and implementation and sometimes, regional and geographical differences at play.

▪ CO2 emissions and oil dependence: the double eco-fuel-efficiency puzzle

Rising demand & dependence on imports

From here on in, the original eco-efficiency debate will be caught up in a much larger issue – oil and energy dependence. In may ways it really is "there we go again" as we re-live the days of the 1970's and the oil crisis. The new debate will largely centre on two key markets: the US and China.

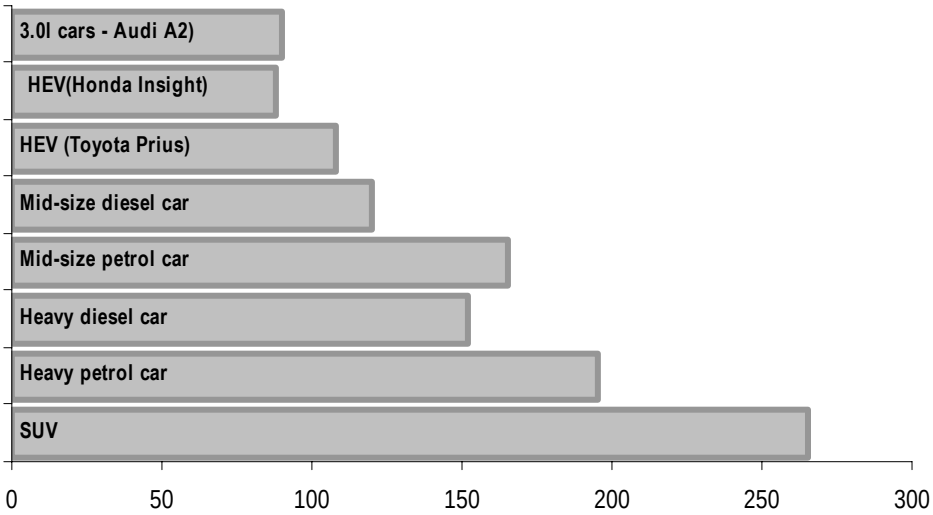
- ***U.S demand for oil is projected to increase by nearly 50% by 2025*** (Source: Hydrogen Posture Plan, U.S. DOE, February 2004)
- ***In 2000, the U.S. consumed nearly 20 million barrels of oil products every day***. Of that, 40% was to fuel cars and trucks at a cost to consumers of $186 billion. (Source: "A New Road: The Technology and Potential of Hybrid Vehicles"; Union of Concerned Scientists, January 2003)
- ***By 2020, US oil consumption is expected to grow by nearly 40% and its dependence on imports is projected to rise to more than 60%***.(Source: "A New Road: The Technology and Potential of Hybrid Vehicles"; Union of Concerned Scientists, January 2003)
- ***Transportation accounted for 66% of all oil consumed in the US*** in 2000 (Source: U.S. DOE, Report of the National Energy Policy Group, May 2001)
- ***Oil consumption is expected to rise to 25.8 million bpd by 2020***, primarily due to growth in consumption of transportation fuels. (Source: U.S. DOE, Report of the National Energy Policy Group, May 2001)

- ***A 10% reduction in energy use from cars and light trucks*** (achieved by introducing an alternative fuel or improving fuel economy) ***would result in displacing nearly 750,000 barrels of petroleum per day***. A similar percent reduction in petroleum energy use from heavy-duty trucks would displace around 200,000 barrels per day, and for buses petroleum consumption could be reduced by about 10,000 barrels per day. (Source: National Renewable Energy Laboratory, Field Operations Program-Overview of Advanced Technology Transportation, July 2000)
- ***By 2040, light duty vehicle oil consumption may be reduced by over 11 million barrels per day using hydrogen fuel cell vehicles*** (Source: Hydrogen Posture Plan, U.S. DOE, February 2004)

Fuel-efficiency & eco-efficiency come to mean the same thing

While eco-efficiency has to date largely been centred on emitting less CO2 than before (climate change), it is now become clear that everybody should use less gasoline. In that sense - by coincidence - fuel efficiency and eco-efficiency mean the same thing, at least when using gasoline and oil & gas fuels.

Some differences of CO2 emissions per type of vehicles



Source: EEA term2004

The only carbon-free solutions – hydrogen, electric, and fuel cells

Hydrogen is a long-term solution

Although it has great promise as a widespread source of energy, as things currently stand, hydrogen is not a feasible solution until production, storage and infrastructure problems are solved.

How does it work

Turns hydrogen into electricity without pollution or emissions

A fuel cell turns hydrogen - the fuel - into electricity using air and other catalysts. The fuel cell harnesses chemical energy trapped in hydrogen gas and converts it into the kinetic energy we know as electricity, without fossil fuels, combustion, or polluting emissions. As a remarkably efficient, incredibly clean source of renewable energy, fuel cells can take the place of both batteries and engines to power vehicles, laptops, and residential power grids.

Practical challenges

Among some of the practical challenges which arise with regard to hydrogen – which can be stored in vehicles either stored as a cryogenic liquid or as a pressurized gas are:

- ***Liquid form*** – is an extremely cold fuel that can be expensive to store and transport, thus posing difficult engineering challenges;
- ***Gas form*** – significant challenges relating to compression, stringent safety precautions, and bulky, heavy storage tanks.

Reformers or fuel processors are a possible solution

For stationary applications, such as homes or office buildings, a sophisticated hydrogen distribution system will be required if fuel cells are to succeed in the commercial market. One possible solution to supplying the necessary hydrogen to the fuel cell involves extracting the hydrogen from a liquid or gaseous fuel. So-called reformers or fuel processors are capable of doing just that. Upon entering the system, fuel is converted using a catalytic process into a hydrogen-rich gas stream, which can then be used to power a fuel cell in the absence of a direct source of hydrogen.

California takes the lead on implementing hydrogen

Hydrogen highway project becomes law

In July 2005, California's Governor Schwarzenegger signed Senate Bill 76 (SB 76) into effect – providing the necessary funding and legislative guidelines to implement the hydrogen-related recommendations of the CA H2 Net Blueprint Plan. SB 76 provides USD 6.5 million in funding for state-sponsored hydrogen demonstration projects until January 1, 2007. The funds may be used for co-funding the establishment of up to three hydrogen fuelling station demonstration projects as well as the State's lease and purchase of a variety of hydrogen fuelled vehicles. The role of the California Hydrogen Highway Network (CA H2 Net) is to assure that hydrogen infrastructure is in place to enable fuel cells and other hydrogen technologies to be used by consumers as those technologies reach commercial readiness. A number of automakers are member partners of the Highway Hydrogen initiative, including: BMW, DCX, Ford, GM, Hyundai, Honda, Toyota and VW.

Electric & fuel cells

See Annex.

Time to get down to the cold, hard facts

We believe that it is time to put aside a number of false assumptions which currently permeate thinking on the sector – let's call a spade a spade – and deal with the tangible realties facing the different players.

Significant improvements with current ICE technology are not possible

Improvements - yes, more than that - no

There is no room for significant fuel efficiency improvement margins with the current ICE technology. That said, small improvements can be achieved through day-to-day innovations and modifications (i.e. changing the balance and compromise between weight, safety, speed, driving style, car style-design etc.). Such an approach would mark a return to the OEM's pre-1990 approach to fuel efficiency.

Nobody is seriously committed to alternative propulsion models

Not even the Japanese

Neither the US nor the European - nor even the Japanese - OEMs are making a serious, committed, wide-scale and imminent technological move towards either hybrids, electric, hydrogen or fuel cell propulsion, let alone diesel.

Consumers need a rational financial reason to change

Cost is King for consumers

The main driver for consumers to change their purchasing habits will not – and should not – be CO2 and climate change *per se*. Rather it needs to be a sound and financially rational justification for them to consider alternatives to ICE.

End of low gas prices will be the kick in the a*s to get things moving again

Tacit compromise over gas prices is over

The stagnation in CAFE standards has not derived from any technologically costly glass ceilings but from a tacit and sound compromise between consumers, OEMs and oil and gas majors – under the auspices of the US government – resulting in 15 years of decreasing gasoline prices (in real-terms). This compromise is now at an end and OEMs, particularly US ones, need to start the search ASAP for a new compromise. On the road again!

Two key outstanding questions

We believe that there are two fundamental outstanding questions which will need to be answered (in time, of course) to fully understand how fuel efficiency trends will evolve:

i) Will the evolving compromise affect car prices and OEM's margins?

Market split – low-costs with improved ICEs vs. SUVs using alternatives

Assuming there are price and margin impacts, we need to analyse the potential impact on specific segments and the leading OEMs in the segment. For instance, will the SUV segment decline with a knock-on market impact for segment leaders such as DCX, Ford and GM? We don't believe that it is as evident as it might seem. For instance, the SUV market is where costlier, new alternative technologies can be implemented at lower prices (relative to production and selling price). We think that there might be a market split into:

- Smaller, lighter fuel-efficient cars, using improved ICEs; and
- Higher-cost SUVs, using an ever increasing proportion of alternative technology powertrains.

ii) Will the changes be sufficient for the US market?

Is a new equilibrium actually possible?

This second question concerns the potential changes and the potential goals – the potential new equilibrium and compromise, if any, which exists between consumers' appetite for cars, fuel prices, technological innovations trends and the sustainability of alternative technologies.

Long-term fuel efficiency trends – what's really going on?

Fuel Efficiency SUMMARY	
▪ While there has been no major change in fuel efficiency standards, fuel efficiency has evolved	
▪ Consumers are not that interested in CO2 emissions, nor mpg, but rather in miles per dollar (mpd)!	
▪ After developments in the 1980s, US CAFE standards have seen little change because of low gas prices	
▪ European carmakers benefit from High Quality Diesel but will not reach voluntary targets (2008-2012)	
▪ Only Japanese OEMs succeeded in improving fuel efficiency despite constant gas prices	
▪ Consumers expect steady fuel efficiency improvements in the long term	
▪ If real gas prices climb, fuel efficiency performance could double from a consumer's point of view!	
▪ Before the Fuel Cell revolution, gasoline prices and tax incentives will trigger a boom in alternatives	
Winners	- Japanese OEMs, in every market
	- American consumers and the Big Three - ten years ago!
Losers	- Big 3 (but only for 2005-2008!)

All is not lost on fuel efficiency

Stagnating CAFE

It has now become something of a cliché that nothing has changed regarding the CAFE standards since 1990. The standards define the minimum average requirement by fleet (and not by model) OEMs should respect in the US. The list of fines is quite long since the CAFE implementation, totalling more than USD500 million (nominal price, see Annex).

But improvements elsewhere

However, despite the stagnating standards, and despite the steady progression of SUVs as part of total sales, some slight improvements have been observed year after year. Even the SUV – Light Trucks segment have improved on fuel efficiency, at their own rhythm. Besides, even if the CAFE Passenger car standard has not changed since 1990, the Light truck standard has. Second, the US only counts for a quarter of worldwide sales – other markets count and have seen some progress on fuel efficiency, in different socio-economic conditions and under other constraints.

▪ But we do need to get down to the facts

In our opinion, it is time to reject two false ideas and make some basic statements:

- ***There is no margin for significant fuel efficiency improvements with current ICE technology***, and neither the US nor the European nor even the Japanese markets are committed to a wide-scale, immediate technological change towards hybrids, diesel, electric, hydrogen or fuel cell propulsion.
- ***The main driver for change from a consumer stance is a sound, reasonable and rational economic calculation*** – and is not and should not be CO2 and climate change alone.

- ***Stagnation in CAFE standards does not derive from a costly technological glass ceiling but from a sound compromise between consumers and OEM, under the auspices of the US government*** thanks to a decreasing gasoline price (in real-terms). What is happening now is that the gasoline price (in real terms) is no longer under pressure. It is the end of the 15-year-game for American and American-based OEMs. The compromise is over, it is time to find a new one and to get on the road again.
- ***Modest improvements can be achieved using current technologies, day-to-day innovation and through changing the balance between weight, safety, speed, driving style, car style-design***, etc. We have no doubts that a slight modification of the current compromise could put all of the OEMs on their previous path of fuel efficiency (i.e. as was known before 1990, until other priorities were found).
- ***One of the two main outstanding questions on the US market is whether this changing compromise will affect car prices and margins?*** If so what would happen – a decreasing market share for SUVs and then some troubles for the segment leaders (Ford, GM, DCX)? That is not sure. The SUV market is probably where newer, costlier technologies can be implemented at a lower relative price (relative to car price). We might see a market split between smaller, lighter, fuel efficient cars using current improved ICE and high-cost SUVs, a growing proportion of them using new alternative technology power trains.
- ***The second question about the US market is: will these changes be enough, and enough for what?*** We need to ask where the new equilibrium stands – between the undisputed consumer appetite for cars, fuel prices, current technology, innovation trends, health issues and new alternative technologies.

US trends – a short history and some explanations

Stringent CAFE standards & fuel efficiency – the correlation (1978-1990)

Impressive correlation (1978-2000)

According to US national data, there was a direct, parallel correlation between more stringent CAFE standards and improvements in fuel efficiency between 1978 and 1990. For passenger cars, CAFE increased from 18 mpg to 27.5 mpg (+52.7% or 4.4% p.a.) while fuel efficiency improved from 19.9 mpg to 28.8 mpg. For light trucks, a CAFE increase from 17.2 mpg to 22 mpg resulted in an improvement in fuel efficiency from 18 to 20.8. Following a linear approach, the improvement rate was 0.79 mpg for passenger cars whereas average fleet performance went up nearly at the same rate (0.68 mpg); improvements were similar for light trucks. The 1978-1990 trends have since slowed but shows that there was room for fuel efficiency improvement without the use of alternative technologies.

CAFE Standards and Performance Improvements 1978-1990

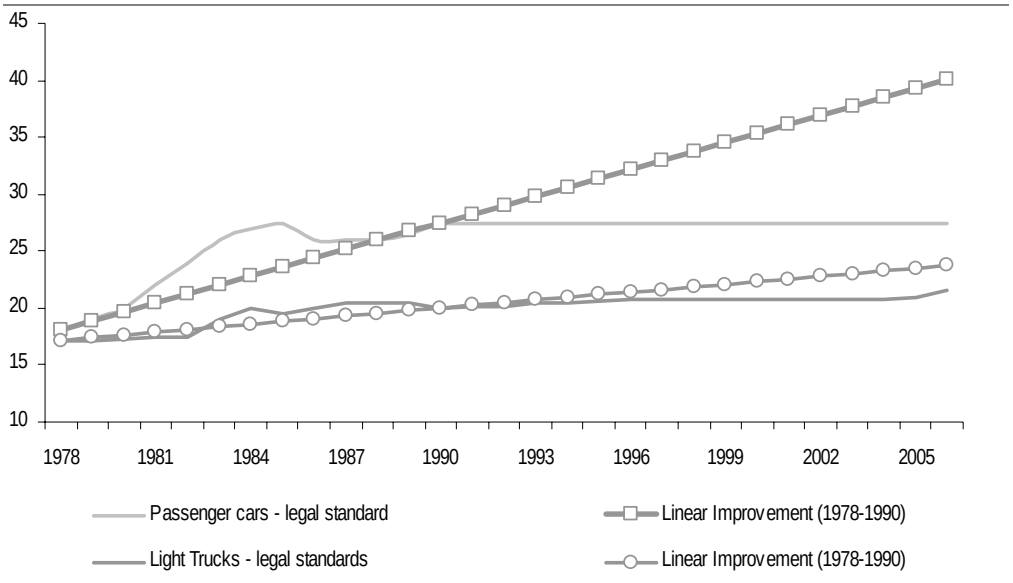
% Change 1978-1990	STANDARDS			CAFE			
Category	Standard Passenger Cars	Standard Light Trucks	Total Fleet	Passenger cars	Domestic	Import	Light Trucks
Total Change	53%	16%	28%	41%	44%	10%	16%
Yearly Arithmetic Average	4.4%	1.4%	2.3%	3.4%	3.7%	0.8%	1.3%
Added mpg / year	0.8	0.2	0.5	0.7	0.7	0.2	0.2
Yearly Geometric Average	3.6%	1.3%	2.1%	2.9%	3.1%	0.8%	1.1%

Source: NHTSA, CM-CIC Securities / ESN estimates

1990 – 2005 – poor performance

In 1990, the US Congress and the Bush (Sr.) administration halted the upward trend and froze CAFE requirements at their current levels.

CAFE Standards Evolution: 1990 breakdown



Source: EPA, NHAS, CM-CIC Securities / ESN estimates

Was there a trade-off in 1990?

Move to higher margin vehicles to let US OEMs catch-up

We can only assume that there was a tacit trade off in 1990 between US OEMs and the federal government. This makes sense - if the OEMs were to catch up with their foreign rivals (financially-speaking), it would be thanks to higher-margin vehicles, such as SUVs. From 1990 to 2004, the CAFE requirements did not change at all and the average performance has been poor but not wholly negative.

1978 – 2005 analysis – there were improvements

1.7% improvement (NLTIR)

With a view towards future developments, it should be pointed out that over the long-term – 1978-2005 – CAFE standards increased by 1.7% overall and the national fleet average rose at 1.7% for passenger cars; for light trucks it rose by 0.8%. This is relatively surprising given market changes such as the introduction of SUVs as well as political lobbying by the OEMs. One can perhaps infer that the US market will, at the very least, follow this *natural long term improvement rate* (NLTIR).

CAFE: Poor performance since 1990, and an average mean performance overall

% Change 1990-2005	STANDARDS		CAFE				
Category	Standard Passenger Cars	Standard Light Trucks	Total Fleet	Passenger cars	Domestic	Import	Light Trucks
Total Change	0%	5%	-1%	7%	12%	0%	5%
Arithmetic Average	0.0%	0.3%	-0.1%	0.5%	0.8%	0.0%	0.3%
Added mpg / year	0.0	0.1	0.0	0.1	0.2	0.0	0.1
Geometric Average	0.0%	0.3%	-0.1%	0.5%	0.7%	0.0%	0.3%
% Change 1978-2005	**STANDARDS**		**CAFE**				
Category	Standard Passenger Cars	Standard Light Trucks	Total Fleet	Passenger cars	Domestic	Import	Light Trucks
Total Change	53%	22%	27%	51%	60%	10%	21%
Arithmetic Average	2.0%	0.8%	1.0%	1.9%	2.2%	0.4%	0.8%
Added mpg / year	0.4	0.1	0.2	0.4	0.4	0.1	0.1
Geometric Average	1.7%	0.8%	0.9%	1.7%	1.9%	0.4%	0.8%

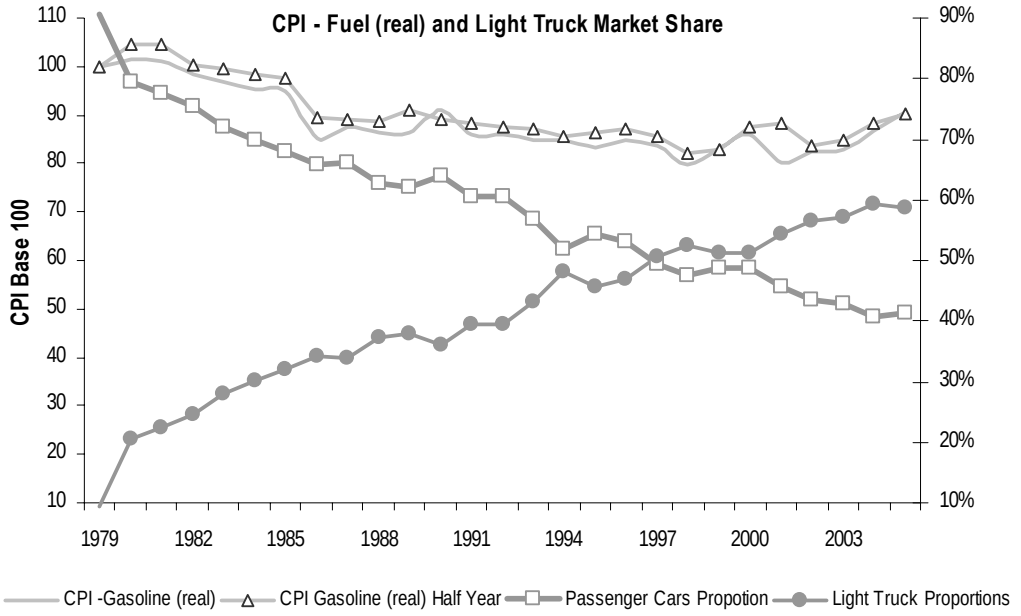
Source: EPA, NHAS, CM-CIC Securities / ESN estimates

The preference for light trucks – cheap gas in real prices

$ and cents explanation

Rationalising the US OEMs success in selling SUVs to consumers (and the end of significant improvements in CAFE standards) is dependent on a strong economic reason - i.e. their ability to increase sales in this segment coupled with a relative decrease in CPI-adjusted (real) gas prices. The following graph illustrates the relation between light trucks sales and CPI-adjusted gas prices.

CPI Gasoline real price as a key driver for Light Trucks sales



Source: NHTSA, EcoWin, CM-CIC Securities / ESN estimates

Delegation of authority from Congress may have increased OEM lobbying

Delegation of authority from Congress down to the NHTSA

One of the other potential reasons explaining the rise of light trucks and decreased focus on the stringency of CAFE standards is the delegation of standard-setting to a federal agency. Congress itself set the 1985 goal of 27.5 mpg for passenger cars and standards for MY 1978, 1979 and 1980. From 1981-4, standards were delegated to the Department of Transport. In 1985 Congress provided for the continued application of the 27.5 mpg standard but again delegated authority to set higher or lower standards to the Department which lowered standards for passenger cars from MY 1986-1989. In 1990, the standard was again amended to 27.5 mpg where it has remained to this date. At present, the Secretary of Transport has delegated CAFE standard-setting to the Administrator of the National Highway Traffic Safety Administration (NHTSA).[7]

Fuel efficiency is about compromise – and lobbying…

It is of crucial importance to understand that the specific fuel-efficiency requirements result from a political compromise taking into account a much more broad range of issues than fuel efficiency *per se*. We believe that delegating the standards to a federal agency opened the door to active, behind-the scenes lobbying (without the relative transparency of Congress). This has worked well for the North American market until now.

▪ Lobbying power of the automakers

GM – one of the US' top lobbyists

Although comprehensive global data is not available, disclosed US data shows that lobbying remains an important priority for the OEMs. GM is ranked 20th in the US in terms of total lobbying contributions and all actors are actively targeting the White House and down – the Congress as well as federal agencies like EPA and NHTSA.

OEM Lobbying in the US - Official Political Contributions & Expenses

US$M				Year			
OEM	1998	1999	2000	2001	2002	2003	2004
BMW	0.06	0.06	0.07	0.00	0.04	0.08	0.12
DCX	6.24	5.52	6.44	3.07	3.56	4.53	3.06
FIAT	-	-	-	-	-	-	-
FORD	5.99	4.48	8.01	5.48	5.56	4.64	7.20
GM	7.36	5.82	5.54	4.72	8.38	7.94	8.50
HONDA	1.04	1.18	0.94	2.25	2.35	2.52	2.99
KIA / HYUNDAI	0.02	0.02	0.08	0.40	0.64	0.50	0.36
NISSAN	0.14	0.26	0.18	0.92	1.64	2.02	2.26
PEUGEOT	-	-	-	-	-	-	-
PORSCHE	0.00	0.01	0.10	0.14	0.10	0.12	0.12
RENAULT	-	-	-	-	-	-	-
TOYOTA	1.20	1.09	1.21	0.75	1.96	2.42	3.66
VW	0.06	0.46	0.90	1.02	0.96	0.56	0.34

[7] NHTSA is responsible for establishing and amending the CAFE standards; promulgating regulations concerning CAFE procedures, definitions and reports; considering petitions for exemption from standards for low volume manufacturers and establishing unique standards for them; enforcing fuel economy standards and regulations; responding to petitions concerning domestic production by foreign manufacturers and all other aspects of CAFE, including the classification of vehicle lines as either cars or trucks; providing program incentives such as credits for alternative-fuel-powered vehicle lines.

US$M				1998-2004			
OEM	Total Contribution	Rank (OEM)	Rank (US Corporation)	Files to EPA	Files to NHTSA	Files to Congress	Files to White House Office
BMW	0,43	10	369	-	-	48	-
DCX	32,42	3	50	27	8	184	20
FIAT	0,00	11	0	-	-	-	-
FORD	41,36	2	34	13	12	113	8
GM	48,26	1	20	23	14	377	31
HONDA	13,27	4	150	2	3	68	1
KIA / HYUNDAI	2,02	8	891	1	1	68	2
NISSAN	7,42	6	269	10	13	76	3
PEUGEOT	0,00	11	0	-	-	-	-
PORSCHE	0,59	9	2722	-	-	2	0
RENAULT	0,00	11	0	-	-	-	-
TOYOTA	12,29	5	160	13	1	156	-
VW	4,30	7	439	26	-	49	-

Source: LobbyWatch, Center for Public Integrity, 2004

In the end – fuel efficiency standards depend on gas prices and not CO2!

Decreasing gas prices explain the 1990 compromise

We may never actually end up knowing what actually happened in 1990 to turn the tide on CAFE standards. Active lobbying inevitably played a part. However, in our view the sole rational explanation for the turning point is decreasing gas prices. This and this alone made a tacit trade-off possible between the auto industry, the federal government and US consumers.

MPD – miles per dollar

MPD - fuel efficiency improved per USD spent

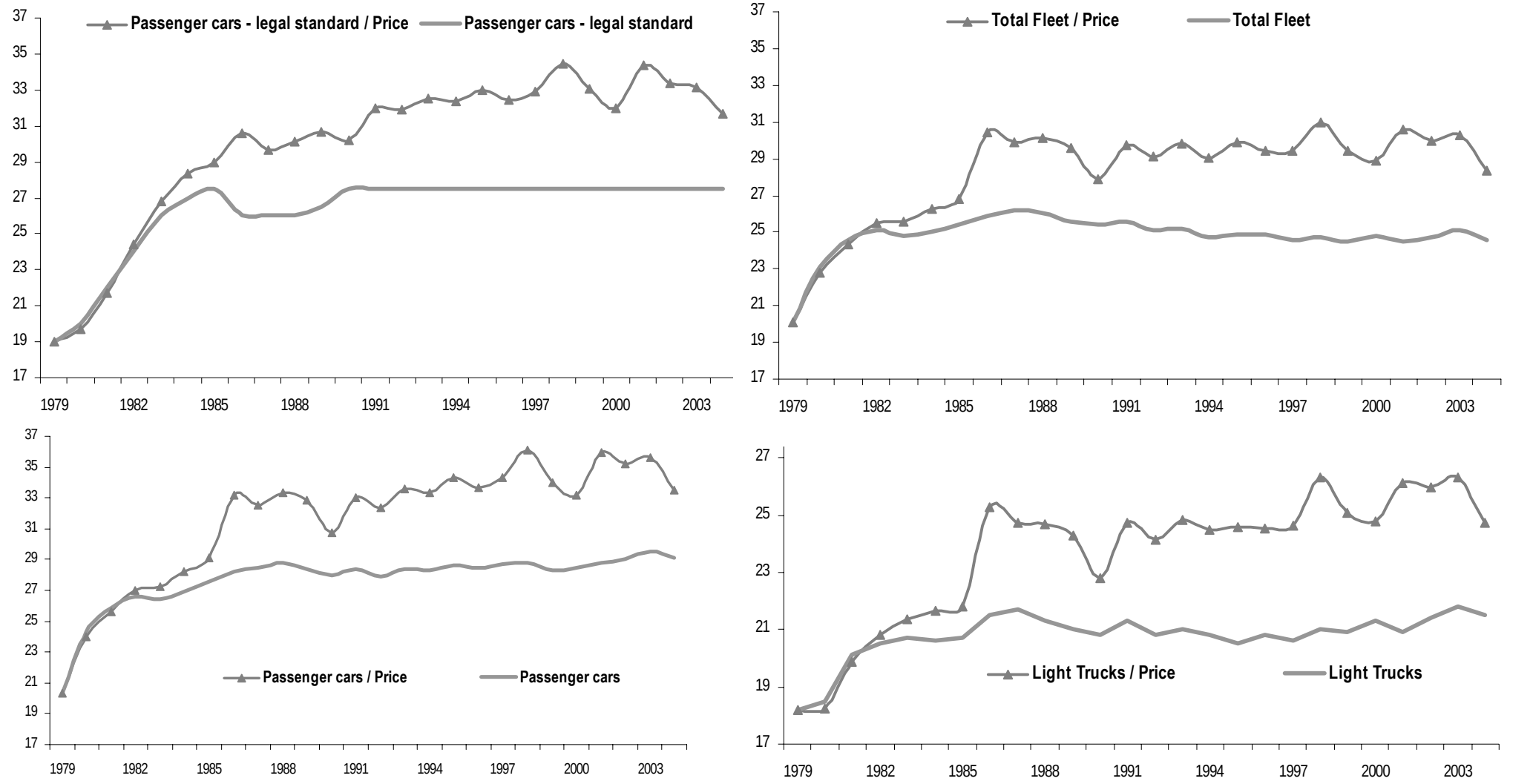
In the end, it is not the number of miles per gallon which counts for drivers and the general public – it is the number of miles per dollar. CPI-adjusted gas prices decreased continually from 1990 to 2003. The real dollar decrease mechanically decreased the absolute cost of a gallon of gas and increased the distance per gallon at a constant price. The US consumer would not have accepted a solution which meant losing money and purchasing power and it didn't have to. The following graphs illustrate that using an MPD measure – MPG/$ (miles per gallon/USD at a constant price) – fuel efficiency did improve for consumers from 1979 through to 1994 (per USD spent in real prices).

Fuel Efficiency: absolute and price-adjusted performance

		CAFE / Price					CAFE (absolute)				
Year	CPI - Gas (real)	Passenger cars - legal standard / Price	Light Trucks - legal standards / Price	Total Fleet / Price	Passenger cars / Price	Light Trucks / Price	Passenger cars - legal standard	Light Trucks - legal standards	Total Fleet	Passenger cars	Light Trucks
1979	100.0	19.0	17.2	20.1	20.3	18.2	19	17.2	20.1	20.3	18.2
1980	101.3	19.7	17.1	22.8	24.0	18.3	20	17.3	23.1	24.3	18.5
1981	101.2	21.7	17.3	24.3	25.6	19.9	22	17.5	24.6	25.9	20.1
1982	98.4	24.4	17.8	25.5	27.0	20.8	24	17.5	25.1	26.6	20.5
1983	96.9	26.8	19.6	25.6	27.2	21.4	26	19	24.8	26.4	20.7
1984	95.2	28.4	21.0	26.3	28.3	21.6	27	20	25	27	21
1985	94.9	29.0	20.6	26.8	29.1	21.8	27.5	19.5	25.4	27.6	20.7
1986	85.0	30.6	23.5	30.5	33.2	25.3	26	20	25.9	28.2	21.5
1987	87.7	29.6	23.4	29.9	32.5	24.7	26	20.5	26.2	28.5	21.7
1988	86.3	30.1	23.8	30.1	33.4	24.7	26	20.5	26	28.8	21.3
1989	86.5	30.7	23.7	29.6	32.8	24.3	26.5	20.5	25.6	28.4	21
1990	91.2	30.2	21.9	27.9	30.7	22.8	27.5	20	25.4	28	20.8
1991	86.0	32.0	23.5	29.8	33.0	24.8	27.5	20.2	25.6	28.4	21.3
1992	86.1	31.9	23.5	29.1	32.4	24.2	27.5	20.2	25.1	27.9	20.8
1993	84.6	32.5	24.1	29.8	33.6	24.8	27.5	20.4	25.2	28.4	21
1994	85.0	32.4	24.1	29.1	33.3	24.5	27.5	20.5	24.7	28.3	20.8
1995	83.4	33.0	24.7	29.9	34.3	24.6	27.5	20.6	24.9	28.6	20.5
1996	84.7	32.5	24.4	29.4	33.7	24.6	27.5	20.7	24.9	28.5	20.8
1997	83.6	32.9	24.7	29.4	34.3	24.6	27.5	20.7	24.6	28.7	20.6
1998	79.8	34.5	25.9	31.0	36.1	26.3	27.5	20.7	24.7	28.8	21
1999	83.3	33.0	24.9	29.4	34.0	25.1	27.5	20.7	24.5	28.3	20.9
2000	85.9	32.0	24.1	28.9	33.2	24.8	27.5	20.7	24.8	28.5	21.3
2001	80.1	34.3	25.9	30.6	36.0	26.1	27.5	20.7	24.5	28.8	20.9
2002	82.4	33.4	25.1	30.0	35.2	26.0	27.5	20.7	24.7	29	21.4
2003	82.9	33.2	25.0	30.3	35.6	26.3	27.5	20.7	25.1	29.5	21.8
2004	86.9	31.7	23.8	28.3	33.5	24.8	27.5	20.7	24.6	29.1	21.5

Source: NHTSA, EcoWin, CM-CIC Securities / ESN estimates

The Consumer point of view – Fuel Efficiency has constantly improved per US dollar spent (real prices)



Source: NHTSA, EcoWin, CM-CIC Securities / ESN estimates

Consumer perceptions on MPD are key to understanding driving habits

MPD determines consumer driving habits

We believe that consumer perceptions on how many miles they can get for their dollar are a key driver. It is this factor which will influence the driving habits of US consumers – their desire to drive, how far they drive, where they will drive to etc. Such consumer habits are likely to have a very low elasticity to gas prices, at least for a certain time, and especially in the US, where collective transportation is far less developed and utilised compared to Europe and Japan. Given that there are no pending changes in this regard in the short to medium term, we believe that it is an added argument for the use of our proposed MPD measure - Miles per Gallon/Price (mpg/d) – for assessing fuel efficiency improvements.

Price-adjusted fuel efficiency (MPD) standards & performance - our findings

MPD determines consumer driving habits

in the following graphs, we propose to summarise our findings on price-adjusted fuel efficiency standards and performance, adding a tendency line based upon the linear improvement of the passenger car CAFE standard from 1978 to 1990. Two quite astonishing findings stand out.

i) MPD measure results in better fuel efficiency (than traditionally seen)

MPD measure is in line with CAFE improvements

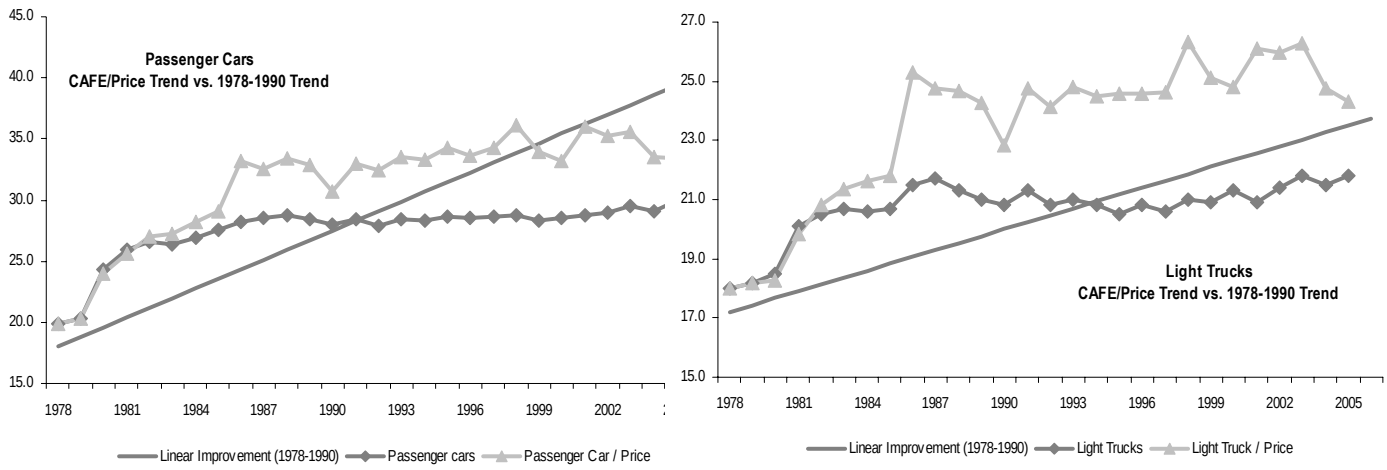
With a dollar-adjusted measure, the fuel efficiency performance of the average American fleet is much better than it has traditionally been seen. Moreover, it is perfectly in line with the linear absolute improvement of the CAFE standard – both for passenger cars and even for the total fleet including light trucks.

ii) 2002 is a key turning point

Performance falls below CAFE

It is only since 2002 that the MPD-adjusted passenger car performance is below the respective CAFE standard. We believe that this point – as well as this point in time - is crucial in understanding the shift of American public opinion regarding fuel efficiency, conservation and alternative technologies.

Price-Adjusted Fuel Efficiency Performance vs. Long Term Trends – PC and LT



Source: NHTSA, EcoWin, CM-CIC Securities / ESN estimates

What consumers expect

0.8 mpg p.a. for cars

From the first point, one could infer that in the long-term, American drivers expect a normalised price-adjusted fuel efficiency performance up to 0.8 mpg p.a. for passenger cars and 0.2 mpg for light trucks). Below this trend line, consumers start to feel the pressure in their pocket and begin to turn back to both the government and the automakers looking for change. With such regular improvements, the respective price adjusted performance for both categories of vehicles has not been that bad.

Gap (%) between price-adjusted fuel efficiency performance and long term standards improvement

Model Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Passenger Car / Price	11	12	9	9	4	4	7	-2	-6	-1	-5	-6	-13	-15
Light Truck / Price	18	20	17	16	15	14	20	14	11	16	14	14	6	3

Model Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Passenger Car / Price	11	8	22	26	28	24	24	24	36	29	29	23	12	17
Light Truck / Price	5	4	3	11	15	16	16	16	33	28	26	23	14	22

Source: NHTSA, EcoWin, CM-CIC Securities / ESN estimates

MPD fuel efficiency performance has climbed faster than the absolute measure for cars

Lack of impetus from CAFE

We can see that since 2001, the CPI-adjusted fuel-efficiency performance measure has climbed faster than fuel efficiency in absolute terms for passenger cars. This is not that surprising given that there was no stimulation at all from the CAFE standard.

No gain for light trucks

A similar analysis for light trucks shows that there is a no gain situation with regards to price adjusted fuel efficiency. This is in our opinion likely to be attributed to the continuous, low improvements in minimum standards for light trucks. This may also explain the paradox of a stagnating CAFE standard for passenger cars and the Natural Long-Term Improvement Rate for light trucks. Eventually the legal increase can be seen as a way to protect the light truck category by maintaining a minimal stimulus for innovation.

Europe & Japan – better performance than the US

Better performance over the same period

Our analysis of the situation and data in both Europe and Japan over the same period – using comparative data wherever possible – shows that the performance of their respective automakers is better than the US players.

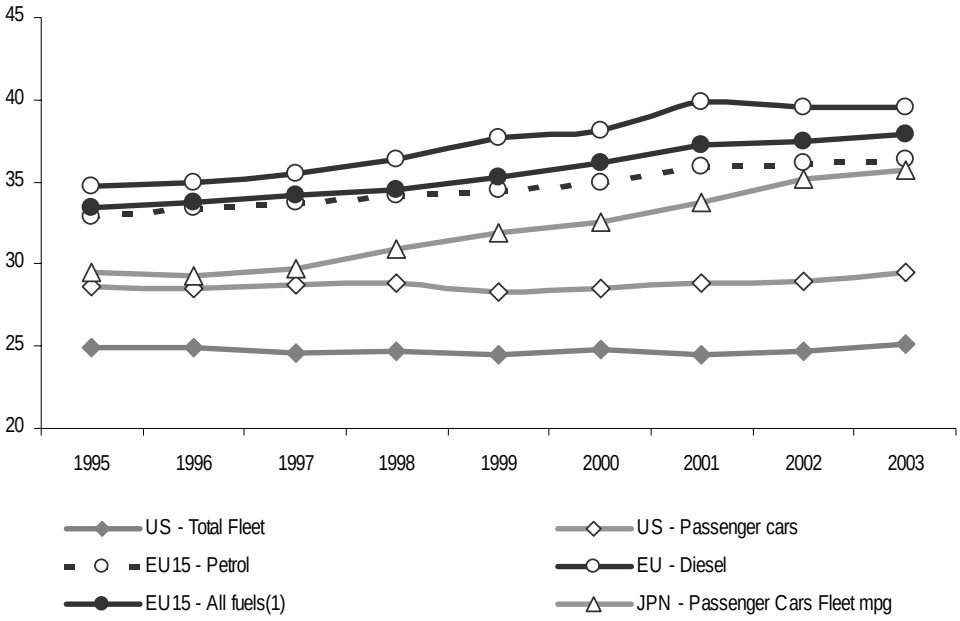
▪ Our key findings

As the tables below more fully flesh out, some of our key findings on the European and Japanese OEMs are that:

- ***Japanese OEMs have adapted to European habits*** – by making substantial and sustainable progress, they have made the adaptation just as they did a generation earlier in the US;

- ***Long-term improvements by European and Japanese OEMs have been based on classical gas-powered ICE technology***;
- ***Diesel plays an important role but does not fully explain European improvements***;
- ***Minimum NLTIR of 0.4 mpg over the long-term*** – for the US (1978-2004) and Europe (1995-2003);
- ***Japanese OEMs out-performed all other players in all markets***;
- ***Korean OEMs made the greatest improvements in Europe*** – in terms of improvements with both gasoline and diesel fuels.

A Fuel-Efficiency Direct Comparison: EU-US-JPN (1995-2003)



Source: NHTSA, EU, JAMA, CM-CIC Securities / ESN estimates

European Fuel Efficiency Performance (non price-adjusted) – 1995-2003

	ACEA			JAMA			KAMA			EU15		
Unit: gCO2/km	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**
1995	188	176	185	191	239	196	195	309	197	189	179	186
1996	186	174	183	187	235	193	197	274	199	186	178	184
1997	183	172	180	184	222	188	201	246	203	184	175	182
1998	182	167	178	184	221	189	198	248	202	182	171	180
1999	180	161	174	181	221	187	189	253	194	180	165	176
2000	177	157	169	177	213	183	185	245	191	178	163	172
2001	172	153	165	174	198	178	179	234	187	173	156	167
2002	171	153	164	172	180	174	178	203	183	172	157	166
2003	170	153	162	170	177	172	171	201	179	171	157	164
IMPROVEMENT (Unit : %)	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**
1996	1.1%	1.1%	1.1%	2.1%	1.7%	1.6%	-1.0%	12.8%	-1.0%	1.6%	0.6%	1.1%
1997	1.6%	1.2%	1.7%	1.6%	5.9%	2.7%	-2.0%	11.4%	-2.0%	1.1%	1.7%	1.1%
1998	0.5%	3.0%	1.1%	0.0%	0.5%	-0.5%	1.5%	-0.8%	0.5%	1.1%	2.3%	1.1%
1999	1.1%	3.7%	2.3%	1.7%	0.0%	1.1%	4.8%	-2.0%	4.1%	1.1%	3.6%	2.3%
2000	1.7%	2.5%	3.0%	2.3%	3.8%	2.2%	2.2%	3.3%	1.6%	1.1%	1.2%	2.3%
2001	2.9%	2.6%	2.4%	1.7%	7.6%	2.8%	3.4%	4.7%	2.1%	2.9%	4.5%	3.0%
2002	0.6%	0.0%	0.6%	1.2%	10.0%	2.3%	0.6%	15.3%	2.2%	0.6%	-0.6%	0.6%
2003	0.6%	0.0%	1.2%	1.2%	1.7%	1.2%	4.1%	1.0%	2.2%	0.6%	0.0%	1.2%
TRANSLATION (Unit: mpg)	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**	**Petrol/Gas**	**Diesel**	**All fuels(1)**
1995	29.8	31.8	30.2	29.3	23.4	28.5	28.7	18.1	28.4	29.6	31.2	30.1
1996	30.1	32.1	30.6	29.9	23.9	29.0	28.4	20.4	28.1	30.1	31.4	30.4
1997	30.6	32.5	31.1	30.4	25.2	29.8	27.8	22.8	27.5	30.4	32.0	30.8
1998	30.8	33.5	31.4	30.4	25.3	29.6	28.3	22.6	27.7	30.8	32.8	31.1
1999	31.1	34.7	32.1	30.9	25.3	29.9	29.6	22.1	28.8	31.1	33.9	31.8
2000	31.6	35.6	33.1	31.6	26.3	30.6	30.2	22.9	29.3	31.4	34.3	32.5
2001	32.5	36.5	33.9	32.1	28.3	31.4	31.2	23.9	29.9	32.3	35.8	33.5
2002	32.8	36.5	34.1	32.5	31.1	32.1	31.4	27.5	30.6	32.5	35.6	33.7
2003	32.9	36.5	34.6	32.9	31.6	32.5	32.8	27.8	31.2	32.8	35.6	34.1

Source: EU, ACEA, CM-CIC Securities / ESN estimates

European Improvement on Fuel Efficiency – 1995-2003

	ACEA			JAMA			KAMA			EU15		
	Petrol/Gas	Diesel	All fuels(1)	Petrol/Gas	Diesel	All fuels(1)	Petrol/Gas	Diesel	All fuels(1)	Petrol/Gas	Diesel	All fuels(1)
Total Improvement	10.6%	15.0%	14.2%	12.4%	35.0%	14.0%	14.0%	53.7%	10.1%	10.5%	14.0%	13.4%
Arithmetic Improvement / year	1.3%	1.9%	1.8%	1.5%	4.4%	1.7%	1.8%	6.7%	1.3%	1.3%	1.8%	1.7%
CO2 Efficiency / year	2.3	2.9	2.9	2.6	7.8	3.0	3.0	13.5	2.3	2.3	2.8	2.8
Added MPG / year	0.4	0.7	0.6	0.5	1.1	0.6	0.6	1.4	0.4	0.4	0.6	0.6
Geometric Improvement / year	1.3%	1.8%	1.7%	1.5%	3.8%	1.6%	1.7%	5.5%	1.2%	1.3%	1.7%	1.6%

Source: EU, ACEA, CM-CIC Securities / ESN estimates

Japanese Fuel Efficiency Evolution (price non-adjusted) – 1993-2003

Year	Average Passenger Cars Fleet (Unit: km/l)	Average Passenger Cars Fleet (Unit: mpg)	Average Passenger Cars Fleet (Unit: CO2/km)	Yearly Improvement
1993	12.4	26.4	212	
1994	12.5	26.6	210	0.8%
1995	12.5	26.6	210	0.0%
1996	12.4	26.4	212	-0.8%
1997	12.6	26.8	209	1.6%
1998	13.1	27.8	201	4.0%
1999	13.5	28.7	195	3.1%
2000	13.8	29.3	191	2.2%
2001	14.3	30.4	184	3.6%
2002	14.9	31.7	177	4.2%
2003	15.1	32.1	174	1.3%

Source: JAMA2005

Japanese Improvement on Fuel Efficiency – 1993-2003

Total Improvement	Arithmetic Improvement / year	gCO2 Efficiency / Year	Added MPG / year	Geometric Improvement / year
22%	2.2%	3.8	0.64	2.0%

Source: JAMA2005

Fuel-price related findings put Japan on top

Japanese come out the big winners – performance & improvements

If we inject price-adjusted fuel price evolutions into our analysis, we obtain even more remarkable results. The Japanese show a surprising acceleration since 1995, with the best price-adjusted fuel efficiency performance and also the best improvements.

Japan's stringent standards

It is interesting to note that contrary to both the US and the EU, Japan has adopted very stringent rules – all new car models should be above the minimum standard of 15.1 km/l in 2010 (35.7 mpg or 174 g CO2/km). This limit has already been reached through fleet averages in 2003. They now have another five years to comply for all of the remaining models, especially luxury models. It is also worth noting that because of deflationary prices (and constant real fuel prices) the Japanese OEMs have to provide absolute fuel efficiency improvement – without the help of gasoline.

Price-Adjusted Fuel-Efficiency Comparison: EU-US-JPN – 1995-2003

	US					EU15			JPN
Model Year	US - Passenger cars - legal standard	US - Light Trucks - legal standards	US - Total Fleet	US - Passenger cars	US - Light Trucks	ACEA - Petrol/Gas	ACEA - Diesel	ACEA - All fuels(1)	JPN - Passenger Cars Fleet mpg
1995	27.5	20.6	29.9	34.3	24.6	26.8	28.6	27.2	26.6
1996	27.5	20.7	29.4	33.7	24.6	25.7	27.5	26.1	26.4
1997	27.5	20.7	29.4	34.3	24.6	26.2	27.9	26.7	26.8
1998	27.5	20.7	31.0	36.1	26.3	28.2	30.7	28.8	27.8
1999	27.5	20.7	29.4	34.0	25.1	24.6	27.5	25.5	28.7
2000	27.5	20.7	28.9	33.2	24.8	23.5	26.5	24.6	29.3
2001	27.5	20.7	30.6	36.0	26.1	27.4	30.8	28.6	30.4
2002	27.5	20.7	30.0	35.2	26.0	26.3	29.4	27.5	31.7
2003	27.5	20.7	30.3	35.6	26.3	26.7	29.7	28.1	32.1
1995-2003 Evolution	0%	0%	1%	4%	7%	0.0%	4.0%	3.0%	21%
1995-2003 Yearly Evolution	0.00%	0.06%	0.17%	0.46%	0.84%	0.0%	0.5%	0.4%	2.37%

Model Year	% Gap		% Evolution (Base 100: 1995)		% Gap		% Evolution (Base 100: 1995)	
	ACEA / US (Total Fleet)	JPN / US (Total Fleet)	ACEA / US (Total Fleet - Base 100)	JPN / US (Total Fleet - Base 100)	ACEA / US (PC)	JPN / US (PC)	ACEA / US (PC - Base 100)	JPN / US (PC - Base 100)
1995	11%	-1%	100	100	-2%	-14%	100	100
1996	8%	0%	97	101	-4%	-13%	98	101
1997	10%	1%	100	102	-4%	-13%	98	101
1998	12%	0%	102	101	-1%	-14%	101	100
1999	3%	8%	95	110	-7%	-6%	94	109
2000	1%	13%	94	114	-8%	-2%	94	114
2001	11%	10%	102	111	-2%	-6%	100	109
2002	8%	17%	100	119	-4%	0%	98	116
2003	9%	18%	102	119	-3%	0%	99	116
Average	8%	7%			-4%	-8%		

Model Year	% Gap		% Evolution (Base 100: 1995)		% Gap		% Evolution (Base 100: 1995)	
	ACEA (Petrol/Gas) / US (PC)	ACEA (Diesel) / US (PC)	ACEA (Petrol/Gas) / US (PC) (Base 100)	ACEA (Diesel) / US (PC) (Base 100)	ACEA (Petrol/Gas) / JPN	ACEA (Diesel) / JPN	ACEA (Petrol/Gas) / JPN	ACEA (Diesel) / JPN
1995	-4%	3%	100	100	12%	20%	100	100
1996	-6%	1%	97	98	8%	16%	97	97
1997	-5%	1%	100	99	9%	16%	98	97
1998	-4%	5%	102	104	12%	23%	100	102
1999	-11%	0%	93	98	-5%	7%	85	89
2000	-12%	-1%	91	96	-11%	1%	80	84
2001	-6%	6%	100	105	0%	13%	90	94
2002	-8%	3%	98	102	-8%	3%	82	86
2003	-7%	3%	99	102	-7%	3%	83	86

Source: NHTSA, EU, JAMA, CM-CIC Securities / ESN estimates

EU & US show more similarities than differences

Western consumer rationality

From the price-adjusted fuel efficiency perspective, the EU and US show similarities from 1995 to 2003, both for diesel and gasoline. This finding reinforces our hypothesis of a "Western" consumer rationality of asking for slight improvements when price is taken into account. From that perspective, both European and US OEMs are on the same starting line.

Europeans might actually be worse off than the US OEMs

Western consumer rationality

This means that contrary to common sentiment - European OEMs are not as well-placed as the US players to guard market share in their domestic markets (vis-à-vis customer expectations). If gas and diesel prices go up, the Europeans face the same pressures for innovative solutions as in the US – assuming they do not want to see a sharp decrease in sales. However, unlike the US, European customers can easily substitute efficient and effective collective transport at a certain price against cars.

Fuel Efficiency Evolution – A Price sensitivity

Model Year	US Passenger cars - legal standard	US Light Trucks - legal standards	US - Passenger cars (1)	US - Light Trucks (1)	US - Passenger cars (2)	US – Light Trucks (2)	ACEA - Petrol/Gas	ACEA - Diesel	EU15 - Petrol/Gas	EU - Diesel	JPN - Passenger Cars
Added mpg / year Hypothesis	**0.8**	**0.2**	**0.8**	**0.2**	**0.4**	**0.1**	**0.4**	**0.7**	**0.4**	**0.6**	**0.6**
CPI Fuel (real) annual rate hypothesis	**0%**										
2016 (mpg)	34.6	23.3	38.7	24.4	34.1	23.3	38.1	44.4	37.8	42.8	39.6
Total (%)	26%	13%	29%	12%	14%	7%	13%	17%	13%	16%	19%
Arithmetic (%)	2.4%	1.2%	2.6%	1.1%	1.2%	0.6%	1.2%	1.6%	1.2%	1.5%	1.7%
CPI Fuel (real) annual rate hypothesis	**1.0%**										
2016 (mpg)	38.6	26.0	43.2	27.2	38.1	26.0	42.4	49.5	42.1	47.7	44.2
Total (%)	40%	26%	44%	25%	27%	19%	26%	31%	26%	30%	33%
Arithmetic (%)	3.7%	2.3%	4.0%	2.2%	2.4%	1.8%	2.4%	2.8%	2.3%	2.7%	3.0%
CPI Fuel (real) annual rate hypothesis	**2.5%**										
2016 (mpg)	45.4	30.6	50.8	32.0	44.8	30.6	49.9	58.1	49.6	56.1	51.9
Total (%)	65%	48%	69%	47%	49%	41%	48%	54%	48%	0.5	0.6
Arithmetic (%)	6%	4%	6%	4%	4%	4%	4%	5%	4%	0.0	0.1
CPI Fuel (real) annual rate hypothesis	**5.0%**										
2016 (mpg)	59.2	39.9	66.2	41.7	58.3	39.9	65.1	75.8	64.6	73.1	67.7
Total (%)	115%	93%	121%	91%	94%	83%	93%	101%	93%	99%	104%
Arithmetic (%)	10%	8%	11%	8%	9%	8%	8%	9%	8%	9%	9%
Change Between Scenarios	**Unit: MPG**										
Gap 0% - 1% CPI increase	4.0	2.7	4.5	2.8	3.9	2.7	4.9	5.7	4.9	5.5	5.1
Gap 0% - 2,5% CPI Increase	10.8	7.3	12.1	7.6	10.6	7.3	13.2	15.4	13.1	14.8	13.7
Gap 0% - 5% CPI Increase	24.6	16.6	27.5	17.3	24.2	16.6	30.0	35.0	29.8	33.7	31.2
	Unit: %										
Gap 0% - 1%	12%	Id	Id	Id	Id	Id	Id	Id	Id	Id	Id
Gap 0% - 2,5%	31%	Id	Id	Id	Id	Id	Id	Id	Id	Id	Id
Gap 0% - 5%	71%	id	Id	id	id	id	id	id	id	id	id

Source: NHTSA, EC, JAMA, ACEA, CM-CIC Securities / ESN estimates

What does the future hold?

What we've discovered so far

So far our analysis has shown the following key findings:

- ***Fuel efficiency should be price-adjusted***;
- ***US OEMs profited from low CPI-adjusted gas prices*** and economic growth in the 1980s ***to impose their home-made SUVs in the 1990s*** as a response to foreign competition – but this period is likely to have ended;
- ***Customers are unlikely to buy fuel efficiency at any price*** – rather they will compare what is on offer and what they can get in terms of mileage for the same amount of money, whatever the fuel - while taking into account the additional price of a vehicle power-trained by a new alternative fuel or system;
- ***Customers expect regular price-adjusted fuel efficiency*** – or at the very least they are accustomed to it;
- ***Carbon and mileage are interchangeable parameters*** – to the extent that no carbon-free technology has been implemented such as a hydrogen ICE (even in this case carbon emissions are reduced to zero but price-adjusted fuel efficiency is not infinite); and
- ***There is still room for improvement with conventional ICE*** – the long-term trends in the US as well as the EU and Japan are proof of that.

What are the automakers planning on ICEs and alternatives?

Likely to play a number of different cards in their hand

Most OEMs have their own plans, which take into account their specific local demands. However, as the survey below indicates, they are likely to play on different leverages in terms of fuel efficiency:

Potential Contribution to CO2 (%) – Conventional and Non-Conventional Technologies

Conventional Propulsion Technologies	
Cylinder deactivation	11.5%
Common-rail turbo diesel	10%
Continuously variable manual transmission (CVT)	9%
Variable valve control	7%
Transmission Optimization	7%
Gasoline injection with turbocharger	6.5%
Reduced friction within engine and transmission	1%
Improved engine thermionics	1%

Conventional vehicle technologies	
Lightweight design	5-10%
Reduction of rolling resistance	1%
Improved aerodynamics	0%

Alternative Propulsion Technologies	
Liquefied Petroleum Gas (LPG) propulsion	10%
Hybrids Gasoline	12.5%
Natural Gas Propulsion	20%
Diesel	25%
Hybrids Diesel	23%
Hydrogen ICE	100%
Natural Gas Propulsion	20%
Electric Powered Car	100%

Source: Arthur D. Little, Automotive News Europe

▪ Cost-effective improvements using conventional technology are likely

15-20% improvements in the next 10 years

As one might expect, some of those technologies have an additional cost and some are already partially implemented, while others are not easy to integrate in some specific markets (eg. lightweight design in US). Looking at all new conventional technology innovations that are currently on the cards or likely to be innovated and developed, it is very likely that OEMs in Europe, Japan and the US can achieve 15-20% improvements at reasonable and decreasing prices over the next ten years.

Yet, with a view on additional new conventional technology innovations to be found out and tested, it is very unlikely that on the 3 different main markets so far OEMs cannot find a 15-25% improvement margin at a reasonable and decreasing price over the next ten years. Two of the key parameters will undoubtedly be:

i. Additional costs to vehicles

ii. Additional costs to fuels

Will the cost of hydrogen decrease to become affordable?

Bush's hydrogen initiative could lower prices

At present, hydrogen is three to four times as expensive to produce as gasoline (when produced from its most affordable source, natural gas). The Hydrogen Fuel Initiative launched by George W. Bush in 2002 seeks to lower that cost enough to make hydrogen cost-competitive with gasoline by 2010, and to advance the methods of producing hydrogen from renewable resources, nuclear energy, and coal with carbon capture and sequestration. Production costs should also include storage costs and needed innovation, both for tankers and gas stations!

Fuel cell costs on the decline

Mass production by 2014

Currently, fuel cells are up to ten times more expensive than internal combustion engines. (Source: US DOE Report on Fuel Cells, 2003). Costs have however come down dramatically. The Department of Energy, based on current best technology, projects the cost of a fuel cell vehicle engine at $225 per kilowatt in mass production. Industry's ultimate goal is USD30 to 50. The CARB sees mass production volumes as feasible by 2014. Mass production should drive the price down significantly. Fuel cell pickups could be sold for USD20,000-25,000 assuming that100,000+ were built.

Hydrogen-powered ICE vehicles

Cost will be King (again)

According to various experts, the same is true for ICE vehicles that run on hydrogen. The technology would only add a few thousand dollars to the base price. However, realistically speaking, developments will not proceed at this ambitious pace. At current costs and even at reduced costs – consumers cannot afford to be green revolutionaries. That said, the development of the technology for the niche market will make the next stage of deployment affordable for the average consumer.

Fuel Price sensitivity – the impacts begin to be felt in the US

High gas prices changing consumer habits

A series of surveys conducted in October 2005 found that increases in gas prices are affecting all aspects of consumers' behaviour as it relates to their vehicles – including changing driving habits and vehicle purchase and maintenance decisions.

2004-2005 – big changes

In response to the increase in gas prices over the past year (2004-2005), significantly more people said they are reducing unnecessary driving (79% in 2005, compared to 65% in 2004), not going on long trips or vacations (52% in 2005 to 39% in 2004) and driving more conservatively (73% in 2005 to 63% in 2004) (*Source: Maritz Research's Automotive Research Group (ARG)*).[8]

What matters is consumers' actions – these will take a long time to change

A short term reverse in gas prices could reverse the trend

We believe that this is potentially good news from an environmental stance. However, as is usual with customer behaviour, we should be cautious about the potential gap between their

[8] Maritz' Automotive Research Group conducted three surveys examining the effect gas prices have on the way Americans are using their vehicles and the vehicles they are considering for purchase. In August 2005, 1,009 adult owners and drivers of vehicles were surveyed in an online Maritz Poll. The results were compared to a similar Maritz Poll of 1,014 adult owners and drivers of vehicles conducted in August 2004. Also, in a separate February 2005 study, 39,000 consumers who had purchased new cars in the past 90 days responded to questions regarding their perceptions of gasoline prices. The U.S. average price for regular gasoline in August 2004 and 2005, respectively, was $1.85 per gallon and $2.58 per gallon.

words and their actions – i.e. the facts. Significant changes in behaviour are likely to be a long-term phenomenon and any significant, temporary short term drop in gas prices could adversely affect this trend the other way round. However these and other surveys show some encouraging signs:

Positive signs on vehicle size

- Two-thirds of respondents said that gas prices have affected the size of vehicle they think about buying. Nearly one-half (45%) agreed with the statement, "I think about buying or have bought a smaller vehicle"; and
- Although trucks still make up more than 50% of new sales, the trend is moving toward smaller vehicles within a purchase class (i.e. from a large SUV to a medium SUV, from a medium SUV to a small SUV) rather than a major shift to cars;

Small SUVs & compact pick-ups could be the big winners

- The segments predicted to suffer the largest losses are full-sized vans, full-sized pickups and medium-sized cars. The winners were small SUVs and compact pickup trucks which could win the popularity race as the initial shock of USD3/gallon+ gas wears off;

Key price sensitivities

USD2.75-3.22/gallon and consumers start to move

The Maritz surveys also reveal what price issues would determine changes in driving habits and vehicle choices. More than 94% of consumers stated an intention to drive less when gas prices reach USD2.76/gallon, 85% stated they would think about purchasing a more fuel-efficient vehicle at USD2.75 per gallon; and 93% would shop for a more fuel-efficient vehicle as soon as possible at USD3.22 per gallon.

Most popular alternatives

Hybrids & fuel cells but NOT diesel

59% of respondents said they would not consider buying a diesel vehicle. Maritz also asked about the appeal of various other powertrain types and, while 27% did not state a preference, hybrids were mentioned the most (24%) followed by fuel cells (12%). Gas blends (10%) and diesel (7%) were the next most appealing choices for alternatives to gasoline in the minds of consumers. Bio-diesel was not examined a discrete option.

Hydrogen Highway (California): where do we stand?

Source: CARB 2005

Cost-related challenges

Technology first, prices second

This question cannot be easily answered at this stage of the game. It is certain that implementing hydrogen would require significant infrastructures investments. According to the US Department of Energy estimates, infrastructure for hydrogen production and distribution would cost USD100 billion or more – to produce 1 million barrels of oil-equivalent energy per day (i.e. just 10 percent of today's US road fuel energy requirements). Infrastructure aside, until the technology reaches the level where it can be used in the same conditions and with similar performance as a classical fuel-powered motor, it is unlikely to be adopted by consumers. Price will come second.

▪ Hydrogen ICE, a reasonable interim before fuel cells?

Very soon

DCX, BMW, and Mazda have developed and tested ICE's fuelled with hydrogen and have concluded that hydrogen can be used successfully as a vehicle fuel. With a slight adaptation and despite some inconveniences, it is possible to use hydrogen very soon and with a good efficiency ratio. This should drive the US government to double its effort to ensure hydrogen availability before the fuel cell be seen as a viable economic solution.

▪ What about all the other new, alternative fuels?

US will be the testing ground

For a more complete explanation of the various technology types currently tested or used in the Automotive sector, please refer to the Annex. However, we estimate that every technology presents a balance of advantages and disadvantages, to the point that at this stage it is very likely that they will all be tested at least on the American market, where size, competition and a “natural” taste for technology create a favourable economic and social environment.

Advantages and Challenges of the Various Alternative Fuel Technology

Alternative Fuel Technology	Advantages	Challenges
Battery Electric Vehicles	-Zero tailpipe emissions (no CO2 or other pollutants) -Use of cleaner electric energy produced through advanced natural gas and coal gasification technologies -Energy security by displacing imported petroleum with domestic generated electricity -Overnight battery recharging (Neighbourhood electric vehicles are recharged by plugging into a standard 110-volt household outlet.) -Recycled energy from regenerative braking -Lower fuel and operational costs -Possible use in secondary markets for used batteries and reduced waste	-Improving battery technology: lower costs, increased energy density, extended durability -Possible need for public recharging infrastructure -Extending mileage range
Hybrid Vehicles	-Reduced fuel consumption and tailpipe emissions -Optimized fuel efficiency and performance -Lower fuelling costs -Recovered energy from regenerative braking -Uses existing gas station infrastructure	-Complexity of two powertrains -Component availability--batteries, powertrains, power electronics -Higher initial cost
Plug-in Hybrid Vehicles	-Reduced fuel consumption and tailpipe emissions -Cleaner electric energy through advances in natural gas and coal gasification -Optimized fuel efficiency and performance -Recovered energy from regenerative braking -Unchanged gas station infrastructure -Grid connection potential -"Home based" battery recharging at a fraction of the cost of petroleum equivalent -Pure zero emission capability -Even lower fuelling costs compared to battery sustaining hybrids -Possible use in secondary markets for used batteries and reduced waste	Cost and complexity of two powertrains -Component availability--batteries, powertrains, power electronics -Higher initial cost -Cost of batteries and battery replacement -Added weight
Fuel cell Electric Vehicles	-Zero tailpipe emissions (no CO2 or other pollutants) -Higher energy efficiency than the internal combustion engine -Regenerative braking captures and reuses braking energy -Potential of near-zero well-to-wheel emissions when using renewable fuels to produce hydrogen -Energy security: no dependence on petroleum -Grid connection potential providing energy "on call" to the grid	-Cost reduction -Increased reliability and durability -Hydrogen generation, distribution, dispensing and onboard storage -Availability and affordability of hydrogen refuelling -Codes and standards development -Scalability for mass manufacture -Consumer education

Source : ETDA 2005

▪ What kind of sales can we expect for alternative fuel vehicles?

US trends are positive

Our models suggest that there might be huge demand for these vehicles if prices come down within the next ten years. However, one should not overestimate the potential for Alternative Fuel Vehicles. Some have been around for many years without anything near commercial success – look at electric cars. The trend is yet still positive for the US market car, the most exposed so far.

Estimated Number of Alternative-Fuelled Vehicles in Use in the United States, by Fuel, 1995-2004

Fuel	1995	1996	1997	1998	1999	2000	2001	2002	*2003*	*2004 (Projected)*	Growth Rate (Percent)
Liquefied Petroleum Gases (LPG)	172 806	175 585	175 679	177 183	178 610	181 994	185 053	187 680	*190 438*	*194 389*	1.3
Compressed Natural Gas (CNG)	50 218	60 144	68 571	78 782	91 267	100 750	111 851	120 839	*132 988*	*143 742*	12.4
Liquefied Natural Gas (LNG)	603	663	813	1 172	1 681	2 090	2 576	2 708	*3 030*	*3 134*	20.1
Methanol, 85 Percent (M85) \a\	18 319	20 265	21 040	19 648	18 964	10 426	7 827	5 873	*4 917*	*4 592*	-14.3
Methanol, Neat (M100)	386	172	172	200	198	0	0	0	*0*	*0*	0.0
Ethanol, 85 Percent (E85) \a\ \b\	1 527	4 536	9 130	12 788	24 604	87 570	100 303	120 951	*133 776*	*146 195*	78.8
Ethanol, 95 Percent (E95) \a\	136	361	347	14	14	4	0	0	*0*	*0*	0.0
Electricity\c\	2 860	3 280	4 453	5 243	6 964	11 830	17 847	33 047	*45 656*	*55 852*	39.1
Non-LPG Subtotal	74 049	89 421	104 526	117 847	143 692	212 670	240 404	283 418	*320 367*	*353 515*	19.0
Total	**246 855**	**265 006**	**280 205**	**295 030**	**322 302**	**394 664**	**425 457**	**471 098**	*510 805*	*547 904*	**9.3**

Sources: 1995: Science Applications International Corporation, "Alternative Transportation Fuels and Vehicles Data Development," unpublished final report prepared for the Energy Information Administration (McLean, VA, July 1996) and U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. 1996-2004: Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels. Beginning in 2000, Federal data were derived from the DOE/GSA Federal Automotive Statistical Tool (FAST), EDTA. \a\ The remaining portion of 85-percent methanol and both ethanol fuels is gasoline.

1.5m vehicles at current growth rates

9.3% growth

If the 9.3% growth rate was to be prolonged for the next ten years, the total amount of alternative-fuel vehicle sales in the US market should reach roughly 1.5 million vehicles.

Hybrids remain a niche

0.5% is a niche

A quick look at Hybrid car sales, the most promising of all the current alternatives, clearly indicates that Hybrids are still a niche market. Without the current combination of strong press campaigns along with a tremendous gasoline price increase, the sales figures would have stagnated below the niche market volume (0.5% after 5 years).

2005 hybrid electric passenger vehicle sales

Honda Accord	14,003 (YTD through September 2005)
Honda Civic	21,022 (YTD through September 2005)
Honda Insight	527 (YTD through September 2005)
Ford Escape	Almost 15,000 Escapes have been sold so far; September sales totalled 1,808.
Toyota Prius	81,042 (YTD through September 2005)
Toyota Highlander	11,073 (June through September 2005 sales only; on the market in June 2005)
Lexus 400h	14,863 (April through September 2005 sales only; on the market in April 2005)
Mercury Mariner	Not available

Source: ETDA 2005 (courtesy of R.L. Polk)

Total hybrid electric passenger vehicle sales 2000-2004

2000	9,367
2001	20,287
2002	35,961
2003	47,525
2004	83,153

Source: ETDA 2005 (courtesy of R.L. Polk)

Breakdown of 2004 registrations

Ford Escape	2,566
Honda Insight	587
Honda Civic	25,586
Honda Accord	653
Toyota Prius	53,761

Source: ETDA 2005 (courtesy of R.L. Polk)

Will the future standards be met?

Not looking good

A very good question. But If current natural trends continue, the answer is... probably not. Our models give the following results (which are not price-adjusted at this stage).

Standards – objectives, deadlines & estimated results

	Objective	Deadline	Model estimates	Long Term Improvement Hypothesis
USA (California)	35.3 mpg	2009	31.5 mpg (PC) 22.4 mpg (LT)	Low Scenario: 0.4 mpg (PC) 0.1 mpg (LT)
USA (California)	35.3 mpg	2009	33.2 mpg (PC) 22.7 mpg (LT)	High Scenario: 0.4 mpg (PC) - 0.1 mpg (LT)
USA (California)	39.4 mpg	2016	33.2 mpg (PC) 22.7 mpg (LT)	Low Scenario: 0.4 mpg (PC) - 0.1 mpg (LT)
USA (California)	39.4 mpg	2016	33.2 mpg (PC) 22.7 mpg (LT)	High Scenario: 0.8 mpg (PC) - 0.2 mpg (LT)
Japan	44 mpg (estimate)	2010	40.1 mpg	0.6 mpg
Europe	40 mpg	2008	34.7 mpg (Gasoline) 38.4 mpg (Diesel)	0.4 mpg (Gasoline) / 0.6 (Diesel)
Europe	46 mpg	2012	36.2 (Gasoline) / 40.6 (Diesel)	0.4 mpg (Gasoline) / 0.6 (Diesel)

Source: CM-CIC Securities / ESN estimates

Much more needs to be done

Targets may become mandatory

From this we must infer that there is a need for significant additional efforts in order to reach the targets. One must also keep in mind that these targets might become mandatory rather than voluntary as is currently the case.

Need a 15-20% conventional ICE improvement

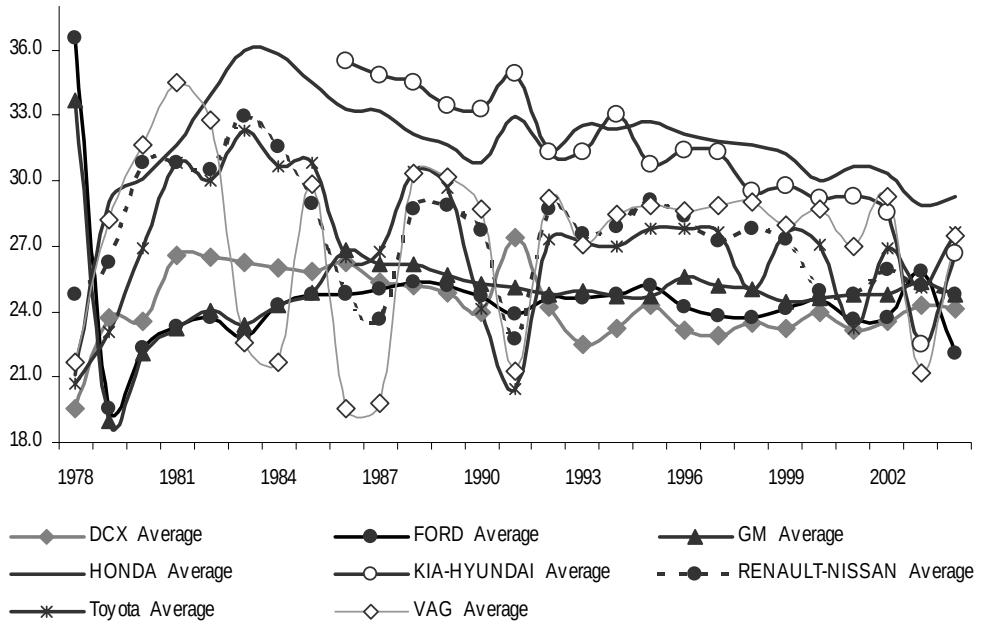
From our 2016 simulations with various (real) fuel prices, it is becoming clear that providing the CPI-adjusted fuel price does not change, conventional ICE improvements of 15-20% could be enough to meet the mandatory targets for all geographic areas. That is probably what some OEMs have been betting on.

Increase in real gas prices would mean disaster

2.5% CPI fuel increase = 41 –60% fuel efficiency improvements

However, any CPI fuel increase (in real terms) would turn the automakers dreams into a nightmare. A 2.5% CPI fuel increase in real terms means fuel efficiency improvements of between 41% and 60%, depending on the regional market. Even a combination of a 100% diesel hybrid fleet and other progress (weight, aerodynamics, direct injection) would not be sufficient to guarantee price-adjusted fuel efficiency stabilised at current level.

CAFE Group Performance (1978 – 2004)



Source: NHTSA, CM-CIC Securities / ESN estimates (see also CAFE data available in the Appendix).

Are the European & Japanese players on top?

Foreign OEMs no longer have a big advantage

Based on what we have seen, it is now important to examine whether the European and Japanese players are more active and better positioned to benefit from likely, tougher regulation in the US. On average this is no longer the case as the foreign automakers have, over the years, adapted their models to US-tastes. Over a long period, they have started and expanded their efforts to commercialise more light trucks and more American-style cars (rather their own traditional models). We even see a deterioration of Japanese OEMs performance, which is attributable to the heavier focus on LT as a proportion of the total vehicles sold. We are reluctant to go too far in interpreting CAFE data on an OEM-by-OEM basis. However, it is true that for passenger cars – Japanese domestics (i.e. in the US market) continue to have better performance and offer the US market with fleet above 30-32 mpg.

But US Japanese domestic PCs do have better performance

APPENDIX

CAFE Group Performance - Light Trucks (1996-2004)

		MOTOR YEAR								
GROUP	Données	1996	1997	1998	1999	2000	2001	2002	2003	2004
BMW	VOLUME	---	---	---	---	5 521	54 534	40 993	43 552	77
	Average	---	---	---	---	17.5	19.2	20.1	20.0	21.5
DCX	VOLUME	1 539 430	1 492 617	1 696 580	1 809 984	1 803 967	1 812 945	1 771 152	1 540 670	1 654 759
	Average	20.2	20.2	20.7	20.8	21.4	20.8	21.5	22.2	20.7
FORD	VOLUME	1 489 446	1 995 575	2 114 353	1 988 008	1 954 590	1 988 290	2 060 578	1 956 347	1 841 316
	Average	20.9	20.3	20.3	20.8	21.0	20.4	20.7	28.2	21.1
GM	VOLUME	1 649 696	1 810 805	1 826 146	2 027 543	2 257 796	2 002 858	2 460 680	2 455 636	2 384 914
	Average	20.8	20.5	21.2	20.4	21.0	20.7	21.2	28.3	21.2
HONDA	VOLUME	---	73 948	96 828	16 137	236 518	281 606	335 916	560 024	516 395
	Average	---	26.9	26.9	26.1	25.4	25.0	25.4	30.4	24.5
KIA-HYUNDAI	VOLUME	8 638	235	26 455	38 232	66 519	109 015	179 438	192 867	222 535
	Average	23.4	23.7	24.4	24.4	23.5	23.9	22.8	21.6	22.5
PORSCHE	VOLUME	---	---	---	---	---	---	---	1 277	24 027
	Average	---	---	---	---	---	---	---	32.4	18.3
RENAULT-NISSAN	VOLUME	186 756	282 844	197 082	170 577	355 867	356 816	287 302	280 327	495 338
	Average	22.9	22.3	22.3	21.2	20.8	20.7	20.7	24.1	21.1
Toyota	VOLUME	306 511	370 873	457 236	457 316	612 868	652 229	747 968	727 041	1 081 706
	Average	23.1	22.6	23.5	22.9	21.8	22.1	22.1	29.8	22.7
VAG	VOLUME	---	1 602	---	2 555	2 791	10 492	10 557	9 918	45 436
	Average	---	18.5	---	19.1	18.9	20.4	20.6	14.5	19.3

Source : NHTSA, 2005

CAFE Group Performance - Domestic Products (1978-1990)

		MOTOR YEAR												
GROUP	Données	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
DCX	VOLUME	1 155 014	97 037	626 666	747 851	609 184	747 748	989 375	1 136 123	918 004	1 180 974	967 067	874 631	652 313
	Average	18.4	20.5	22.3	26.8	27.6	26.9	27.8	27.8	27.8	27.5	28.5	28.0	27.4
FIAT	VOLUME	61 131	---	---	---	---	---	---	---	---	---	---	---	---
	Average	18.4	---	---	---	---	---	---	---	---	---	---	---	---
FORD	VOLUME	50 706	2 458 049	1 416 706	1 367 193	1 373 700	1 287 328	2 062 323	2 082 476	2 045 464	1 884 477	2 141 053	2 002 593	1 645 391
	Average	19.0	19.2	22.9	24.1	25.0	24.3	25.8	26.5	27.0	26.9	26.6	26.6	26.3
GM	VOLUME	---	5 102 362	4 508 031	4 003 568	3 402 306	3 503 997	4 844 819	4 538 801	4 463 512	3 503 956	3 461 080	3 337 532	2 815 394
	Average	---	19.1	22.6	23.8	24.6	24.0	24.9	25.8	26.6	26.9	27.6	27.3	27.1
HONDA	VOLUME	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	---	---	---	---	---	---	---	---	---	---	---	---	---
RENAULT-NISSAN	VOLUME	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	---	---	---	---	---	---	---	---	---	---	---	---	---
Toyota	VOLUME	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	---	---	---	---	---	---	---	---	---	---	---	---	---

(1991-2004)

GROUP	Données	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
DCX	VOLUME	615 534	519 521	65 421	684 359	850 676	675 732	709 115	674 093	682 489	812 907	739 681	671 372	498 296	641 474
	Average	27.5	27.8	27.8	26.3	28.4	27.6	27.6	28.8	27.2	27.9	27.9	27.7	29.7	29.7
FIAT	VOLUME	7 581	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	27.6	---	---	---	---	---	---	---	---	---	---	---	---	---
FORD	VOLUME	91 356	1 311 548	2 048 832	1 669 254	2 002 305	1 522 819	1 664 228	1 597 670	1 638 848	1 608 378	1 309 834	1 190 157	1 136 369	83 168
	Average	27.1	27.4	28.4	27.8	27.8	26.6	27.2	27.8	27.6	28.3	27.7	27.9	21.3	26.5
GM	VOLUME	---	2 884 543	2 701 721	2 903 926	3 039 085	2 609 778	2 434 575	2 408 597	2 505 485	2 510 986	2 184 214	2 106 105	1 872 984	1 854 104
	Average	---	26.7	27.4	27.7	27.4	28.1	28.2	27.8	27.7	27.9	28.3	28.8	21.3	29.0
HONDA	VOLUME	---	---	---	---	---	614 565	44 955	797 432	349 715	837 105	794 448	815 785	378 129	45 061
	Average	---	---	---	---	---	33.0	28.5	32.7	33.5	31.4	32.7	32.4	31.9	31.1
RENAULT-NISSAN	VOLUME	---	---	---	---	---	---	---	159 224	174 349	147 978	137 253	192 701	225 388	209 167
	Average	---	---	---	---	---	---	---	29.9	29.9	28.1	27.9	28.9	21.9	27.9
Toyota	VOLUME	---	---	---	---	6 037	65 924	73 991	76 189	61 819	296 021	---	254 673	17 504	756 543
	Average	---	---	---	---	28.5	28.3	28.8	28.0	28.3	33.3	---	33.6	32.4	33.2

Source : NHTSA, 2005

CAFE Group Performance - Imported Products (1978-1990)

		MOTOR YEAR												
GROUP	Données	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
BMW	VOLUME	32 749	37 943	36 408	36 673	37 957	50 261	10 598	87 139	86 072	94 336	77 548	69 555	57 045
	Average	19.8	19.8	26.3	26.9	26.9	26.1	26.5	26.2	25.7	24.8	21.6	22.2	22.1
DCX	VOLUME	135 334	165 629	198 960	193 077	156 627	190 326	201 429	239 604	212 307	342 627	253 136	339 035	89 247
	Average	29.4	28.3	31.2	31.0	30.8	31.1	31.5	30.2	34.0	29.4	27.8	28.0	24.4
FIAT	VOLUME	5 803	13 506	42 205	28 341	10 847	2 821	6 270	5 682	8 030	10 681	5 278	3 391	1 968
	Average	21.5	23.9	27.2	28.0	25.6	22.8	23.3	21.7	26.6	23.7	22.6	21.8	20.1
FORD	VOLUME	2 695 637	172 293	283 383	236 655	262 325	98 506	291 008	333 395	367 720	239 015	519 739	696 347	422 052
	Average	36.8	24.3	25.4	29.6	28.2	25.7	28.7	29.2	27.2	28.7	31.3	29.7	29.3
GM	VOLUME	5 188 972	14 697	15 331	19 045	32 037	38 586	58 765	158 216	382 726	389 283	476 180	289 735	306 431
	Average	33.7	21.7	24.3	35.6	30.8	28.5	27.4	37.5	39.8	36.2	36.4	34.3	32.3
HONDA	VOLUME	250 829	323 261	349 641	---	353 607	401 744	48 297	541 872	629 534	7 644	848 142	754 499	894 186
	Average	21.1	29.0	30.1	---	33.9	36.0	35.8	34.5	33.3	33.2	32.1	31.6	30.8
KIA-HYUNDAI	VOLUME	---	---	---	---	---	---	---	---	127 183	231 537	296 987	216 667	116 629
	Average	---	---	---	---	---	---	---	---	35.5	34.8	34.5	33.4	33.3
PORSCHE	VOLUME	---	---	---	---	---	---	---	20 893	27 448	31 616	16 137	10 715	7 013
	Average	---	---	---	---	---	---	---	26.3	26.5	11.4	24.7	23.0	21.7
PSA	VOLUME	10 117	12 869	9 418	15 765	12 687	11 797	19 301	20 847	13 218	808	4 019	9 756	725
	Average	10.8	23.8	28.1	28.7	28.0	25.6	25.0	25.2	25.4	25.4	23.6	25.5	25.5
RENAULT-NISSAN	VOLUME	420 524	399 792	537 222	486 417	482 505	503 567	504 028	50 579	438 411	812 888	441 949	478 408	491 103
	Average	24.8	26.8	32.2	31.4	31.2	33.4	32.5	23.0	25.7	23.5	30.8	30.4	28.5
Toyota	VOLUME	492 833	452 596	674 478	580 215	542 336	547 199	539 959	124 001	634 684	642 246	660 876	735 055	74 152
	Average	20.7	24.0	27.4	31.8	30.9	33.3	33.5	23.9	27.4	27.8	33.0	32.1	30.8
VAG	VOLUME	291 002	---	390 368	333 215	221 959	1 479	2 713	19 099	267 410	235 233	200 569	147 685	146 505
	Average	21.7	---	32.3	34.5	33.4	30.7	29.1	21.3	19.1	19.0	30.5	30.4	29.1

(1991-2004)

GROUP	Données	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BMW	VOLUME	52 322	7 461	64 973	84 782	119 704	58 438	131 944	119 927	113 829	177 836	203 534	196 729	230 176	2 305
	Average	23.2	23.9	25.1	25.1	25.3	27.3	25.7	25.4	25.4	24.8	25.0	26.2	26.8	26.3
DCX	VOLUME	739 596	269 323	206 835	309 480	441 795	333 100	189 094	248 336	326 061	375 117	215 072	266 903	294 104	864 751
	Average	28.9	26.7	27.6	28.4	28.4	27.9	26.0	28.3	28.4	27.6	26.5	26.6	26.3	26.6
FIAT	VOLUME	4	1 858	1 079	1 033	1 358	286	786	685	1 405	898	1 077	1 971	1 594	2 298
	Average	30.5	22.5	23.9	20.0	15.7	13.9	13.7	13.5	13.7	13.6	13.7	15.1	27.9	15.0
FORD	VOLUME	613 756	562 263	384 689	454 751	328 212	216 240	210 332	203 679	232 399	297 683	236 797	279 827	207 599	265 537
	Average	30.8	27.4	---	27.6	30.6	30.1	29.7	27.2	28.5	27.4	27.9	28.1	28.9	27.8
GM	VOLUME	1 685 364	119 110	79 210	21 073	107 749	110 171	181 706	86 317	105 128	12 628	126 691	50 790	50 541	120 671
	Average	31.8	31.4	30.6	25.9	36.7	37.2	32.1	29.4	26.5	27.3	28.5	27.9	34.2	29.5
HONDA	VOLUME	882 466	766 617	691 903	779 072	795 598	135 318	832 909	101 334	408 055	69 844	42 271	71 567	498 229	292 329
	Average	32.9	31.3	32.5	32.4	32.7	28.3	32.4	28.1	29.4	29.3	29.8	29.8	24.7	37.4
KIA-HYUNDAI	VOLUME	133 747	105 082	10 763	123 581	144 781	111 473	146 728	94 920	187 020	352 399	289 166	466 732	447 405	314 958
	Average	34.9	31.3	31.3	33.0	31.2	32.0	31.3	30.9	30.8	30.3	31.3	30.7	22.9	29.6
PORSCHE	VOLUME	6 037	3 065	2 674	298	8 123	7 092	11 748	9 781	26 121	21 141	2 391	22 009	17 907	13 963
	Average	13.3	22.4	22.5	22.1	22.7	21.5	23.2	24.5	24.1	24.3	23.7	23.9	18.0	23.3
PSA	VOLUME	3 211	467	14	---	---	---	---	---	---	---	---	---	---	---
	Average	21.3	25.0	26.2	---	---	---	---	---	---	---	---	---	---	---
RENAULT-NISSAN	VOLUME	---	389 065	---	491 253	520 834	488 719	520 268	254 601	229 169	301 193	257 247	251 455	281 994	261 639
	Average	---	30.2	---	30.1	29.5	30.5	29.9	30.7	29.9	28.3	28.7	29.5	28.9	29.1
Toyota	VOLUME	---	804 113	763 011	760 291	735 266	704 364	738 059	75 533	951 532	748 256	98 639	757 715	1 107 167	236 648
	Average	---	29.1	29.1	29.2	30.4	29.8	30.1	30.7	29.9	28.9	30.6	29.3	21.9	32.4
VAG	VOLUME	4 729	84 631	60 503	74 415	140 051	156 536	163 189	219 273	34 483	391 571	45 894	411 475	420 273	307 959
	Average	34.6	29.2	27.2	28.5	29.0	28.6	29.0	29.0	28.6	28.8	28.5	29.5	21.3	28.7

Source : NHTSA

CAFE Group Performance - All Products (1978-1990)

		MOTOR YEAR												
GROUP	Données	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
BMW	VOLUME	32 749	37 943	36 408	36 673	37 957	50 261	10 598	87 139	86 072	94 336	77 548	69 555	57 045
	Average	19.8	19.8	26.3	26.9	26.9	26.1	26.5	26.2	25.7	24.8	21.6	22.2	22.1
DCX	VOLUME	1 290 348	350 484	1 019 818	1 086 489	970 252	1 121 805	1 631 534	1 974 599	1 687 639	2 505 374	2 204 986	2 245 992	1 642 593
	Average	19.6	23.7	23.5	26.6	26.5	26.2	26.0	25.8	26.2	25.4	25.2	24.9	24.0
FIAT	VOLUME	66 934	13 506	42 205	28 341	10 847	2 821	6 270	5 682	8 030	10 681	5 278	3 391	1 968
	Average	18.7	23.9	27.2	28.0	25.6	22.8	23.3	21.7	26.6	23.7	22.6	21.8	20.1
FORD	VOLUME	2 746 343	2 663 667	2 164 332	2 266 638	2 176 557	2 180 577	3 477 267	3 349 197	3 792 019	3 362 512	4 093 684	3 995 210	3 186 125
	Average	36.5	19.5	22.3	23.3	23.7	22.8	24.3	24.8	24.8	25.0	25.3	25.2	24.7
GM	VOLUME	5 188 972	5 613 214	5 180 788	4 617 967	4 202 163	4 405 664	5 758 391	6 124 115	5 415 035	5 100 674	5 586 633	5 198 043	4 461 869
	Average	33.7	19.0	22.1	23.2	24.0	23.4	24.3	24.9	26.8	26.1	26.2	25.6	25.3
HONDA	VOLUME	250 829	323 261	349 641	396 375	353 607	401 744	48 297	541 872	629 534	7 644	848 142	754 499	894 186
	Average	21.1	29.0	30.1	31.6	33.9	36.0	35.8	34.5	33.3	33.2	32.1	31.6	30.8
KIA-HYUNDAI	VOLUME	---	---	---	---	---	---	---	---	127 183	231 537	296 987	216 667	116 629
	Average	---	---	---	---	---	---	---	---	35.5	34.8	34.5	33.4	33.3
PORSCHE	VOLUME	---	---	---	---	---	---	---	20 893	27 448	31 616	16 137	10 715	7 013
	Average	---	---	---	---	---	---	---	26.3	26.5	11.4	24.7	23.0	21.7
PSA	VOLUME	10 117	12 869	9 418	15 765	12 687	11 797	19 301	20 847	13 218	808	4 019	9 756	725
	Average	10.8	23.8	28.1	28.7	28.0	25.6	25.0	25.2	25.4	25.4	23.6	25.5	25.5
RENAULT-NISSAN	VOLUME	420 524	478 544	663 195	594 352	613 039	528 989	567 750	718 289	771 069	1 049 640	596 628	623 914	650 871
	Average	24.8	26.2	30.8	30.8	30.5	33.0	31.6	28.9	24.8	23.6	28.7	28.8	27.7
Toyota	VOLUME	492 833	564 412	723 252	711 843	611 860	647 341	817 530	929 202	1 071 604	999 932	945 750	1 008 333	308 053
	Average	20.7	23.0	26.9	30.8	30.0	32.3	30.6	30.8	26.5	26.8	30.4	29.7	24.1
VAG	VOLUME	291 002	212 640	428 823	333 215	251 212	11 837	23 887	276 530	277 772	247 856	204 307	151 439	153 861
	Average	21.7	28.2	31.7	34.5	32.7	22.6	21.7	29.9	19.6	19.8	30.3	30.2	28.7

(1990-2004)

GROUP	Données	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BMW	VOLUME	53 175	7 461	64 973	84 782	119 704	58 438	131 944	119 927	113 829	183 357	258 068	237 722	273 728	2 382
	Average	23.1	23.9	25.1	25.1	25.3	27.3	25.7	25.4	25.4	24.6	23.8	25.1	25.7	26.1
DCX	VOLUME	1 540 365	1 642 421	1 405 245	2 309 741	2 569 461	2 548 262	2 390 826	2 619 009	2 818 534	2 991 991	2 767 698	2 709 427	2 333 070	3 160 984
	Average	27.3	24.2	22.5	23.2	24.3	23.2	22.9	23.5	23.3	23.9	23.1	23.5	24.3	24.1
FIAT	VOLUME	7 585	1 858	1 079	1 033	1 358	286	786	685	1 405	898	1 077	1 971	1 594	2 298
	Average	27.6	22.5	23.9	20.0	15.7	13.9	13.7	13.5	13.7	13.6	13.7	15.1	27.9	15.0
FORD	VOLUME	2 662 049	3 166 574	3 949 865	3 835 767	3 975 104	3 228 505	3 870 135	3 915 702	3 859 255	3 860 651	3 534 921	3 530 562	3 300 315	2 190 021
	Average	23.9	24.6	---	24.7	25.2	24.2	23.8	23.7	24.2	24.5	23.6	23.7	25.9	22.1
GM	VOLUME	4 597 797	4 474 523	4 319 197	4 845 550	5 236 346	4 369 645	4 427 086	4 321 060	4 638 156	4 781 410	4 313 763	4 617 575	4 379 161	4 359 689
	Average	25.1	24.7	24.9	24.7	24.7	25.6	25.2	25.0	24.5	24.6	24.8	24.7	25.4	24.8
HONDA	VOLUME	882 466	766 617	691 903	779 072	795 598	749 883	951 812	995 594	773 907	1 143 467	1 118 325	1 223 268	1 436 382	853 785
	Average	32.9	31.3	32.5	32.4	32.7	32.2	31.8	31.7	31.2	30.0	30.7	30.3	28.8	29.3
KIA-HYUNDAI	VOLUME	133 747	105 082	10 763	123 581	155 254	120 111	146 963	121 375	225 252	418 918	398 181	646 170	640 272	537 493
	Average	34.9	31.3	31.3	33.0	30.7	31.4	31.3	29.5	29.7	29.2	29.3	28.5	22.5	26.6
PORSCHE	VOLUME	6 037	3 065	2 674	298	8 123	7 092	11 748	9 781	26 121	21 141	2 391	22 009	19 184	37 990
	Average	13.3	22.4	22.5	22.1	22.7	21.5	23.2	24.5	24.1	24.3	23.7	23.9	19.0	20.1
PSA	VOLUME	3 211	467	14	---	---	---	---	---	---	---	---	---	---	---
	Average	21.3	25.0	26.2	---	---	---	---	---	---	---	---	---	---	---
RENAULT-NISSAN	VOLUME	577 373	508 795	551 703	715 664	555 136	675 475	803 112	610 907	574 095	805 038	751 316	731 458	787 709	966 144
	Average	22.7	28.7	27.6	27.8	29.1	28.4	27.2	27.8	27.3	24.9	24.8	25.9	25.2	24.7
Toyota	VOLUME	392 046	1 069 268	1 062 589	1 113 790	1 032 746	1 076 799	1 182 923	608 958	1 470 667	1 657 145	750 868	1 760 356	1 851 712	2 074 897
	Average	20.4	27.3	27.2	27.0	27.8	27.8	27.7	25.0	27.7	27.1	23.2	26.9	25.1	27.6
VAG	VOLUME	115 165	84 631	61 568	74 667	141 865	156 536	164 791	219 273	37 038	394 362	56 386	422 032	430 191	353 395
	Average	21.3	29.2	27.1	28.5	28.9	28.6	28.9	29.0	27.9	28.7	27.0	29.3	21.1	27.5

Source : NHTSA2005

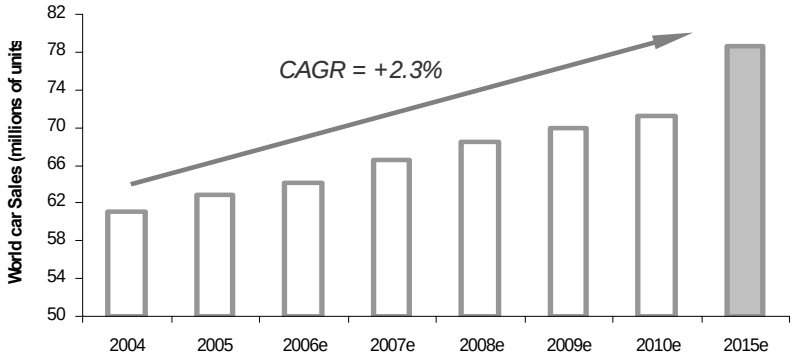
Technological transition will separate the sheep from the goats

Technology will determine mix & market share (but don't forget overall market growth trends)

Up to 80m new cars by 2015

Assuming that the global automotive market follows its projected long-term growth trend path for the next ten years – and assuming that the macroeconomic projections provided by organisations such as *Global Insight, Jato Dynamics, LMC, Automotive News*, *et al* – are accurate, 2010 could see 68-70m new cars on the market, and 80m five years later in 2015.

In ten years, the World Car market could almost reach 80M units/year



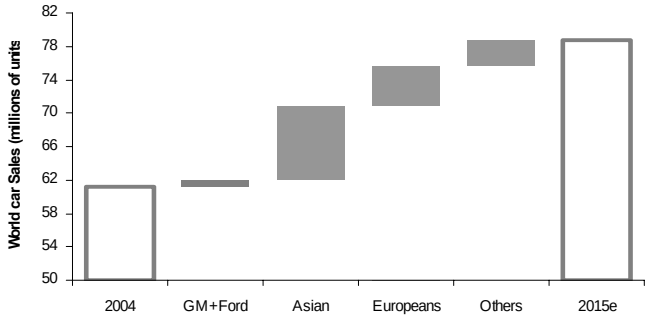
Source : Industry, Global Insight, CM-CIC Securities / ESN estimates

▪ Developing countries will be the main growth drivers

Asia – 36% of the global new car market

The developing countries are obviously going to be the main growth drivers: Asia's market could grow by 20-40% thanks to the heavyweights, China (+30-40%) and India. Indeed, India's market might well double in size over the coming six years. All told, the two countries could be looking at nearly 10m new cars on the market in 2010, and maybe 12-13m five years later. If all goes according to prediction, Asia will account for 36% of the new car market vs. just over 25% today.

As expected, Asian carmakers should contribute to the bulk of the growth



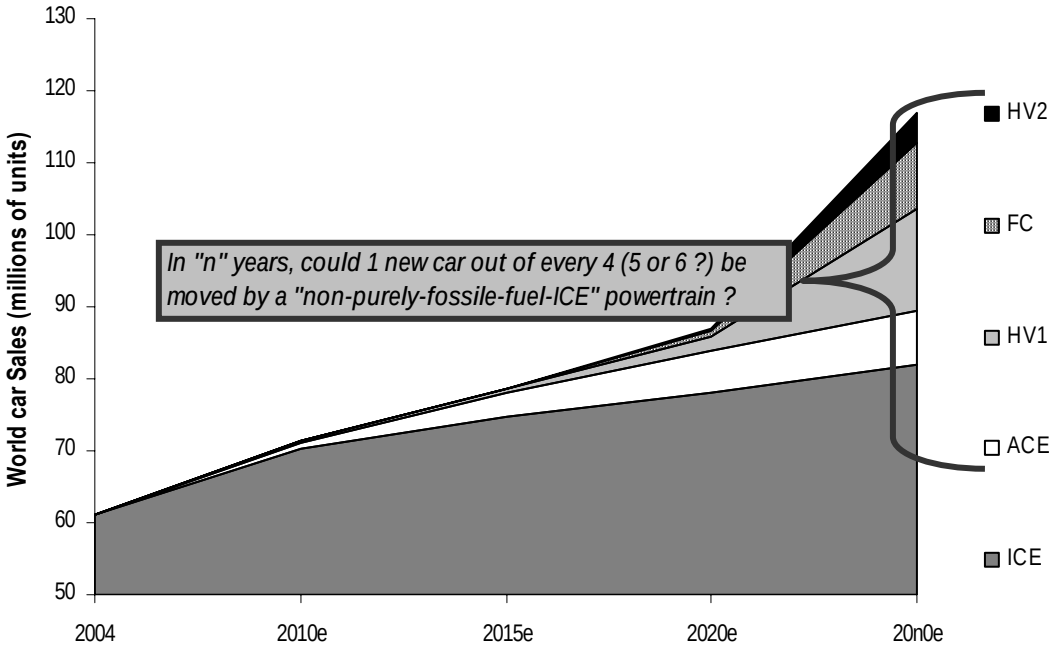
Source: Industry, Global Insight, CM-CIC Securities / ESN estimates

Technology will determine the mix

Key question is proportion of ICE- vs. non-ICE technologies

The underlying technology will not be an additional driver for the global car market but rather a factor that will determine the mix. The question to be asked is as follows: are we moving towards a global car market that in "n" years time will be 100% ICE-based, or one where ICE technologies will account for (100-x)%, where "x" stands for other technologies such as HV, FC, H2, etc., and will "x" no longer be infinitesimal as it is today?

What could be a reasonable market share ("x") attributable to alternative powertrains in "n" years : 10%, 25% or more?



Source: Industry, Challenge Bibendum, CM-CIC Securities / ESN estimates

Legend

ICE = Internal combustion engine (using fossil fuel)
ACE = ICE + Alternative Fuel (&/or H2 addition directly injected in the chamber)
HV1 = Hybrid Vehicle –> Type 1 = ICE or ACE + Battery
FC = Fuel Cell
HV2 = Hybrid Vehicle –> Type 2 = FC + Battery + ???

Source: Industry, Challenge Bibendum, CM-CIC Securities / ESN estimates

Cost will be the driving force behind the emergence of the clean car

Actions speak louder than words

The notion of "social cost" and of a debt of responsibility towards the environment and towards future generations is not viable as a "sustainable" driver – i.e. one that is not just informed by the dictates of what is "fashionable" at a given point in time. At best, current and future car-owners see environmental awareness as a "duty", but their actions do not necessarily match their convictions and words.

▪ Public funds are little more than symbolic

Governments meanwhile accord paramount importance to protecting jobs and fiscal stability, so that environmental concerns are by and large secondary. The Kyoto[9] agreement was ratified rather quickly once the ratification process began, but what would happen to a country that found itself in breach of its commitments? Probably nothing.

Bush's subsidy for fuel cells

US$ 1.2 billion

Another telling example concerns the "efforts" made by the US government to give a helping hand to the automotive sector in its quest for social and environmental respectability: President Bush promised to grant a once-off subsidy of USD1.2bn to various consortiums led by top US carmakers as well as Toyota, Nissan, Hyundai and BMW to help finance fuel cell research.

R&D budgets of the eight carmakers included in the US Dept of Energy's Fuel Cell Project

	DCX (1)	Ford	GM	Toyota	Honda	Nissan	BMW	Hyundai	US GDP	US Federal Expenses
R&D Expenses (USD billions)	3.55	7.40	6.50	6.31	4.33	3.68	3.49	1.54		
Cars produced (units m.)	4.02	6.62	8.22	6.88	2.91	2.99	1.14	2.99	**11,554**	**2,292**
R&D per car (USD)	*883*	*1118*	*791*	*917*	*1485*	*1232*	*3060*	*515*		

Source: Companies, estimates and restatement by CM-CIC Securities. (1) MCG and Chrysler only

0.1% of US GDP

Given that it will be disbursed over a period of five years, the subsidy amounts to only 0.011% of US GDP or 2.8% of the total annual R&D costs of the eight carmakers included in the FuelCell programme. Without wanting to make a value judgement regarding the size of the subsidy, we would suggest that public funding in this area today is little more than symbolic.

▪ [9] *The Kyoto agreement seeks to reduce greenhouse gas emissions; 149 countries have ratified (the US is not a signatory).*

Except for Toyota & Hyundai, nobody is making a real effort

No significant investment & no business case

With the exception of Toyota and Hyundai, carmakers are devoting little in the way of resources to alternative powertrains and/or fuels (according to DCX, its MCG subsidiary is alone in investing around EUR100m, or less than 5% of total R&D resources). The reason is simple: the industry is characterised by high capitalisation and low average returns. Moreover, as Carlos Ghosn put it, there is no business case as yet for hybrid technologies because the consumer is not yet ready to spend the EUR4500[10] added cost of an FHV.

▪ Cost & budgets will be the deciding factor

Lack of binding regulation on GHGs

ACEA & EURO standards lack bite

With the exception of California, there are few binding regulations in place as regards greenhouse gases. As was so brilliantly demonstrated by Louis Schweitzer in the run-up to the entry into force of the 140g/km rule for the ACEA CO2 agreements, the targets are not stable over time. The ACEA agreements on the reduction of CO2 emissions are nothing more than voluntary commitments to good conduct, and the Euro standards governing key pollutants (NOx, CO, HC and PM) also lack binding values (will version V contain binding regulations?).

Only binding constraint is a financial one

Money will be the ultimate arbitrator

In our view, the only credible constraint is a financial constraint. A financial constraint will either emerge owing to skyrocketing demand for fossil fuels, as is currently the case, or else due to a supply crunch stemming from the finite nature of fossil fuel resources. That said, we believe that for a long time to come – until 2020 – any proposed solutions will fail to address the core issue. Our assertion that the only credible constraint is a financial constraint is based on the consideration that in the absence of political will, money will be the ultimate arbitrator: car-owners have limited budgets, and if one assumes (optimistically) that their aim is to keep to that budget constraint, then upward pressure on fuel prices will probably have the following impacts:

Impacts of rising fuel prices

- **Reduced car-use** – in favour of other forms of transport (public transport and bicycles)
- **Tendency to change cars less frequently**
- **Preference for lower-range or lower horsepower vehicles**
- **Change of powertrains:**
  - a) switch gasoline for diesel - only really viable in Europe today
  - b) opt for hybrids -light, mild or heavy
  - c) other - depending on the technology at the time and location).

▪ [10] This is the average cost of adapting a classic platform to make it compatible with a combined ICE/E powertrain.

A variety of technologies will coexist despite lobbying efforts

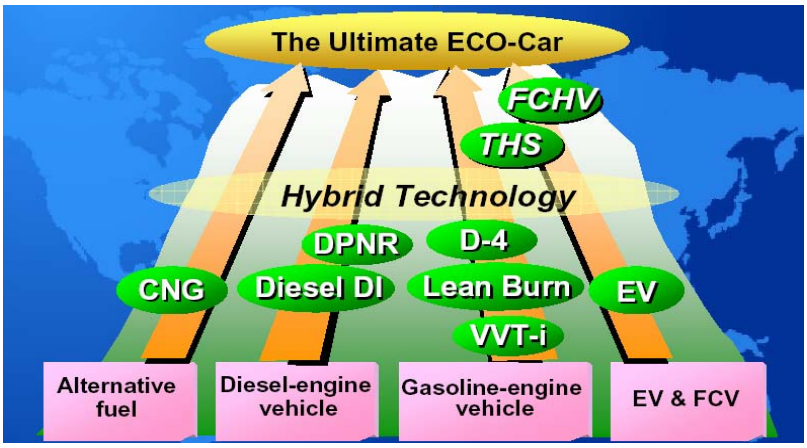
Impossible to make projections for timeframe or market share

The above list of impacts is not a list of "necessary phases", but instead an enumeration of possible options or environments - both technological and socio-economic (i.e. changes in attitudes to transport). Because all or some of the scenarios described above could occur at the same time, it is extremely difficult to make projections that are both rigorous and reliable as regards the timeframe and the potential market share of any given powertrain. This is all the more true given the absence of biting legislation and the fact that status and desire for impendence are often the main reasons for buying a car in developing countries. These considerations take primacy above the need to be able to get around.

▪ The road to the clean car

Toyota Motor, a pioneer as far as the ECO-car is concerned, offers a neat summary of the various pathways to an environmentally-improved vehicle.

Pathways towards the "Ultimate ECO-Car"

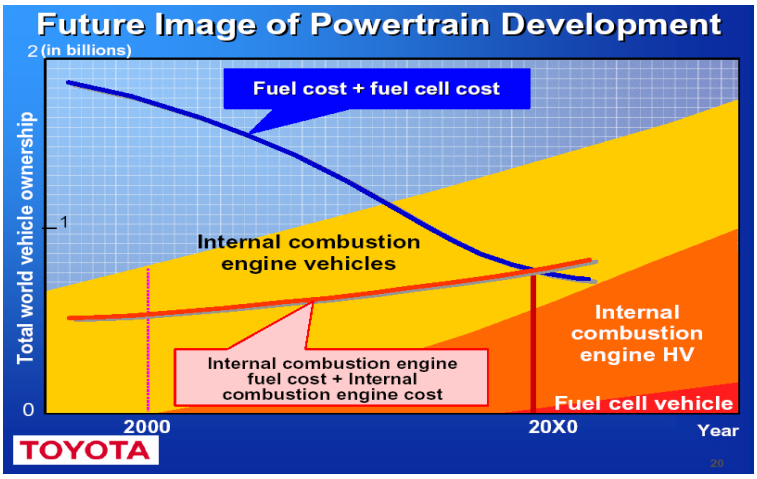


Sources : Toyota Motor Corp

Volumes = viability

Toyota says that there will be more than one technology and that these will sometimes be in competition. More often though (according to Toyota), they will be complementary or even convergent. In any case, the key issue is that of finding a viable business model, and that will require volumes.

Only volumes can secure a viable business case …



Sources: Toyota Motor Corp

Fuel prices will determine the time frame

Steadily rising fossil fuel prices will eventually mean equivalent total costs (engine plus fuel) for the two technologies (FuelCell and ICE), meaning that there will be no incentive for producers or consumers to prefer one technology over the other. The only unknown factor, by no means a minor one, is time. The timeframe will depend on fuel prices paid by consumers (gasoline/diesel), prices that will increasingly reflect the level of proven, probable and possible reserves (regardless of the theoretical level of demand).

Determining "costs to target": difficult in the absence of reliable tools

▪ The cost/efficiency advantage of a technology: gasoline vs. diesel

Not as obvious as it seems

It is difficult to quantify the cost and speed of technological transition. The same applies when looking at the relative advantages of diesel over gasoline in terms of pollutants and CO2 emissions: what seems an obvious advantage at first glance turns out on closer inspection to be patchy and inexact.

Diesel vs. Gasoline : a few examples of "efficiency gaps"

Make	Model	Fuel	Horse Power	Selling price € (France-entry versions)	l/100km on average	CO2 g/km	g of CO2 per litre of fuel
BMW	318 Ci	G	105	24,005	7.4	180	24.3
BMW	320 d	D	110	26,451	5.7	153	26.8
Efficiency / Price Gap				*-10.2%*	*23.0%*	*15.0%*	
Audi	A6 - 2.4	G	177	29,187	9.9	238	24.0
Audi	A6 - 2.7	D	179	31,294	7.0	187	26.7
Efficiency / Price Gap				*-7.2%*	*29.3%*	*21.4%*	
Mercedes	E-Class 280 E	G	231	35,116	9.4	224	23.8
Mercedes	E-Class 320 Cdi	D	224	39,801	7.3	194	26.6
Efficiency / Price Gap				*-13.3%*	*22.3%*	*13.4%*	
Peugeot	206 - 3p - 1.4	G	75	9,536	6.3	149	23.7
Peugeot	206 - 3p - 1.4Hdi	D	70	10,821	4.3	113	26.3
Efficiency / Price Gap				*-13.5%*	*31.7%*	*24.2%*	
Renault	Clio Campus 1.2 E	G	60	9,121	6.0	143	23.8
Renault	Clio Campus 1.5 dCi	D	65	10,821	4.3	115	26.7
Efficiency Gap				*-18.6%*	*28.3%*	*19.6%*	

Source: Volkswagen Group, CM-CIC Securities restatements

Are diesel engines more expensive to produce?

The choice looks like an easy one in favour of diesel vehicles, which are sold at prices as little as 10% above those of an equivalent gasoline-fuelled car and which at equal horsepower give a 25% higher engine yield. The real question that should be asked however is: are they more expensive to produce? The answer to this key question depends on the following factors:

Range of factors at play

- **The volumes sold per engine,** because the automotive industry is one where the notion of break-even point is paramount (probably the reason behind Ford's wise decision in 1999 to collaborate with PSA)
- **The number of years of testing** (i.e. the amount of capital tied up in R&D and capex)
- **The number of competing technologies** (e.g., Volkswagen has had up to three different technologies running at any one time, including the peerless "PumpeDüse", semi-direct injection and direct injection)
- **The assigned assembly capacities** (gasoline capacity cannot be readily reassigned to diesel capacity; the adaptation cost would come to EUR1,300-1,500€/vehicle)
- **The indirect costs** (the applied cost of R&D, sales and marketing resources).

Volume is the determining factor

Fiat – weak diesel mix: costs them more to produce engines

At the end of the day, volume rather than rules is the determining factor. Fiat said a while back that the cost of making an "average" diesel engine comes to EUR 1,200 per unit vs. EUR1,500 for an equivalent gasoline engine. We believe that this is largely due to the weak share of diesel in Fiat's mix - 33% of Fiat's Europe-wide output is diesel fuelled. We also believe that it reflects the commercial situation of a group that is struggling with volumes. That said, Fiat was able to achieve economies of scale and share development costs thanks to partnerships with GM (which has since been dissolved).

PSA & VW – diesel volumes makes the engines lucrative

The other side of the story is illustrated by groups such as PSA (~52% diesel mix) and Volkswagen (~61% for Audi, ~55% for Volkswagen). For these players, substantial diesel volumes (the production capacity of each of the groups comes to 1.9m units and their sale prices are higher) makes diesel engines just as lucrative (or even more lucrative) as gasoline engines, despite the more complex technologies involved (pressure above 2,000 bars).

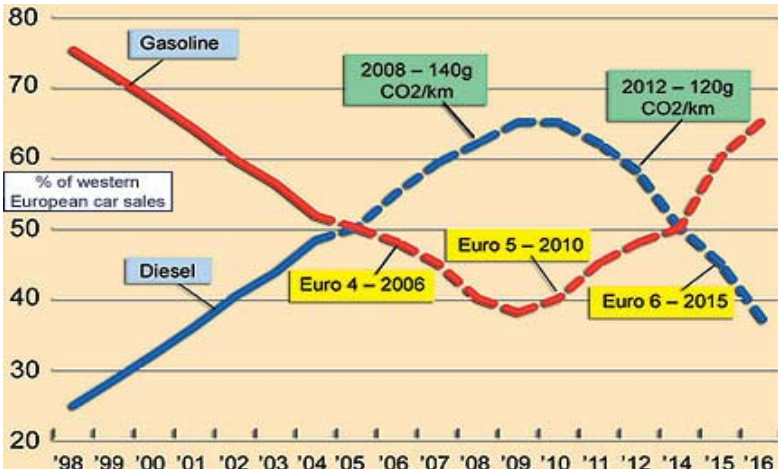
▪ Conflicting emissions targets: CO2 vs. pollutants

Gasoline may have the advantage on pollutants

Diesel's poor positioning on pollutants – a return for gasoline?

Although diesel engines meet CO2 emission commitments (GHGs), they do not always meet the restrictions set forth in Euro IV (pollutants). Carmakers have gone a long way towards reducing the particle emissions (PM) impact of diesel engines by fitting particle filters to exhaust systems. However, the fact that the future Euro 5 & 6 standards (the scope and timeframe of which has not yet been finalised) will be targeting Nox and SO emissions may well mean a comeback for gasoline in ten years time.

Gasoline in Europe…. A comeback in 2015?



Source: Fiat Research Center in "Automotive News Europe"

Diesel has the advantage on CO2 Emissions

Up to 25% lower emissions at equal horsepower

As far as CO2 emissions are concerned, diesel offers a clear advantage: 20-25% lower emissions at equal horsepower. However, in the light of how the Euro V standards may pan out for 2010, gasoline could turn out to offer a more suitable solution in Europe. Either way,

both diesel and gasoline engines will require additional fittings to ensure enhanced timing of valve opening, as well as turbo-chargers to reduce the CO2 yield of gasoline engines and particle filters to trap diesel particles.

Automakers – a mixed picture on environmental constraints

Hypothetical

Imagine a simplified world with two carmakers (**carmaker A and carmaker B**) in which the following three hypotheses applied:

1) Carmaker **A** has a smaller market share than carmaker **B**; **A**'s volumes are therefore lower than **B**'s; and

2) **A** converted to direct diesel injection five years after **B**

3) **A** having failed to prepare properly for the Euro IV transition is now preparing for Euro V and VI (which require particle emissions to be halved).

Not everyone has access to the same technology at the same price!

Per unit cost / €	Carmaker A		Carmaker B	
(Except for CO2)	Diesel 1.4l	Petrol/Gas 1.4l	Diesel 1.4l	Petrol/Gas 1.4l
Engine - Base Cost Euro III	2250	1500	1950	1500
CO2 (g/km)	*120*	*150*	*120*	*150*
Euro IV compliant?	No	Yes	No	Yes
Particle filters	400	---	250	---
Turbo, valve enhancement, …	No	800	No	800
Marketing and Distribution Cost	150	300	---	300
CO2 g/km)	*120*	*128*	*120*	*128*
Euro IV compliant?	Yes	Yes	Yes	Yes
Total Clean Engine Cost	**2800**	**2600**	**2200**	**2600**
Marginal Cost for CO2: €/g/car	---	36	---	36
Marginal Cost Regulatory %	24%	---	13%	---
Total Marginal "Cleaning Cost"	**24%**	**73%**	**13%**	**73%**

Source: CM-CIC Securities / ESN estimates

Two important conclusions from this hypothetical

Firstly, carmaker A deems it less costly to opt for the gasoline solution, an accurate judgement in carmaker A's particular case. Nevertheless, in absolute terms, diesel is the less costly solution in this two-carmaker world; but because the car industry is not one big sharing community, carmaker A is not sufficiently low-cost to make the right choices (carmaker A is lower down the learning curve).

Carmaker B, on the other hand, has been using diesel technology for years now, meaning that B's particle filter is less costly (thanks a combination of experience plus volumes). Nor does B require additional marketing and sales efforts to promote its diesel engine, unlike A which needs to spend EUR150 more per vehicle so as to sell its diesel car.

Complex set of economic & technical factors

Beyond that, it would be **misleading to base assumptions on "all other things being equal"**: the technology is not static, and besides, any engine solution needs to be looked at in the context of a complex set of economic and technical parameters. For instance, carmakers first started incorporating carbon and pollutant emission requirements in their

R&D budgets back in 1998, with the result that successive models have been progressively adapted to meet the statutory requirements on emissions. It would be incorrect to assume that a given carmaker would add a particle filter or other device to a stand-alone engine and then to derive the added cost of doing so. **It is not economically viable for carmakers to simply add on a new cost without offsetting that cost elsewhere**. This is an ongoing issue in an industry that has to juggle a whole set of constraints at once because costs need to drop at least as fast as prices given that the objective trend is towards falling prices.

The economic equation needs modifying

Stating that the transition to Euro V would cost an extra EUR1,000 per car (according to VW and Fiat) or that a Full Hybrid would cost between EUR2,500 and EUR4,500 extra (DCX, Toyota, Volkswagen, Nissan) above the cost of an equivalent vehicle (performance-wise) is not a particularly helpful analysis: carmakers **need to make savings elsewhere**, **if only because raising prices would mean losing the equivalent in volumes**. To the best of our knowledge, no carmaker is prepared to contemplate any significant loss of volumes.

Temporary add-on solutions during transition periods

That said, during transition periods, carmakers could well decide to opt for temporary add-on solutions (particle filters fitted on part of a new range of cars for which the next generation of engine will not be ready for a few months): such a solution can only be palliative; to make it the standard solution in stable production mode would be economic suicide. Moreover, the general trend is for each new generation of engine to offer greater horsepower at identical cylinder capacity (less consumption and therefore lower carbon emissions). The solution does not necessarily involve adding a device to the exhaust system: it makes more sense to re-engineer the engine completely so as to meet the requirements. Renault, for instance, says that a large proportion of its diesel range will meet Euro IV without the need for particle filters (up to 2 litres and 150HP, the group's latest engine generation).

Hybrid-related additional costs will fall as volumes rise

Toyota Prius succeeded in avoiding price comparisons

Toyota had the good idea of an unbeatable price offering with the Prius (the Prius is in more or less the same price bracket as the most popular four-door sedan in the US, the Toyota Camry), a car with no comparable peer (in price terms) in pure ICE format. The resulting advantage was two-fold: the affordable price quickly caught the attention of the group's target customer base, enabling the group to push its hybrid technology and product smoothly to market.

Keeping hybrid prices stable for years to come is key

Most importantly, it avoided consumers making price comparisons between hybrid and non-hybrid versions. This is the usual criticism levelled at direct derivatives of existing cars, such as the Accord Hybrid (+USD11,000 for the hybrid version vs. for the pure gasoline version) or the Lexus RX 400h (+USD9,000 for the hybrid vs. for the classical RX 330 version). Here, there are two solutions: carmakers either hold out in earnings terms until the market share of hybrids is sufficient for volumes to cover costs, or else they raise their prices. In the latter instance, what might be acceptable to an affluent Californian client in terms of price rise for a Lexus premium SUV (20% price premium on the RX400h vs. the RX 330) will obviously be less acceptable for someone buying a Civic. We believe that if carmakers succeed in

keeping the prices of hybrids stable generation after generation, that in and of itself will be a major victory in what is a deflationary industry.

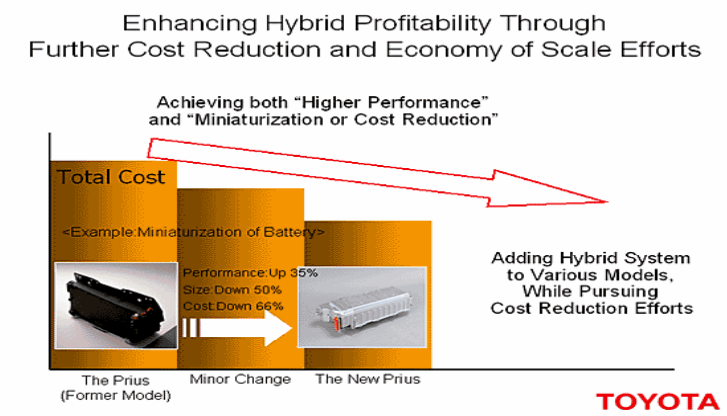
The instantaneous additional cost of hybrids could be USD3,500-4,500

Per unit cost / USD	Low	High
Battery (42V), Cooling systems and misc.	1250	1500
Electric engine (50/65KW)	650	900
Inverter and controllers	1250	1500
Miscellaneous (wiring, buses, softs)	250	500
Total Marginal "Cleaning Cost"	**3,400**	**4,400**

Source: Toyota Motor, Nissan Motor and various Industry Sources

The above calculation has notional value only: it omits the volume aspect to focus exclusively on the net additional cost per type of vehicle (four-door sedan or light-trucks) without taking into account any re-engineering effect or impact stemming from the juggling of other functions. Nor does it consider any public subsidies that could be granted to ease the transition for manufacturers and consumers. The experience effect among manufacturers and suppliers should see marginal costs falling very quickly.

The experience effect combined with volumes will help reduce added costs



Sources: Toyota Motors

Lobbying for their chosen option - another obstacle

Specialising in only 1 option could prove fatal

At the end of the day, each individual manufacturer will push for the technology into which that manufacturer has invested the most (the hybrid/diesel, hybrid/fuel cell split). For instance, despite having access to colossal volumes, despite having a diesel friendly product mix (one vehicle out of two being a Light Truck), and despite having access to Isuzu's technology, General Motors looks set to lobby in favour of hybrids instead of pushing for diesel (is this yet another strategic error?). Aside from Toyota, which has looked at many different options over the past 15 years, most carmakers tend to specialise in one solution or another. This could prove fatal in the event of excessive investment in "alpha" powertrains if "beta" powertrains prevail in the end.

Different bets for the future

	Diesel	Bio-Fuel	Hybrids	Batteries	H2	Fuel cell	CNG
GM	◎		◎			◎	
Ford Motor	◎◎◎	◎	◎◎		◎	◎◎	
DaimlerChrysler	◎◎	◎◎		◎		◎	
Toyota	◎◎		◎◎◎			◎◎	
Renault-Nissan	◎◎			◎		◎	◎◎◎
Honda	◎		◎◎			◎	
Hyundai	◎◎		◎◎			◎◎	
Volkswagen	◎◎◎	◎◎				◎	
BMW	◎◎				◎◎	◎	
Peugeot	◎◎◎			◎		◎	◎◎◎
Fiat	◎		◎		◎	◎	◎◎
Porsche			◎				

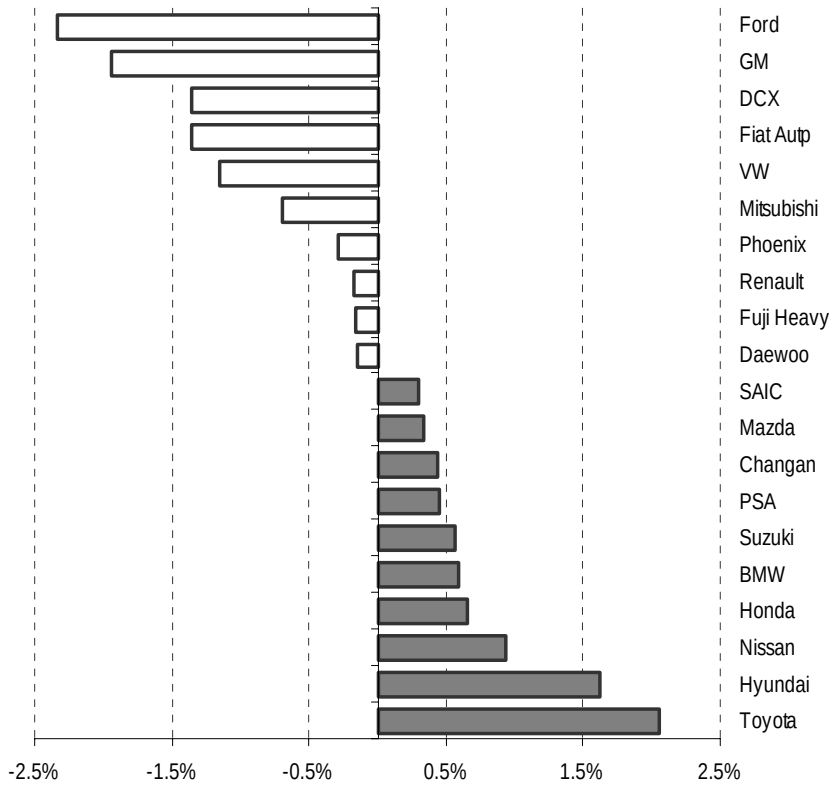
Source: Industry, CM-CIC Securities / ESN estimates

Low returns imply low investment in low-emission technologies

No one is really capturing market share – but investment remains high

The industry is not about to shed its bad habits of old: investment remains excessively high (capex and R&D) given the current feeble growth (2/2.5% annually). No single carmaker stands out from the crowd as regards market share capture: over the past six years, only ten carmakers have succeeded in capturing market share globally, and only two of those, BMW and PSA, are based outside Asia.

Very few carmakers have gained market share over the past five years



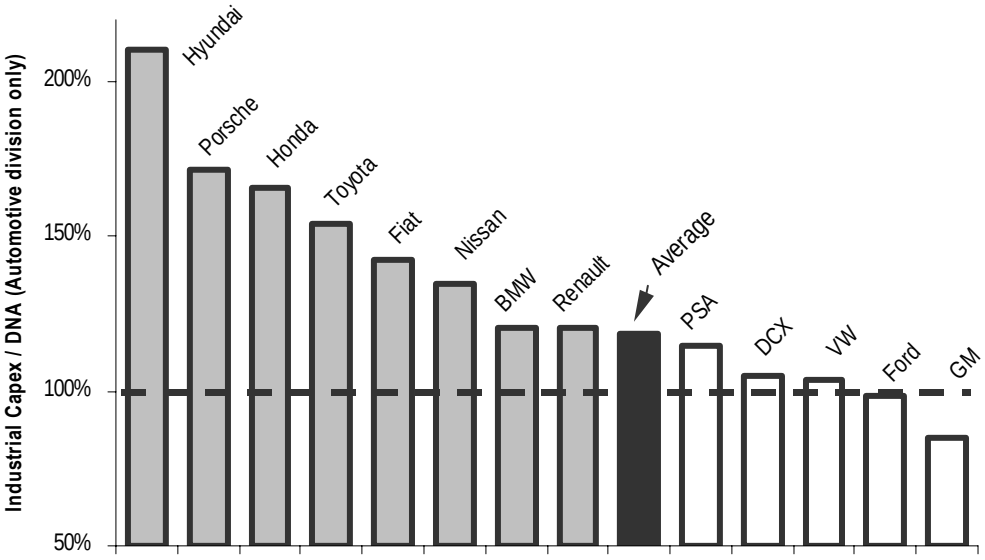
Sources: Industry, Automotive News DB and Global Insight

Don't over-estimate the market's potential

Resource allocations are often not realistic

That serves as a salutary reminder that the market is not elastic and that its potential should not be over-estimated: low returns (ROS = 4% on average) in what is a profoundly deflationary industry (-1% drop in net transaction price on average, sometimes reaching double digits temporarily depending on the geographical zones – e.g. China of late – and the manufacturers) mean that carmakers base their resource allocation budgets on growth / market share / price assumptions that are not always realistic. When the calculations turn out to be inaccurate, the temptation is to keep the production lines running regardless of the cost. Old habits die hard...

The sector seems to believe growth is strong: otherwise why invest 118% of amortisation?



Sources: Annual Reports, Restatement and estimates by CM-CIC Securities / ESN

Returns are low and some carmakers are unable to meet their capex!

	Auto Ebita / Revenues	Capex / DNA	Capex + R&D / DNA	Capex / Auto Revenues	Capex / AutoEbitda	Capex / Mkt Cap
BMW	7.8%	121%	226%	7.6%	53.7%	13%
Fiat Spa	-4.1%	142%	247%	6.6%	***1281.0%***	15%
Peugeot SA	2.9%	115%	229%	5.0%	69.1%	17%
Porsche AG	16.7%	171%	254%	14.6%	57.7%	9%
Renault	3.9%	120%	191%	9.0%	79.0%	15%
Volkswagen AG	1.3%	104%	167%	8.8%	89.9%	37%
DaimlerChrysler (1)	3.7%	105%	198%	6.5%	65.5%	15%
Toyota Motor	8.5%	154%	254%	6.8%	52.6%	6%
Nissan Motor	9.4%	134%	248%	5.7%	41.9%	9%
Honda Motor	6.5%	166%	373%	6.7%	63.4%	8%
General Motors	1.4%	85%	151%	4.5%	67.1%	46%
Ford Motor	-0.1%	98%	214%	4.3%	101.9%	37%
Hyundai Motor	5.4%	210%	309%	6.7%	78.1%	16%
Sector Average	***4.0%***	***118%***	***213%***	***6.3%***	***67.0%***	***13%***

Source: Companies, estimates and restatement by CM-CIC Securities / ESN. (1) MCG and Chrysler only.

The situation is not what it should be

Lack of strategic investment

On the one hand there is over-investment in the short/medium term (product life cycle or 6/7 years), and on the other hand there is practically no strategic investment (alternative energy sources, etc.) anywhere in the sector (although there is a dearth of disclosure). Any strategic investment that does exist tends to concern image, finish or institutional communication.

Not all will get out alive

They will pay for their short-termism

The fact that there is an over-abundance of under-performing short-term investment means that the industry is under-investing in the steps needed to advance technologically. Because their hands are tied by short-term concerns (the need for immediate returns on investment) or perhaps because of sheer short-sightedness, most carmakers are neglecting alternative energy sources and arguing against the wind that their current technologies are sound.

Our conclusions

1) **Technological partnerships are going to become a more frequent occurrence** - they are needed to share risk as indicated by VW/DCX in the case of bio fuels and GM/BMW/DCX with hybrids. It is not viable for carmakers to go it alone and wait for a hypothetical return on investment in fuel cells or electric engines.
2) **Equity participation in small specialised enterprises should become more common –** players such as Batscap (France- 80% Boloré/20% EDF), Ballard Power (Canada – 19.2% DCX, 11.5% Ford, remainder is public).
3) **Licensed technologies will be a medium-term means to meet emissions requirements** - Nissan is using technologies developed by Toyota for its future hybrids and is to release a hybrid next year in the US only so as to meet the CARB requirements.
4) **The medium-term should see most carmakers opt en masse for the all-hybrid**, which requires deep re-engineering of most platforms rather than full-scale disruption of the value chain.
5) **The development of alternative powertrains will only be viable if the appropriate infrastructure is developed in tandem**. The FuelCell in particular raises the problem of the production, storage and distribution of hydrogen: where can consumers source hydrogen and who can supply it in an environmentally acceptable manner? (Well-to-Wheel's analysis is not fully credible).
6) **Electric engine technology is secondary for the moment**, **except in China** where universities and public institutes (Shanghai, Beijing, Wuhan, Qingshan, Wanxiang) have already snapped up practically all patents filed in this area. We would not be surprised if the first mass-produced light vehicles (i.e. not coaches or buses) were to roll off the production lines of manufacturers such as SAIC, Dongfeng or FAW … unless, that is, Batscap (lithium metal polymer technology) strikes a major partnership with a carmaker that would enable it to take the wind out of China's sails.

Today's winners will be the winners of tomorrow

To conclude, we believe that today's winners will be the winners of tomorrow: they have the means to finance their transition and neither their resources nor their attention are diverted by short-term profitability concerns. Toyota and Hyundai are set to come out on top.

Company Profiles : Reviewing tomorrow's players

BMW AG

- Our friend from Munich

DaimlerChrysler AG

- There more than just "HEMI inside"?

Fiat SpA

- The Italian patient

Ford Motor Company

- Anyone want to be CEO?

General Motors Corp.

- A stop sign at every turn

Honda Motor Company

- Toyota's younger, smaller brother

Hyundai Motor

- The morning dawn rises to the challenge

Nissan Motors Co.

- Back from the dead but what's next?

Porsche AG

- All in the Family

PSA-Peugeot-Citroën

- Is PSA destined to go it alone?

Renault SA

- Nissan's other half

Toyota Motor Corp.

- Zeronize & Maximise: the Sector Benchmark

Volkswagen AG

- Will Dr Bernhard have the time he needs?

Summary of sector data

All data relate to FY 2004	Country	Price €	Nb of shares (millions)	Market Cap (€b)	Automotive Revenues (€b)	DNA	Ebita	Capex	R&D	Nb of car produced ('000)
BMW	Germany	38.3	667	25,627	42,544	2,672	3,333	3,226	2,818	1,142
DaimlerChrysler (1)	Germany	42	1,013	42,721	98,530	6,080	3,688	6,400	5,658	4,020
Fiat	Italy	6.9	1,256	8,766	20,356	945	-840	1,345	990	2,000
Ford	USA	7.1	1,831	13,793	118,656	5,161	-177	5,081	5,968	6,617
General Motors	USA	23.2	565	12,866	129,824	6,927	1,828	5,874	5,242	8,222
Honda	Japan	47.6	927	44,019	51,800	2,088	3,365	3,459	4,326	2,913
Hyundai	South Korea	60.6	263	16,245	39,476	1,253	2,122	2,636	1,241	2,989
Nissan	Japan	9.2	4,379	40,783	60,764	2,598	5,742	3,491	2,962	3,034
PSA	France	56	243	13,468	45,239	1,975	1,300	2,263	2,263	2,890
Porsche	Germany	606	18	10,529	6,185	525	1,034	900	433	91
Renault	France	76.2	285	21,399	36,560	2,752	1,433	3,308	1,961	2,447
Toyota	Japan	37.9	3,610	123,831	127,201	5,612	10,806	8,643	5,617	6,883
Volkswagen	Germany	47.4	399	18,991	80,253	6,798	1,037	7,047	4,296	4,475
Sector Average	---	---	---	*393,037*	*857,389*	*45,386*	*34,670*	*53,672*	*43,775*	*47,725*

Source: Companies, estimates and restatements by CM-CIC Securities / ESN. (1) MCG and Chrysler only.

Data per vehicle produced

All data in € per unit produced (2004)	Revenue	EBITA	Capex	R&D	Market Cap	Nb of car produced ('000)
Porsche	68,004	11,366	9,895	4,760	115,757	91
BMW	37,253	2,918	2,825	2,468	22,439	1,142
Nissan	20,025	1,892	1,151	976	13,440	3,034
Toyota	18,480	1,570	1,256	816	17,990	6,883
Honda	17,782	1,155	1,187	1,485	15,111	2,913
DaimlerChrysler (1)	24,509	917	1,592	1,407	10,627	4,020
Sector Average	*17,965*	*726*	*1,125*	*917*	*8,236*	*3,671*
Hyundai	13,207	710	882	415	5,435	2,989
Renault	14,939	586	1,352	801	8,744	2,447
Peugeot	15,656	450	783	783	4,661	2,890
Volkswagen	17,932	232	1,575	960	4,243	4,475
General Motors	15,789	222	714	638	1,565	8,222
Ford	17,933	-27	768	902	2,085	6,617
Fiat Auto	10,177	-420	672	495	4,382	2,000

Source: Companies, estimates and restatement by CM-CIC Securities / ESN. (1) MCG and Chrysler only.

BMW AG

Number of vehicles produced (*millions*)	1.1
Global market share	1.9%
% of non-ICE models	ND
Market share in non-ICE rear-wheel drive vehicles	n.s.
R&D budget (€ billions)	2.8
Estimated R&D for non-ICE technologies	<2.5%
Number of partly alternative models	0
Proportion of Diesel (Europe)	~48%
CAFE USA (average)	24.2
Market Cap. (€ billions)	26
EBITA / unit sold (€)	2,913
EBITA as % of sales	7.8%
(ROCE/Wacc x CE) – Liabilities (€ billions)	29
Reuters:	BMWG.DE
Bloomberg :	BMW GY

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Our friend from Munich

Even if BMW does not shout it out for all to hear, we suspect that consumption reduction is not this automaker's main priority. In view of its engine mix and the existence of an *M-Technik* department (like AMG for Mercedes), BMW cannot make any claims to the title of cleanest car manufacturer. That said: 1) its technical developments (diesel and hydrogen liquid), 2) the exemplary management of its range (and its strong capacity to generate cash), as well as 3) its respect for third parties (suppliers and employees) go a long way to painting a better picture of the not so environmentally-friendly car maker than what we see at first glance. Without doubt, the group is one of the most sound car manufacturers in the sector.

Brands (light vehicles): BMW, Mini and Rolls-Royce.

Alternative key models: Designs: BMW 750h - Clean Energy (HL for ICE), X5 Efficient Dynamics (HV)

According to the group, it has reduced CO2 emissions by 25% from the fleet marketed every year between 1990 and 2005. In its annual report, BMW underlines the ACEA's voluntary commitment of a target of 140g/km (or -25% vs. 1995 levels); the car manufacturer says that it will take part in reducing CO2 emissions (although it has not disclosed the size of its contribution). The reduction in its mix (development towards the lower end with the Mini and the Serie-1) as well as the high proportion of diesel vehicles (345k or 48% of total sales in Europe) automatically bring an improvement to the group's average emission levels seen five years ago. BMW seriously thinks that its developments in hydrogen liquid (see recent interventions of R&D director Professor Burkhard Göschel) and in HVs will provide a credible alternative by 2010. In 2020, BMW estimates that one quarter of registered vehicles could run on hydrogen (FC, FCHV and ICE – HL). This will all depend on the speed of the rollout of the HL distribution infrastructure.

Strength(s): 1) Brands and pricing power (ARP = EUR37,253 or number two behind Porsche); 2) Strong cash generation and share buybacks; 3) Flexible and saturated production system; and 4) Its HL technology could be used for the ICE, which is not a fuel cell; BMW could have a medium term hybrid (see X efficient Dynamics).

Weakness(s): 1) High sensitivity to the dollar which can be corrected in the short term by hedging, in the medium term by offshoring purchases and in the long term by re-balancing production.

Next big step: Succession planning for CEO Helmut Panke (aged 59, in his position since 2002 and leaving in two years) goes as smoothly as his own (for J. Milberg).

Overall rating:

DaimlerChrysler AG

No. of vehicles produced (*millions*)	4.0
Global market share	6.7%
% of non-ICE models	<0.25%
Market share in non-ICE rear-wheel drive vehicles	ND
R&D budget (€ billions)	5.7
Estimated R&D for non-ICE technologies	<2.5%
Number of partly alternative models	« 1 »
Proportion of Diesel (Europe)	~57%
CAFE USA (average)	26.3
Market Cap. (€ billions)	43
EBITA / unit sold (€)	917
EBITA as % of sales	3.7%
(ROCE/Wacc x CE) – Liabilities (€ billions)	36
Reuters :	DCXG.DE
Bloomberg :	DCX GR

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Is there more than just "HEMI inside"?

Leaving aside the HEMI and its unexpectedly powerful marketing pull for Chrysler as well as the group minor collaborative relationships with VW (SynFuel) and GM and BMW (FCX), DCX is lagging behind as far as alternative powertrains are concerned. The group must have been busy elsewhere, because it has made a number of stop-starts over the past ten years (Chrysler, the PL, then MCG). For MCG, fuel savings are not exactly on the cards, and Chrysler is counting on MCG's diesel expertise to make its products environmentally-friendly in the NAFTA zone.

Brands (cars): Mercedes, Smart, Maybach, Chrysler, Dodge and Jeep.

Key alternative models: FC: NECAR, Class A F-Cell, Hermes Sprinter, Jeep Commander (none in serial production as yet)

Emissions reductions are not MCG's number one priority. Obviously, each new generation of cars has a more environmentally-friendly engine than the last, but even then the smallest Mercedes (Class-A 160Cdi) launched in Europe only goes under the 140g/km threshold in the version equipped with a CVT gearbox. This is probably part of the group's philosophy: the Mercedes division makes legendary cars such as the Mercedes-McLaren SLR, which emits 348g/km, or the Class G 55 AMG, which emits 392g/km. The group is conducting research into alternative vehicles such as the NECAR, the F600 or the Class A F-Cell, of which 60 last generation units are currently being tested in Europe. To be fair, mention must be made of the efforts already made by the group and of the virtues of the down-sizing drive launched in 1998 with the Smart urban micro-car.

Relatively speaking, the situation is more favourable for Chrysler. MDS-enhanced HEMI engine technology (which modulates the number of active cylinders depending on the vehicle's power needs) contributes a lot to Chrysler's image. Chrysler is also seeking to promote diesel in North America with technological assistance from its European sister company via concept cars such as the Jeep Patriot and Compass and serial models such as the Dodge Ram.

Strength(s): 1) A relatively healthy balance sheet (cash>0) and social commitments are "under control"; 2) Dieter Zetsche, who saved Chrysler from going under, will replace Schrempp as CEO in 2006; 3) MCG's perceived quality improvement and line-up expansion will enable it to benefit fully from market bi-polarisation.

Weakness(es): 1) Smart is moving away from break-even and looking for "a solution"; 2) Chrysler continues to be at the mercy of GM as far as incentives are concerned.

Next big step: For Zetsche: to match his past performance at Chrysler when he takes the helm of the group.

Overall rating:

Fiat SpA

No. of cars produced (*millions*)	2.0
Global market share	3.2%
% of non-ICE models	ND
Market share in non-ICE rear-wheel drive vehicles	0
R&D Expenses (€ billions)	1.0
Estimated R&D for non-ICE technologies	< 1%
Number of partly alternative models	0
Diesel share (European range)	35%
CAFE USA (average)	15.3
Market Cap. (€ billions)	8.8
EBITA / unit sold (€)	– 420
EBITA as % of sales	– 4.1%
(ROCE/Wacc x CE) – Liabilities (€ billions - average 05e/07e)	8.5
RIC:	FIA.MI
Bloomberg :	F IM

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The Italian patient

Sergio Marchionne has taken over the reins of Fiat Group (May 2003) but is struggling to delegate and stabilise management (the group has been without a CFO since Q2-2005, H. Demel former COO of Fiat Auto left a year ago). Clearly, Fiat Auto (and hence Fiat SpA) is not yet out of the woods. 2006 will be a decisive year as the Grande Punto (350k units) - the first "last chance" model, will be available throughout the full year and Stilo 2 (2nd last chance) is to arrive towards the end of the year. At Fiat Auto, no holds have been barred when it comes to efforts to obtain greater optimisation and raise activity levels. It is not surprising therefore that strategic investment in alternative technology is not a priority: the Auto division does not have the resources (financial or human), and needs to concentrate on more pressing issues.

Brands operated (light vehicles): Fiat, Alfa Romeo, Lancia, Maserati and Ferrari.

Key alternative models: prototypes: Punto Natural Power (GN), Seicento Elettra (FC), Punto "Stop & Start", Panda Hydrogen and EcoDriver (no prototype yet for a hybrid GMP).

Emphasis on the mix. Because most of its volumes are generated in small A/B/C segments and its strong European exposure (which implies high diesel levels), Fiat Auto is very careful when it comes to emissions. Presently, the group's resources are mostly dedicated to other tasks including launching good products through the correct channels (private client base rather than short dated fleet) and a good mix. Remember that two years ago the group launched its new multijet engines (1.3l D in 2003 which reduced consumption by 10% in relation to the previous generation and reduced emissions by 50%). The *Centro Ricerche Fiat* has a high level of technical expertise (we should not forget that direct injection was invented by Fiat) and are finalising a number of innovations (FC, HV, GN and gas circulation modules) but this has not resulted in any concept cars of late nor has there been a HV (or FC) marketing-related project.

Strengths: 1) A leader with high profitability in Brazil; and 2) as a semi low-cost provider, Fiat Auto currently has revenue problems and not cost problems; 3) Excluding Fiat Auto … the conglomerate is doing well (Comau, Iveco)!

Weaknesses: 1) A serious revenue problem (the market is ignoring its products).

Next big step: Install Grande Punto and successfully complete the launch of Stilo II (2006)

Overall Rating:

Ford Motor Company

Number of vehicles produced (*millions*)	6.6
Global market share	10.6%
% of non-ICE models	<0.25%
Market share in non-ICE rear-wheel drive vehicles	<5%
R&D budget (€ billions)	6.0
Estimated R&D for non-ICE technologies	[2.5%;5%]
Number of partly alternative models	1
Proportion of Diesel (Europe)	~50%
CAFE USA (average)	26.0
Market Cap. (€ billions)	14
EBITA / unit sold (€)	-27
EBITA as % of sales	-0.1%
(ROCE/Wacc x CE) – Liabilities (€ billions)	5
Reuters:	F
Bloomberg :	F US

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Anyone want to be CEO?

William Clay Ford III seems to be faltering when it comes to turning around his great-grandfather's legacy. He has already tried wooing Carlos Ghosn and Dieter Zetsche, but these two eminent CEOs had other tasks on their plate. Although its earnings are lower than GM's, Ford enjoys two relative advantages: Ford's social commitments are much less of a drain than GM's, and it has an entire battalion of prestigious premium models at its disposal – the PAG. Somehow though, the group is having problems getting the most out of its premium product portfolio (Jaguar is still losing money).

Brands (cars): Ford, Lincoln, Mercury, Mazda, Volvo, Jaguar, Land Rover and Aston Martin.

Key alternative models: Full Hybrid: Ford Escape (2005) and Mercury Mariner Hybrid (2006). FC: Ford Focus FCHV, Ford Focus FCV and Ford P2000 (H-FC), Ford Focus FC5 and Mazda Primacy (Methanol FC).

Ford has launched a number of hybrids over the past 18 months. Its Escape model, for example, sells at USD2,500-2,700 above the price of the pure ICE version. We are not aware of the exact volumes shifted, but we estimate them at several thousand since the car was first put to market. Ford probably sold 2,000-3,000 hybrids last year, and will probably sell less than 10,000 this year. Next year's scheduled launch of the Mercury Mariner hybrid should see hybrid sales reaching 10,000 to 15,000 units. Compared with Toyota and Honda, Ford is now five years behind (which is better than can be said for most of its competitors). That said, Ford has recently set a goal of increasing hybrid production 10-fold by 2010 to 250k p.a. The company is also moving on ethanol (E85) with a goal of boosting global flex-fuel production to as high as 280k units in 2006.

Strength(s): 1) FMAC's robust health.

Weakness(es): 1) Social commitments (170,000 pensioners costing USD730/unit); 2) a lack of innovation and the burden inherited with Visteon (Ford has taken over 24 sites and 17,400 employees of this former subsidiary); 3) not much in the way of fat left to shed (few disposal-eligible assets left except for the prestigious but not very lucrative PAG)

Next big step: renegotiate the UAW labour agreements (like GM) and speed up the pace of Jaguar's recovery in particular and that of the Premier Automotive Group in general.

Overall rating:

General Motors Corp.

Number of vehicles produced (*millions*)	8.2
Global market share	14%
% of non-ICE models	<0.25%
Market share in non-ICE rear-wheel drive vehicles	n.s.
R&D budget (€ billions)	5.2
Estimated R&D for non-ICE technologies	<2.5%
Number of partly alternative models	0
Proportion of Diesel (Europe)	~48%
CAFE USA (average)	26.5
Market Cap. (€ billions)	13
EBITA / unit sold (€)	222
EBITA as % of sales	1.4%
(ROCE/Wacc x CE) – Liabilities (€ billions)	7
Reuters:	GM
Bloomberg :	GM US

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A stop sign at every turn

GM is navigating choppy waters now and cannot afford to be distracted by environmental concerns. Its key challenge is to reduce its colossal social commitments (USD1,200 per vehicle) by forcing the UAW to revise labour agreements and make sizeable concessions. Otherwise, GM could follow in the wake of former components subsidiary Delphi and file for Chapter 11 bankruptcy protection.

Brands (cars): Olden, Opel, Vauxhall, Saab, Chevrolet, Pontiac, Buick, Cadillac, GMC, Oldsmobile, Saturn and Hummer.

Key alternative models: Full Hybrid: Chevy Tahoe and GMC Yukon, (2007), Saturn, VUE and GMC Hybrid Truck. FC Concept-Cars: HY-Wire, AUTOnomy, Hydrogen 3 and Sequel.

GM has a plethora of technological partnerships, but these are bringing little in the way of hard economic benefits. GM has partnerships with Toyota Suzuki (FC) and BMW (liquid hydrogen) as well as with oil companies and high-tech outfits (*Quantum* and *Hydrogenics*). Despite these high profile partnerships, the first batch of mass produced vehicles will not be rolling off the production lines until 2007. Yet again, GM has let itself be overtaken by its competitors (Ford, Nissan and Toyota) in the hybrids segment; as far as FC vehicles are concerned, suffice it to say that these will probably never see the light of day (as with most of GM's competitors' FC vehicles).

GM is facing stop signs at every turn: market share loss in the US (800bp in ten years - a record high in the US auto market); declining product attractiveness; marginal effectiveness of negative "incentives" (already high at the outset at USD2,200 per unit, they rose at triple the rate of universal challenger Toyota's to reach almost USD4,000 in 2004); and above all else, social liabilities that have become unmanageable, well above the group's unit margins. We refer here to pension costs (approximately USD300/unit) and healthcare costs (approximately USD900/unit). Nine months ago Wagoner tried like his colleagues at Ford and Chrysler to transfer a portion of the group's healthcare costs to the State. All three were amicably rebuffed by George W. Bush. The recent agreement with the UAW could be a beacon of hope for reducing social costs.

Strength(s): 1) GMAC is in robust health (but might be spun off after the UAW agreement).

Weakness(es): 1) Social commitments (450,000 pensioners costing USD1,200/unit); 2) a lack of innovation and the Delphi legacy (purchases via Delphi add USD400/unit in costs for GM).

Next big step: Succeed in renegotiating the UAW agreements to restore competitiveness (the recent agreement is a good first step).

Overall rating:

Honda Motor Company

Number of vehicles produced (*millions*)	2.9
Global market share	5.1%
% of non-ICE models	0.9%
Market share in non-ICE rear-wheel drive vehicles	~15%
R&D budget (€ billions)	4.3
Estimated R&D for non-ICE technologies	2.5-5%
Number of partly alternative models	4
Proportion of Diesel (Europe)	n.d.
CAFE USA (average)	31.0
Market Cap. (€ billions)	44
EBITA / unit sold (€)	1,155
EBITA as % of sales	6.5%
(ROCE/Wacc x CE) – Liabilities (€ billions)	38
Reuters:	7267.T
Bloomberg :	7267 JP

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Toyota's younger, smaller brother

Although Honda has its fingers in other pies (only 80% of its sales are automotive), its profile resembles that of Toyota (low cost and flexible). The difference lies in Honda's high-tech image (Asimo) and its trend-setting appeal (maybe because it also makes motorbikes). Honda has everything it should take to challenge Toyota, but its mix and pricing-power are dragging it down (its average turnover per unit is 7-8% below that of Nissan and Toyota): this probably explains its lower margins (6.5% of sales).

Brands (cars): Honda, Acura.

Key alternative models: Accord, Civic, Insight (HV), FCX (FC)° Design stage and others: Kiwami (FC, 2003).

Honda is a credible number two in hybrids and a credible number one in FC vehicles. The following were some of the arguments put forward by Honda two years ago regarding the relative merits of the Civic Hybrid over the gasoline-only Civic (US version): 30% fuel savings; 30% reduction in CO2 emissions; 41% less CO emissions and 89% less NOx emissions. That would suggest that Honda is Toyota's successor-in-waiting in the HV sector. Last year, the group sold around 25,000 units (all models) and hopes to shift just under 50,000 this year in North America.

FuelCell, Hybrids and Pick-Ups? Honda is counting on FuelCell vehicles making the difference. The first batch of FCX vehicles has already been sold in California with the help of the State government. The group is not yet making money on these vehicles. It was only very recently that Honda caught up in the SUV segment with the launch of the Ridgeline FS pick-up in North America, just at the very time when consumers are showing signs of backing away from this type of product. A hybrid Ridgeline might not be a bad idea, but we are unaware of any such project in the pipeline in the medium-term.

Strength(s): 1) A low-cost provider with six main platforms, of which two (Civic and Accord) generate just under two-thirds of sales (Accord and Civic); 2) Trend-setting appeal and high-tech image (motorbikes and Asimo)

Weakness(es): 1) Late arrival on the US light trucks market; 2) weaker pricing-power/mix than Nissan and Toyota; and 3) its small size could see it looking for a partner or a merger (though thus is not Honda's style).

Next big step: Full-scale launch of the FCX following the marketing campaign conducted with the CARB and the Californian government.

Overall rating:

Hyundai Motor

Number of vehicles produced (*millions*)	3.0
Global market share	5.6%
% of non-ICE models	<0.5%
Market share in non-ICE rear-wheel drive vehicles	<2.5%
R&D budget (€ billions)	1.24M€ *(1)*
Estimated R&D for non-ICE technologies	~43%
Number of partly alternative models	1 à 2
Proportion of Diesel (Europe)	
CAFE USA (average)	26.5
Market Cap. (€ billions)	16
EBITA / unit sold (€)	710
EBITA as % of sales	5.4%
(ROCE/Wacc x CE) – Liabilities (€ billions)	23
Reuters:	005380.KS
Bloomberg :	005380 KR

(1) Nearly EUR2.6bn with Kia

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The morning dawn rises to the challenge

Hyundai Motor Corp (HMC) is no longer the laughing stock of the industry: the quality of its output is fast improving and its MCAP has soared seven-fold in six years. At the sales end, the group has gained 160bp in global penetration since 2000. HMC is going into overdrive at the manufacturing and sales ends, with two new auto-plants opened in India and the Czech Republic. Perhaps its most spectacular leap forward came with its 11th place ranking in the 2005 IQS survey: the group now has respectability credentials to match its new status.

Brands (cars): Hyundai, (Kia, 47% stake).

Key alternative models: Click/Getz (HV). Design stage: Santa Fe and **Tucson** (SUV - FC). Partnerships with Texaco and UTCFC.

Despite some lofty declarations of good intentions, HMC has yet to unveil a standard bearer for HV technology. The Click Getz has already been sold to the Korean government (200 units in 2004), and may well be launched nationally in 2007. Like many of its peers, HMC prefers to focus attention on the Fuel Cell engine, which it says it will be fitting Tucson SUVs starting in 2010. HMC was one of the beneficiaries of the Bush administration's Fuel Cell Budget (USD350m for HMC's pool).

Hyundai's sales outside Korea have been rising by 8.5% a year over the past five years. Like the Japanese just before their heyday, HMC entered via the back door and lost no time in mastering the rules of the game. HMC now has four production plants outside Korea and its sales are very well spread out geographically: a quarter in Korea, a quarter in the US, a fifth in Europe, and no less than 15% in China and India. In China, the group is not far off the 8% market share mark, just behind Honda and Shanghai GM. In Europe, HMC has risen in the space of less than five years from 0% to 43% dieselisation, or just below the market average (48%).

Strength(s): 1) A low-cost provider that has merged its R&D (cumulative total USD3bn) with that of Kia (HMC has a 47% stake in Kia); 2) A very strongly perceived and real improvement in quality (JD Powers IQS score 111 vs. 118 market average); and 3) Fast adaptation to a changing market.

Weakness(es): 1) Payroll costs are rising fast in Korea, and HMC is still a small fish in the global sea; 2) HMC lacks a premium model (but there might be one in the pipeline?); 3) The Korean market is becoming highly competitive, and HMC faces competition from other players entering the budget car market (Dacia, *et al*).

Next big step: Launch of a premium brand by 2010.

Overall rating:

Nissan Motors Co.

Number of vehicles produced (*millions*)	3.0
Global market share	5.0%
% of non-ICE models	ND
Market share in non-ICE rear-wheel drive vehicles	<2.5%
R&D budget (€ billions)	3.0
Estimated R&D for non-ICE technologies	<2.5%
Number of partly alternative models	0
Proportion of Diesel (Europe)	~38%
CAFE USA (average)	25.6
Market Cap. (€ billions)	41
EBITA / unit sold (€)	1892
EBITA as % of sales	9.4%
(ROCE/Wacc x CE) – Liabilities (€ billions)	53
Reuters:	7201.T
Bloomberg :	7201 JP

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Back from the dead but what's next?

The story of Nissan Motor, the erstwhile tortoise of the car industry that mutated into the industry's new rising star, hardly needs retelling. With "NRP" and "180" already old hat, Nissan is now well into its third revitalisation plan, this time called "Value Up". The plan is to boost sales and enhance the competitive position of Nissan's Infiniti premium model. Nissan has never made any bones about its "economic hostility" to hybrids: as its CEO said, the USD4,500 price gap is not something consumers are ready to swallow yet. Like HMC, Nissan is looking at skipping a generation to the next step: Fuel Cells.

Brands (cars): Nissan, Infiniti.

Key alternative models: Altima Hybrids (2006). The group is putting (almost) all its eggs in its CVT technology basket. FC car concept: X-Trail.

Nissan is about to launch a hybrid car under duress. The group has repeatedly voiced its hostility to hybrids, but is going to launch a hybrid model in March 2006 so as to meet the CARB requirements. Nor is that stopping it from continuing to extol the virtues of its XTRONIC CVT (variable drive). Nissan says that putting a million CVT-equipped SULEV vehicles on the market (its target for 2007/2008) would be carbon-equivalent to 200,000 HEVs.

Alternative powertrains are something that Nissan would rather keep quiet about. Let us just say that for the moment, Nissan is in the same club as PSA and Volkswagen in seeking to demonstrate that the good old ICE still has a long life ahead of it. Of the 28 vehicles due to be put to market as part of the *Value Up* plan, we understand that only one will be a hybrid. As far as Fuel Cell technology is concerned, we are only aware of one prototype to date, the X-trail FCV.

Strength(s): 1) A low-cost provider that enjoys synergies derived from its alliance with Renault; 2) a draconian management approach whereby a vehicle is only put to market if it will be earnings-positive immediately; 3) the Infiniti model offers good potential for capturing market share in the premium segment (Toyota recently imitated Nissan's strategy: a sign of the times?) in a bi-polarised market context.

Weakness(es): 1) Little scope for improvement in volumes, ROS and ROCE, given the improvements already achieved; 2) Nissan is an atypical creature and may become prone to "managerial and stock market schizophrenia" if it takes too long to merge with Renault; 3) the issue of how to integrate a third partner into the alliance.

Next big step: Can the CEO successfully manage the group while straddling two horses galloping ahead at full tilt?

Overall rating:

Porsche AG

Number of vehicles produced (*thousands*)	91
Global market share	0.13%
% of non-ICE models	0
Market share in non-ICE rear-wheel drive vehicles	0
R&D budget (€ billions)	0.4 *(est.)*
Estimated R&D for non-ICE technologies	<2.5%
Number of partly alternative models	0
Proportion of Diesel (Europe)	0%
CAFE USA (average)	21.5
Market Cap. (€ billions)	10.5
EBITA / unit sold (€)	11,366
EBITA as % of sales	16.7%
(ROCE/Wacc x CE) – Liabilities (€ billions)	9.5
Reuters:	PSHG_P.DE
Bloomberg :	POR3 GY

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All in the family

Aside from its impressive cash generation, which means it has the most financial leeway in the sector, Porsche is not a true SRI-EFI-oriented vehicle. Its products have the second lowest CAFE in the sector, no diesel versions are available, and dividends are nothing to write home about (POR ~10%; yield <1%). Only preferred shares are listed. The recent stake acquired in Volkswagen has less to do with progress in the sense of German capitalism and more to do with the ruling hand of F. Piëch (family spokesperson). No real worries as regards the company's environment, either in terms of pollution or shareholders.

Brands operated (light vehicles): Porsche.

Key alternative models: None. A concept car like Audi's Hybrid Q7 SUV is expected to be on the market shortly (Geneva or Paris in 2006).

The group has never been interested in diesel but could bring a hybrid vehicle to market within five years. Porsche's profitability really took off with the arrival of CEO Wendelin Wiedeking (1993) and the launch of the Boxster, marking its first "100% Porsche" diversification. Since then, the group has put out three other product lines, Cayman S, Carrera GT and most importantly Cayenne. This SUV was jointly developed and is jointly manufactured with Volkswagen. But Porsche's legendary sporty image still dominates ("never very far from the race course"): performance without compromise. This means that diesel is unlikely to (ever?) enter the doors of its Zuffenhausen and Leipzig factories. However, a Cayenne-based hybrid model is expected to come on the market within five years, but it should be a relatively tame version with an electrical engine of less than 50hp or ~10/11% of the total power of the future hybrid.

Strengths: 1) A virtually unequalled brand image (ARU of EUR68k) and outstanding profitability; 2) one of the first to benefit from market bipolarisation given its size; and 3) R&D savings of EUR1bn targeted on its next three electronic platforms, following extended cooperation with Volkswagen

Weaknesses: 1) Not a possible takeover target: only the preferential shares are listed and the voting rights are all in the hands of the founding family. 2) Poor corporate governance including a total absence of concern for minority shareholders (i.e. 18.53% stake in Volkswagen which made no sense whatsoever - economically nor technically).

Next big step: Launch of the four-door coupe, *Panamera*, in 2009.

Overall rating:

PSA-Peugeot Citroën

Nb of cars produced (millions)	2.9
Global market share	5.1%
% of non-ICE models	ND
Of which on non-ICE	0
R&D Expenses (€ billions)	2.3
Estimated R&D for non-ICE technologies	< 2.5%
Number of partly alternative models	0
Diesel share (European range)	51%
CAFE USA (average)	n.a.
Market Cap. (€ billions)	14
EBITA / unit sold	450
EBITA as % of sales	2.9%
(ROCE/Wacc x CE) – Liabilities (€ billions - average 05e/07e)	18
RIC:	PEUP.PA
Bloomberg :	UG FP

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Is PSA destined to go it alone?

Things seem to have been running very smoothly since Mr. Folz took the reins of the French carmaker. PSA is the only non-Asian group to have gained market share in Western Europe: its penetration rate in Europe has improved by +250% since 1999. PSA has generated cash at all points of its past cycle which it has regularly returned to its shareholders (via share buyback programmes and dividends). How much has the regular innovation and promotion of more sober (Hdi) and/or cleaner vehicles (FAP) contributed to this? Significantly it seems, but these are also well designed and well priced vehicles with an established client base. But are they prepared for the next phase?

Brands operated (light vehicles): Peugeot and Citroën.

Key alternative models: Partner, Berlingo, Jumper, Boxer and C3 NGV+Essence; Concept: Quark (FC).

Diesel, FAP StopandStart and NG. PSA is interested in NG and has just signed (alongside Renault) an agreement with the French government and sector members to make natural gas an attractive alternative fuel for all vehicles by 2010. Under this agreement, PSA would produce the 100,000 vehicles targeted for 2010 (50% PSA and 50% Renault?). The other partners will develop the necessary infrastructure. Two distribution methods have been selected: a filling apparatus for home use and NG stations located at gasoline stations with 300 stations targeted by 2010. Folz is clearly a supporter of combined diesel (the "alterno-starter" and/or Particle filter) and Gasoline/CNG solutions that are just as good as hybrid vehicles, to which it, like Renault, is fiercely opposed. The Quark concept (FC) appears to be the only available long-term "concept-solution". Diesel could serve as a spring board for the group in the US, if this fuel succeeds in gaining a cleaner image in American consumers' minds. Having noticed this, we feel that the group will have to establish a partnership if it wishes to develop FC/H2 in a credible manner. And what about a partnership with Honda? We think that this is something to watch.

Strengths: 1) A low-cost provider that unlocks value for the shareholder through strong and regular cash generation and share buy back programmes; 2) Diesel technologies (Hdi/TDci + Soot filter); 3) Excellent skills in scaling projects (Mercosur and China) and smooth cycles (balancing launches between two brands).

Weaknesses: 1) No global clout; 2) No growth drivers in India; and 3) no credible long-term solutions for non-ICE powertrains.

Next big step: 1) Speeding up presence outside Western Europe; 2) Signing an "extended" partnership?

Overall rating:

Renault SA

Nb of cars produced (millions)	2.4
Global market share	3.9%
% of non-ICE models	ND
Of which on non-ICE	n.s.
R&D Expenses (€ billions)	1.9
Estimated R&D for non-ICE technologies	< 2.5%
Number of partly alternative models	1
Diesel share (European range)	~56%
CAFE USA	n.a.
Market Cap. (€ billions)	21
EBITA / unité vendue (€)	586
EBITA en %age du CA	3.9%
(ROCE/Wacc x CE) – Liabilities (€ billions - average 05e/07e)	24
RIC:	RENA.PA
Bloomberg :	RNO FP

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Nissan's other half

Renault ("-Nissan") is still something of a "strange two-headed animal" but which is currently one of the three most profitable carmakers in the world. Cooperation between the two is very wide-ranging now (purchases, R&D, plants …) and as the two entities have the same CEO, there is no longer any valid reason to maintain two listed vehicles and lock value for Renault's shareholders. Regarding technological innovation, the group seems to be catching up (new generations of diesel and CNG) but remains furiously opposed to HEV for which Carlos Ghosn says he does not currently see any credible business-case: consumers are not identifying enough value in HEV that they are prepared to pay for.

Brands used (light vehicles): Renault, Samsung and Dacia.

Alternative key models: Kangoo Clean Energy Range (2004/2005) – LPG, CNG (end of 2004) and electric power. Logan NG (2006^{e}). Concepts; Pangea (197), Koleos and Modus (2000) for the HVs.

Renault-Nissan has flourished in the past decade which can be explained by the success of an impeccable model offering everywhere it operates. But we feel that Renault is having trouble finding a second wind for the products which made its success in segments A and B. On the alternative front, the last two "concept-cars" (*Zoe* and *Egeus*) did not use an alternative engine, which is disappointing for a "Créateur d'Automobiles" (Renault) coupled with a technician (Nissan). The group's latest innovations show for example: 1) the new Diesel 2l (from the development of the Alliance) which until its 150ch version may pass the Euro IV standard without a particle filter; and 2) developments in natural gas (CNG) vehicles since the signing of a protocol with a series of partners (including PSA) for the production of 100k vehicles (to be shared between PSA and Renault) by 2010. Today the group's range is amongst the most efficient in the market given its product mix (small-size engines / A, B and C segment accounting for 75% of the range) and geographical mix (56% of the European range is diesel). We think that the Alliance has sufficient means to allow Renault to explore other fields than ICE-fossil fuels (H2, FC).

Strength(s): 1) Alliance with Nissan; 2) "Low-cost provider"; 3) "Logan" world car; and 4) Track record of an exemplary CEO.

Weakness(s): 1) Entry-level strategy to be redefined while product momentum soars; and 2) Keeping two listed vehicles for social (pride of employees) or even national (France vs. Japan) sensitivities is not really the most efficient way forward for the shareholder

Next big step: 1) Simplification of legal structures; and 2) Return to NAFTA?

Overall rating :

Toyota Motor Corp.

Number of vehicles produced (*millions*)	6,9
Global market share	11.6%
% of non-ICE models	~2%
Market share in non-ICE rear-wheel drive vehicles	~85%
R&D budget (€ billions)	5.6
Estimated R&D for non-ICE technologies	5 / 10%
Number of partly alternative models	10
Proportion of Diesel (Europe)	~36%
CAFE USA (average)	30.8
Market Cap. (€ billions)	137
EBITA / unit sold (€)	1,570
EBITA as % of sales	8.5%
(ROCE/Wacc x CE) – Liabilities (€ billions)	121
Reuters:	7203.T
Bloomberg :	7203 JP

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Zeronize & Maximise: the Sector Benchmark

Over the past five years, Toyota Motor has been one of the automotive industry's star performers in terms of market share capture, placing it ahead of Hyundai. Toyota's high margins, huge production facilities (the group is the world's second largest carmaker, alongside GM in first place and Ford in third) and hitherto excellent strategic vision should see the group move to number one position worldwide over the next five years on volume and perhaps margins too (the group is number two or three behind Porsche and Nissan).

Brands (cars): Toyota, Lexus, Scion and Daihatsu.

Key alternative models: HV = Prius, RX400h (a new model based on the GS450h coach concept was recently unveiled in Tokyo). Other alternative vehicles: Harrier, Kluger, HighLander, Estima, Alphard, Crown Royal Sedan, Dyna and Toyace

Toyota created the "alternative" market with Prius. The group launched the Prius, its first mass produced hybrid vehicle, back in 1997. This was a landmark event insofar as the Prius was neither a replacement model nor an environmentally-friendly version of an existing car. It took Toyota three years to establish a customer base, three years during which only 60,000 units were sold. Sales began to pick up in 2000, with 38,000 units shifted in that year alone. By 2003, that number had risen to more than 50,000. By the end of 2004, cumulative sales of hybrid models had reached almost 350,000 units, with Prius cars accounting for the bulk of this impressive number.

A million HV a year by 2010? Toyota will probably breach the one million mark in total cumulative sales by 2008. But one million hybrid vehicles *a year* would be equivalent to 11-12% of Toyota's total annual output, requiring at least four high volume models (Prius is likely to peak at 350,000 to 400,000 units a year, or triple the 2004 output).

Strength(s): 1) Toyota has been the instigator of most process innovations and many a product innovation over the past 20 years; 2) the group has not ruled out any form of technology; 3) Toyota puts long-term profitability ahead of immediate returns (the Prius model, for instance, is currently losing money).

Weakness(es): 1) an overly cosy relationship with its *kereitsu*; 2) Japanese-style governance prevails.

Next big step: The launch of the Lexus brand in Japan (probably including a hybrid version of the Lexus) in response to the bi-polarisation of the market along Premium / Access-Price lines.

Overall rating:

Volkswagen AG

Number of vehicles produced (*millions*)	4.5
Global market share	8.2%
% of non-ICE models	ND
Market share in non-ICE rear-wheel drive vehicles	n.s.
R&D budget (€ billions)	4.3
Of which proportion estimated for non-ICE technologies	< 2.5%
Number of partly alternative models	0
Proportion of Diesel (Europe)	~61%
CAFE USA (average)	24.4
Market Cap. (€ billions)	19
EBITA / unit sold (€)	232
EBITA as % of sales	1.3%
(ROCE/Wacc x CE) – Liabilities (€ billions)	19
Reuters:	VOWG.DE
Bloomberg :	VOW GY

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Will Dr Bernhard have the time he needs?

When Dr Wolfgang Bernhard took over the helm at Volkswagen, hopes were that major changes would soon follow. After all, Bernhard was Dieter Zetsche's right-hand man during the Chrysler turnaround. Bernhard is probably the right men for the job, but the market seems to be overestimating just how fast transformation can take place. Speed, though, is of the essence, because Volkswagen Brand Group's (VBG) product cycle is now in a down phase. On top of that, the group recently fell under the control of Porsche, now Volkswagen AG's top shareholder (18.53% of its voting rights). Beyond some major latent problems with governance, another fear is that F. Piëch stays on as head of the Supervisory Board – this could pose a problem for the group in its negotiations with IG Metall. As far as emissions are concerned, Volkswagen's expertise in the diesel field make it one of the industry's best performers despite a product mix that is not as favourable as PSA's.

Brands (cars): Volkswagen, Audi, Skoda, Seat, Lamborghini, Bentley and Bugatti.

Key alternative models: Concepts: Touran Mild-Hybrid; Golf Tdi Hybrid and Touran FC.

Volkswagen's base is in Europe and so its short-term focus is on diesel. Its dieselisation rate is probably one of the highest in Europe (Audi's is above 65%, Volkswagen's exceeds 60%): the group's average rate for cars in Europe was more than 55% in 2004 vs. the 49.5% market average. Volkswagen is working with DCX on developing a synthetic fuel (SunFuel by Choren), with production scheduled to start in 2006. The group is also looking at GTL and CTL fuel options. Like many of its peers, Volkswagen is shying away from embracing hybrids wholeheartedly (the group has the technology and has unveiled concept cars), preferring instead to focus on its latest ICE innovations (FS / TDIS with or without particle filters). Its other strategy involves postponing its FC projects in favour of a longer-term horizon (FC technology alone holds the key to a future technological breakthrough) without being specific as to timeframes. In the NAFTA zone, VW is set to become one of the key movers in diesel alongside DCX.

Strength(s): 1) a new management team with an unprecedented and colossal restructuring plan (EUR10bn, or more than EUR2,000/ vehicle!) and 2) strong pricing power (EUR18,000) among Mass-Market players

Weakness(es): 1) High costs; 2) clear problems with governance before and after Porsche took a stake; 3) VW's product offensive is over; 4) too many brands (what does the future hold for Seat?)

Next big step: Renegotiate agreements with IG Metall.

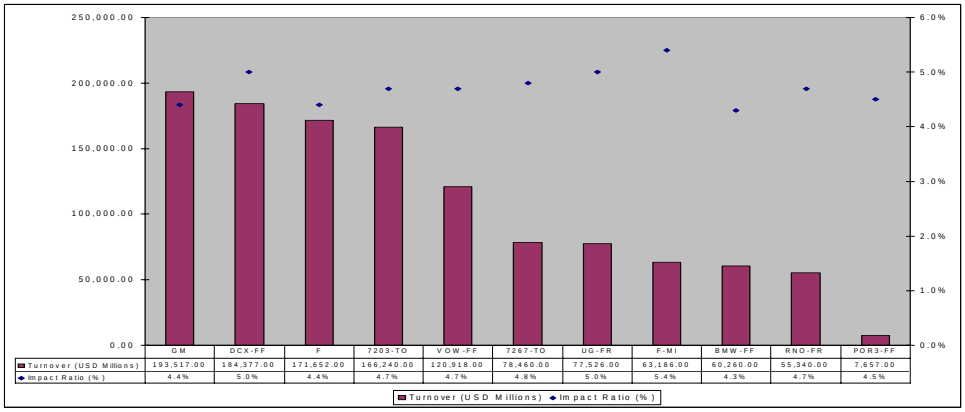
Overall rating:

Environmental Performance and Reporting in the Automotive Sector *(by Trucost)*

Introduction

The environmental performance of companies in the global motor manufacturing sector is set to become a key investment driver in the coming years. The automotive divisions of two of the biggest companies in the sector, General Motors and Ford, have reported significant losses in the current financial year-to-date, as the prospect of sustained high oil prices is changing the consumption and purchasing patterns of these companies' most profitable business line, the sports utility vehicle.

This has prompted some manufacturers to accelerate the launch of environmentally friendly fuel-efficient vehicles and raise the profile of fuel-saving technology. While this is to be welcomed from an environmental viewpoint, such a reaction ignores the significant environmental efficiency gains that may be made closer to home within the companies' own operations and their choices of suppliers. Investors and analysts will want to know not only how companies are altering their product lines in the light of these changing patterns of demand, but also how they are performing 'in-house'. Trucost's analysis indicates disparities both in environmental performance and the reporting of such for the 11 companies covered in this research report.



Environmental Performance Measurement

It is increasingly recognised that good environmental performance makes good business sense. The motor manufacturing sector is highly energy and resource intensive, and environmental risks and uncertainties for the sector affect investment decisions, consumer behaviour and Government policy. The sourcing and management of energy supply, the use of raw materials and natural resources within the manufacturing supply chain, and the production of waste all impact the financial efficiency and ultimately the profitability of motor manufacturers, to a greater or lesser extent.

A high price of oil and growing pressure to reduce carbon emissions from all activities of modern living are already playing an increasingly significant part in consumer purchasing decisions, both in the corporate fleet and in domestic demand. For companies that fail to plan for this in the future, potential loss of market share and lower revenues will result. Investors need to know how these motor manufacturers compare, not only in their environmental performance, but also in terms of adequate and compliant disclosure on their performance in absolute terms and relative to their peers, in their annual financial statements.

To highlight the disclosure disparity, of the three key environmental performance indicators that the automotive sector is primarily concerned with (greenhouse gas emissions, water use and waste), only five companies covered in this research report disclose quantified performance data on all three in their most recent public disclosures.

			Direct Impacts Disclosed			Weighted
		Year End	GHGs	Water	Landfill	Disclosure, FY 2004
PEUGEOT	UG-FR	31/12/2004	y	y	y	100%
RENAULT	RNO-FR	31/12/2004	y	y	y	88%
FIAT	F-MI	31/12/2004	y	y	y	87%
TOYOTA	7203-TO	31/03/2004	y	y	y	80%
BMW	BMW-FF	31/12/2004	y	y	n	79%
FORD	F	31/12/2004	y	y	n	70%
PORSCHE	POR3-FF	31/07/2004	y	y	y	63%
DAIMLERCHRYSLER	DCX-FF	31/12/2004	y	y	n	51%
HONDA MOTOR	7267-TO	31/03/2004	y	n	n	18%
GENERAL MOTORS	GM	31/12/2004	n	n	n	0%
VOLKSWAGEN	VOW-FF	31/12/2004	n	n	n	0%

Companies that are able to measure, manage and communicate their environmental performance are considered to be better positioned to understand how they may improve their internal production processes, seize new market opportunities and reduce production costs. Such companies are also in a good position to comply with mandatory or self-imposed disclosure requirements and meet stakeholder and shareholder expectations.

Yet current company financial statements do not give their principal readers, the companies' shareholders and financial analysts, the necessary information that they need in a consistent and comprehensive manner across the entire business. In doing so, readers would be able to assess whether there are implicit costs or liabilities from an environmental perspective, or even a relative 'best' or 'worst' in class for investors to benchmark. The implicit link between financial and environmental performance is seldom made in companies' annual financial statements11.

Across the world, the last few years have witnessed increasing legislation that is designed to improve the quality and consistency of company reporting, and specifically requiring companies to consider and report their environmental impacts. The EU Accounts Modernisation Directive, applicable to financial statements relating to years beginning on or after 1st April 2005, introduces requirements for large companies to include an 'analysis of environmental and social aspects necessary for the understanding of the company's development, performance or position' within an enhanced Director's Report. In France, where two global motor manufacturers have their principal stock exchange listing, the French

[11] Environmental Disclosures in the Annual Report & Accounts of companies in the FTSE All Share, UK Environment Agency study, July 2004. 'Only 35 companies (11% of FTSE 350 Index covered in the study) make a link between the environment and

Company Law as amended by the *Nouvelles Régulations Economiques* (NRE - Article 116) in 2001, requires companies listed on the Premier Marche to include mandatory disclosures in their annual reports published from 2003 as to how 'the company takes into account the social and environmental consequences of its activities.' Other countries have passed, or are in the process of passing, similar legislation.

What is striking about the French legislation is that the law requires companies to report their environmental performance against a set of quantitative, as well as qualitative, indicators although it does not describe how companies should best comply with this. Environmental disclosure is, and should be far from a standardised exercise in form-filling and box-ticking. Yet by placing the mandatory requirement to disclose against a set of issues with the Board of Directors, and signed by the officers of the Company, the French Company Law amendment has succeeded in forcing through major changes in the extent of relevant corporate environmental performance disclosure in France.

Issues to be included in French company annual reports

Specific issues are to be included in the annual report and accounts of French listed companies. In relation to resource consumption, these include water and energy use, (including renewable energy and initiatives for energy efficiency, land use, and the use of raw materials and natural resources), and also emissions to air, land and water. It is implicit that to disclose effectively on such uses requires companies to produce quantitative data of resources used and tonnes of emissions produced during the financial year.

What the NRE do not ask companies to consider and report on is the extent of environmental use within the companies' supply chain, such as purchased energy, raw materials or transportation costs – a company's indirect costs. Further, it is argued by some commentators that the amended regulation is lacking because it does not require companies to give consideration to the environmental impact of products or services in use, nor does it differentiate between the environmental risks associated with different stock market sectors. The type and scale of a company's environmental impacts are largely dependent on the business activities in which it is involved, or the industry sector to which it belongs. It is therefore important that quantitative and comprehensive data covering the full extent of the company's operations should be reported to aid comparative analysis by shareholders and financial analysts.

Analysis of Environmental Performance

In terms of absolute environmental impacts as percentages of turnover and EBITDA, the companies in this sector show low direct costs, relative to those within their supply chains, or indirect costs. This is because the vast majority of the motor manufacturing sector's environmental impacts are incurred during the production process. The sector's direct external costs range from below 1% of EBITDA (Peugeot, Renault, BMW, Toyota, DaimlerChrysler, Ford, Porsche and Honda) to 2.1% of EBITDA in the case of Volkswagen and 3.5% for Fiat. These external costs are principally generated from greenhouse gas emissions and water use.

some aspect of their financial performance and only 17 (5% of FTSE 350) explicitly link it to shareholder value'. p8. www.trucost.com

It is therefore important to look at the indirect external costs associated with these companies' suppliers. Of course, disclosure of environmental impacts of companies' suppliers is still at a formative stage. Automotive manufacturers' supply chains are by their nature highly complex, multi-layered and global, and the fact that many electronic components are sourced through distributors effectively makes working down the supply chain problematic.[12]

Performance analysis within the supply chain

As we have noted previously, the key environmental impacts of the automotive sector lie predominantly within their supply chain. The automotive manufacturing sector has been one of the leading industrial sectors requiring suppliers to demonstrate their environmental credentials. Since October 1999, both Ford and General Motors have required their suppliers with manufacturing facilities to be accredited with the ISO 14001 international environmental management standard, and Toyota mandated a similar requirement from its suppliers providing direct or indirect raw materials, parts and components, to receive ISO 14001 third-party registration by December 2003. Now DaimlerChrysler, BMW, Volkswagen, Renault and other manufacturers all require their suppliers to demonstrate that they have appropriate environmental management systems in place.

Significant supplier industries associated with the manufacture of motor and trailer vehicles include:

- metal manufacturers
- electricity
- oil and gas

One of the clearest examples of the importance of knowing the environmental performance of a company's supply chain in the motor manufacturing sector is the upcoming REACH Directive (Registration, Evaluation, and Authorisation of Chemicals Directive). In advance of this, companies such as Ford have developed globally applied schemes such as the 'restricted substance management standard' (RSMS) to identify carcinogenic and toxic substances within vehicle parts and materials. Ford estimates that its vehicles and production processes contain up to 10,000 identified chemicals13, and has developed an electronic database with standardised reporting formats for suppliers to submit declarable information on their components and materials.

Such detailed knowledge of the content of Ford's suppliers' products will be invaluable in reducing the cost of compliance with REACH when it finally comes into force14. Given that the registration process under REACH requires substance manufacturers and importers to gather information on the substances they manufacture or import, estimated to be some 30,000 in number, the cost of this will be significant. Investors will want to know how companies are set to manage this increased regulatory cost and reduce the potential for disrupted supply chains. Clearly companies that have systems in place, such as Ford's, will

- [12] ENDS Report, September 2005, p48
- [13] ENDS Report, September 2005, p48
- [14] REACH is still at the drafting stage. EU Member States will have three years in which to transpose the Directive into law after it is in force.

stand to gain a competitive advantage and achieve reductions in compliance costs associated with REACH.

Peer Group analysis

Trucost's analysis compared the companies in the motor manufacturing sector with their peers, using both direct and indirect external costs, to identify relative overall performance. Using the latest full year accounts available, in addition to showing the Impact Ratio (total external costs of the company divided by the company's turnover), turnover (revalued to US$) is provided to show relative scale of the companies. Intuitively, environmental reporting levels should correlate with sectors in accordance with the scale of their environmental impacts. As we are looking at a single stock sector, we would expect to find a level of consistent disclosure of key environmental impacts. As the disclosure table below shows, this is not the case.

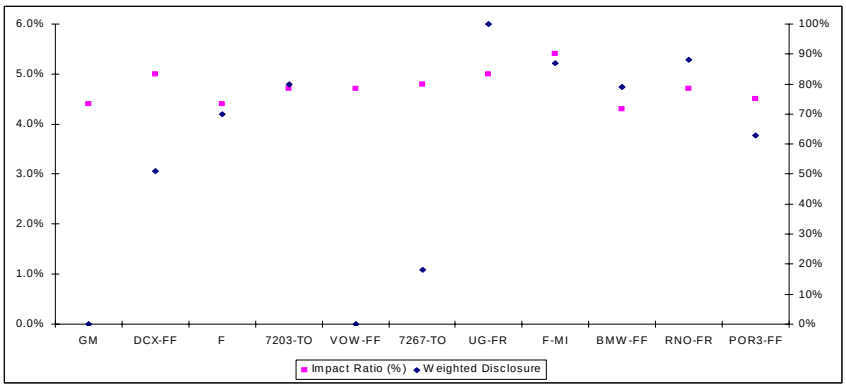
			Direct Impacts Disclosed			Weighted
		Year End	GHGs	Water	Landfill	Disclosure, FY 2004
PEUGEOT	UG-FR	31/12/2004	y	y	y	100%
RENAULT	RNO-FR	31/12/2004	y	y	y	88%
FIAT	F-MI	31/12/2004	y	y	y	87%
TOYOTA	7203-TO	31/03/2004	y	y	y	80%
BMW	BMW-FF	31/12/2004	y	y	n	79%
FORD	F	31/12/2004	y	y	n	70%
PORSCHE	POR3-FF	31/07/2004	y	y	y	63%
DAIMLERCHRYSLER	DCX-FF	31/12/2004	y	y	n	51%
HONDA MOTOR	7267-TO	31/03/2004	y	n	n	18%
GENERAL MOTORS	GM	31/12/2004	n	n	n	0%
VOLKSWAGEN	VOW-FF	31/12/2004	n	n	n	0%

Recent research conducted by Trucost for the UK Environment Agency has shown that overall reporting levels by companies in the FTSE All Share are not clearly related to the differing scale of environmental impacts across sectors15.

Environmental Impact

According to Trucost's analysis, Ford, and BMW have the lowest overall environmental impact per unit of turnover, while Fiat, DaimlerChrylser and Peugeot have relatively higher environmental impact per unit of turnover than their peers.

[15] ibid, UK Environment Agency, p8



Such analysis provides investors with information on relative performance and raises issues to be taken up with the companies in question. Does this indicate that cost and efficiency gains are potentially greater at these companies, or does this imply that there are greater possible future costs associated with these companies that need to be discounted in company valuation models as future liabilities?

Weighted Disclosure

Analysts should note that the quality and quantity of the DaimlerChrysler's environmental performance disclosure for FY2004 is relatively low, yet it is estimated that the company has the second highest figure of external environmental cost per unit of turnover and has the second largest turnover out of the companies covered in this report. Honda's weighted disclosure figure is low in relative terms, as a result of only reporting global CO2 emissions for FY2004. Other environmental performance disclosures are made only in relation to their manufacturing operations in Japan. General Motors and Volkswagen have yet to make any environmental performance disclosures for FY2004, and this analysis has made assumptions using prior year data to enable, in the absence of any company data, some form of comparative performance. Bearing this in mind and relative to its nearest peer, DaimlerChrysler has a total external cost to EBITDA ratio in excess of 50%, as against General Motors at 35%.

Investors seek to value companies based on published company accounts and from a variety of external sources. It follows that full disclosure of environmental information enables shareholders to consider the environmental factors and operating risks facing a company when they are evaluating that company. Some companies may fear that such disclosure increases uncertainty about future possible liabilities, and diminishes a firm's valuation in the process, as a polluting company's valuation is discounted to its peers. Further, even worse performing companies (from an environmental perspective) could receive a boost to their relative sector valuation by operating a programme of full disclosure. This would certainly hold true if environmental performance and disclosure data is fully known by the market, which is not the case at present.

Trucost's analysis suggests that company stock market valuations for Peugeot, Renault, Fiat and Toyota should reflect a premium relative to Volkswagen, General Motors and DaimlerChrysler that reflects the greater certainty of future potential liabilities and management's capacity to plan for and manage the company's response as part of its mainstream planning.

Conclusion

Companies such as Peugeot and Renault have management systems in place to measure and manage the environmental impacts associated with their operations, and are thus in position to disclose their performance in a relevant and consistent fashion. They have also demonstrated to their shareholders that in terms of environmental efficiency of production, they compare favourably with the performance of their peers. Yet certain companies, that clearly have highly developed Environmental Management Systems in place, have yet to publish environmental performance data from the last financial year. This leaves analysts and investors at an information disadvantage. With the French law in place requiring concurrent environmental disclosure with the annual report and accounts, there appears to be no reason for non or late disclosure.

Other environment related Regulations and Directives

Other EU Directives relevant to assessing the environmental performance of the motor manufacturing sector include the ACEA Agreement, the End of Life Vehicle Directive (ELV) and the Waste Electrical and Electronic Equipment Directive (WEEE)

The ACEA Agreement16 establishes industry-wide targets for average emissions from these manufacturers' vehicle fleets to reach 140 grams of CO2 per kilometre (gCO2/km) by 2008, with the possibility of extending the agreement to 120 gCO2/km by 2012. Research by the World Resources Institute (WRI) and SAM Group suggest that the costs for the industry are likely to be distributed differently between the member companies, yet these costs remain undisclosed by the companies themselves.17

The research states that the industry has reached 165 gCO2/km in 2002, but that individual company commitments and progress made towards meeting the required reduction remain unknown and that data on company CO2 performance remains undisclosed. Investors therefore currently have no way of knowing the competitive position of the member companies in the agreement, with respect to ACEA. However, those companies with the most fuel-efficient fleets already, such as Peugeot and Renault, Toyota and Honda, should stand to gain from a relative capital expenditure and design cost perspective.

▪ End of Life Vehicle Directive (Dir. 2000/53/EC)

This Directive, which takes effect in 2007 in all EU member countries, is designed to reduce waste. It applies to cars, vans, trucks and 3-wheeled vehicles, and affects producers directly. Producers must implement a system whereby vehicle users can safely dispose of their vehicles at facilities authorised by the Government, and they must also provide free take-back services. In other words, manufacturers – not end users – must bear the direct cost.

▪ Waste Electrical & Electronic Equipment - (Dir. 2002/96/EC)

This Directive, implemented in 2004, requires electric/electronic equipment to be disposed of in an environmentally responsible way. The WEEE framework allows many manufacturers to set up joint schemes for the disposal of waste goods and it also makes

provision for individual manufacturers who do not wish to join a scheme. Distributors must take back electronic equipment free of charge and deliver it to authorised disposal sites. Stricter requirements take effect in 2005 and 2006.

In most cases, transport companies are only end-users and so face fewer obligations. If they do not coordinate the disposal of their electrical equipment with producers or distributors, however, they may face fines. And in cases where such EEE goods were produced without any provision for disposing of them (i.e. they are old), end-users bear the cost of disposal. The UK Department of Trade & Industry's assessment18 suggests that the impact on end-

- [16] Association des Constructuers Europeens d'Automobiles, or European Automobile Manufacturers Association
- [17] Transparency Issues with the ACEA Agreement: Are Investors driving blindly? World Resources Institute and SAM Group, 2005
- [18] The UK Dept of Trade & Industry WEEE Regulatory Impact Assessment, July 04, http://www.dti.gov.uk/sustainability/weee/WEEERIA_July_2004.pdf

users will be minimal since most large businesses already have agreements in place with producers to trade old EEE goods for new.

Products & Downstream Impacts

No discussion of the environmental impacts of the motor manufacturing sector would be complete without mention of design and product use. For some companies, the environmental impacts of their products after sale may be as great as, or much greater than, the impacts from the materials and the production processes used in creating the products. This is particularly true of products which consume energy during their use phase, such as motor vehicles.

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BMW AG

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (EUR m)	44,335
EBITDA (EUR m)	9,325
Quote Symbol / ISIN	BMW-FF / DE0005190003
Total External Environmental Costs (EUR m)	1,921
Direct External Environmental Costs (EUR m)	48
Indirect External Environmental Costs (EUR m)	1,873

Key Ratios

Total External Cost to Turnover	**4.3%**	**Total External Cost to EBITDA**	**20.6%**
Direct External Cost Ratios		**% Turnover**	**0.1%**
		% EBITDA	**0.5%**
Indirect External Cost Ratios		**% Turnover**	**4.2%**
		% EBITDA	**20.1%**

Direct External Environmental Costs

The direct external environmental costs are those incurred when BMW emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	ENV*	75,930,090	24.58
2. Carbon Dioxide To Air (Tonnes)	ENV*	397,557	9.07
3. Landfill Waste (Tonnes)	TC	203,144	6.13
4. Nitrogen Oxide To Air (Tonnes)	TC	4,774	1.90
5. Sulphur Dioxide To Air (Tonnes)	TC	1,425	1.24
6. Xylene To Air (Tonnes)	ENV*	1,191	1.23
7. Styrene To Air (Tonnes)	ENV*	1,063	1.10
8. Dinitrogen Oxide To Air (Tonnes)	TC	83	0.58
9. Chromium To Air (Tonnes)	ENV*	6	0.52
10. Toluene To Air (Tonnes)	ENV*	311	0.32

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by BMW's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	1,792,389,994	580.24
2. Carbon Dioxide To Air (Tonnes)	23,487,562	535.70
3. High Level Nuclear Waste To Land (Tonnes)	125	321.16
4. Coal Extraction/Open Cast (Tonnes)	8,977,894	171.74
5. Sulphur Dioxide To Air (Tonnes)	50,378	43.85
6. Bauxite Extraction (Tonnes)	1,039,321	28.97
7. Landfill Waste (Tonnes)	939,145	28.33
8. Methane To Air (Tonnes)	56,840	27.39
9. Nitrogen Oxide To Air (Tonnes)	63,975	25.51
10. Chromium To Land (Tonnes)	208	18.89

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. abel, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

Indirect External Costs: All companies have environmental impacts through the goods and services that they purchase. These are known as supply chain or indirect impacts. In many cases, particularly for service companies, these impacts are greater than the direct impacts the company has. Trucost uses a comprehensive input-output model to analyse a company's indirect environmental impacts.

Source: The source of direct external cost data is identified and divided into estimates and company disclosures. Trucost estimates a company's direct impacts using an analysis of the business activities they are involved in. Trucost also searches for any public disclosures that have been made by the company and incorporates them where appropriate.

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DaimlerChrysler AG

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (EUR m)	135,652
EBITDA (EUR m)	15,437
Quote Symbol / ISIN	DCX-FF / DE0007100000
Total External Environmental Costs (EUR m)	6,717
Direct External Environmental Costs (EUR m)	108
Indirect External Environmental Costs (EUR m)	6,609

Key Ratios

Total External Cost to Turnover	**5.0%**	**Total External Cost to EBITDA**	**43.5%**

Direct External Cost Ratios	**% Turnover**	**0.1%**
	% EBITDA	**0.7%**
Indirect External Cost Ratios	**% Turnover**	**4.9%**
	% EBITDA	**42.8%**

Direct External Environmental Costs

The direct external environmental costs are those incurred when Daimlerchrysler AG emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Carbon Dioxide To Air (Tonnes)	ENV	2,200,000	50.18
2. Ethylene Glycol To Water (Tonnes)	PRE	11,543	11.96
3. Phenol To Land (Tonnes)	PRE	7,841	8.12
4. Landfill Waste (Tonnes)	PRE	151,596	4.57
5. Xylene To Air (Tonnes)	PRE	4,164	4.31
6. Groundwater Abstraction (Cubic Metres)	ENV*	12,658,446	4.10
7. Styrene To Air (Tonnes)	PRE	3,717	3.85
8. Naphthalene To Land (Tonnes)	PRE	2,118	2.19
9. Diazinon To Air (Tonnes)	PRE	2,004	2.08
10. Toluene To Land (Tonnes)	PRE	1,879	1.95

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Daimlerchrysler AG's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	6,310,506,673	2,042.85
2. Carbon Dioxide To Air (Tonnes)	82,244,855	1,875.81
3. High Level Nuclear Waste To Land (Tonnes)	428	1,101.99
4. Coal Extraction/Open Cast (Tonnes)	33,227,745	635.61
5. Sulphur Dioxide To Air (Tonnes)	178,149	155.06
6. Bauxite Extraction (Tonnes)	4,182,571	116.57
7. Landfill Waste (Tonnes)	3,338,026	100.69
8. Methane To Air (Tonnes)	194,216	93.59
9. Nitrogen Oxide To Air (Tonnes)	214,465	85.52
10. Chromium To Land (Tonnes)	791	71.96

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

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Fiat SpA

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (EUR m)	46,488
EBITDA (EUR m)	2,534
Quote Symbol / ISIN	F-MI / IT0001976403
Total External Environmental Costs (EUR m)	2,503
Direct External Environmental Costs (EUR m)	89
Indirect External Environmental Costs (EUR m)	2,414

Key Ratios

Total External Cost to Turnover	**5.4%**	**Total External Cost to EBITDA**	**20.6%**

Direct External Cost Ratios	**% Turnover**	**0.2%**
	% EBITDA	**3.5%**
Indirect External Cost Ratios	**% Turnover**	**5.2%**
	% EBITDA	**95.3%**

Direct External Environmental Costs

The direct external environmental costs are those incurred when Fiat emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Carbon Dioxide To Air (Tonnes)	ENV*	2,096,731	47.82
2. Landfill Waste (Tonnes)	ENV	525,920	15.86
3. Water Abstraction (Cubic Metres)	ENV	31,793,000	10.29
4. Nitrogen Oxide To Air (Tonnes)	TC	9,405	3.75
5. Incineration Waste (Tonnes)	ENV	61,459	3.21
6. Sulphur Dioxide To Air (Tonnes)	TC	3,168	2.76
7. Chromium To Air (Tonnes)	TC	10	0.93
8. Xylene To Air (Tonnes)	TC	789	0.82
9. Styrene To Air (Tonnes)	TC	672	0.70
10. Dinitrogen Oxide To Air (Tonnes)	TC	92	0.65

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Fiat's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	2,267,655,776	734.09
2. Carbon Dioxide To Air (Tonnes)	30,625,835	698.50
3. High Level Nuclear Waste To Land (Tonnes)	153	393.67
4. Coal Extraction/Open Cast (Tonnes)	12,632,762	241.65
5. Sulphur Dioxide To Air (Tonnes)	65,790	57.26
6. Bauxite Extraction (Tonnes)	1,479,290	41.23
7. Landfill Waste (Tonnes)	1,221,156	36.84
8. Methane To Air (Tonnes)	70,208	33.83
9. Nitrogen Oxide To Air (Tonnes)	77,894	31.06
10. Chromium To Land (Tonnes)	295	26.87

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. abel, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

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Ford Motor Company

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (USD m)	171,652
EBITDA (USD m)	24,721
Quote Symbol / ISIN	F / US3453708600
Total External Environmental Costs (USD m)	7,493
Direct External Environmental Costs (USD m)	175
Indirect External Environmental Costs (USD m)	7,318

Key Ratios

Total External Cost to Turnover	**4.4%**	**Total External Cost to EBITDA**	**30.3%**

Direct External Cost Ratios	**% Turnover**	**0.1%**
	% EBITDA	**0.7%**

Indirect External Cost Ratios	**% Turnover**	**4.3%**
	% EBITDA	**29.6%**

Direct External Environmental Costs

The direct external environmental costs are those incurred when Ford emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost USD Millions
1. Carbon Dioxide To Air (Tonnes)	ENV*	2,800,000	86.60
2. Water Abstraction (Cubic Metres)	ENV	81,800,000	35.99
3. Landfill Waste (Tonnes)	TC	572,516	23.47
4. Nitrogen Oxide To Air (Tonnes)	TC	13,583	7.36
5. Sulphur Dioxide To Air (Tonnes)	TC	4,100	4.85
6. Xylene To Air (Tonnes)	TC	2,312	3.25
7. Styrene To Air (Tonnes)	TC	2,063	2.91
8. Dinitrogen Oxide To Air (Tonnes)	TC	237	2.28
9. Chromium To Air (Tonnes)	TC	16	2.02
10. Toluene To Air (Tonnes)	TC	603	0.85

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Ford's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost USD Millions
1. Water Abstraction (Cubic Metres)	5,159,190,597	2,270.04
2. Carbon Dioxide To Air (Tonnes)	67,526,659	2,093.33
3. High Level Nuclear Waste To Land (Tonnes)	359	1,254.56
4. Coal Extraction/Open Cast (Tonnes)	25,702,346	668.26
5. Sulphur Dioxide To Air (Tonnes)	144,693	171.17
6. Bauxite Extraction (Tonnes)	2,995,115	113.45
7. Landfill Waste (Tonnes)	2,706,506	110.97
8. Methane To Air (Tonnes)	162,743	106.60
9. Nitrogen Oxide To Air (Tonnes)	184,443	99.97
10. Chromium To Land (Tonnes)	595	73.60

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

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General Motors Corp.

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (USD m)	193,517
EBITDA (USD m)	28,708
Quote Symbol / ISIN	GM / US3704421052
Total External Environmental Costs (USD m)	8,604
Direct External Environmental Costs (USD m)	522
Indirect External Environmental Costs (USDm)	8,082

Key Ratios

Total External Cost to Turnover	**4.4%**	**Total External Cost to EBITDA**	**30.0%**
7		**% Turnover**	**0.3%**
		% EBITDA	**1.8%**
Indirect External Cost Ratios		**% Turnover**	**4.2%**
		% EBITDA	**28.2%**

Direct External Environmental Costs

The direct external environmental costs are those incurred when GM emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost USD Millions
1. Carbon Dioxide To Air (Tonnes)	PRE	14,080,821	436.51
2. Water Abstraction (Cubic Metres)	PRE	62,232,200	27.38
3. Landfill Waste (Tonnes)	PRE	640,133	26.25
4. Nitrogen Oxide To Air (Tonnes)	TC	15,236	8.26
5. Sulphur Dioxide To Air (Tonnes)	TC	4,514	5.34
6. Xylene To Air (Tonnes)	TC	2,538	3.57
7. Styrene To Air (Tonnes)	TC	2,266	3.19
8. Dinitrogen Oxide To Air (Tonnes)	TC	267	2.57
9. Chromium To Air (Tonnes)	TC	18	2.22
10. Toluene To Air (Tonnes)	TC	662	0.93

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by GM's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost USD Millions
1. Water Abstraction (Cubic Metres)	5,698,362,693	2,507.28
2. Carbon Dioxide To Air (Tonnes)	74,497,993	2,309.44
3. High Level Nuclear Waste To Land (Tonnes)	397	1,389.62
4. Coal Extraction/Open Cast (Tonnes)	28,346,549	737.01
5. Sulphur Dioxide To Air (Tonnes)	159,700	188.93
6. Bauxite Extraction (Tonnes)	3,290,542	124.65
7. Landfill Waste (Tonnes)	2,980,748	122.21
8. Methane To Air (Tonnes)	180,368	118.14
9. Nitrogen Oxide To Air (Tonnes)	203,689	110.40
10. Chromium To Land (Tonnes)	655	81.01

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

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Honda Motor Company

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Mar-04
Turnover (JPY m)	8,162,600
EBITDA (JPY m)	865,566
Quote Symbol / ISIN	7267-TO / JP3854600008
Total External Environmental Costs (JPY m)	395,880
Direct External Environmental Costs (JPY m)	10,000
Indirect External Environmental Costs (JPY m)	385,880

Key Ratios

Total External Cost to Turnover	4.8%	Total External Cost to EBITDA	45.7%

Direct External Cost Ratios	% Turnover	0.1%
	% EBITDA	1.2

Indirect External Cost Ratios	% Turnover	4.7
	% EBITDA	44.6%

Direct External Environmental Costs

The direct external environmental costs are those incurred when Honda emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost JPY Millions
1. Water Abstraction (Cubic Metres)	TC	117,474,861	5,377.46
2. Carbon Dioxide To Air (Tonnes)	AR*	552,229	1,780.99
3. Landfill Waste (Tonnes)	TC	328,191	1,399.88
4. Nitrogen Oxide To Air (Tonnes)	TC	6,705	378.08
5. Sulphur Dioxide To Air (Tonnes)	TC	2,173	267.48
6. Xylene To Air (Tonnes)	TC	1,187	173.87
7. Styrene To Air (Tonnes)	TC	1,050	153.87
8. Chromium To Air (Tonnes)	TC	9	121.52
9. Toluene To Air (Tonnes)	TC	310	45.46
10. Methyl Isobutyl Ketone To Air (Tonnes)	TC	289	42.36

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Honda's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost JPY Millions
1. Water Abstraction (Cubic Metres)	2,590,548,122	118,583.36
2. Carbon Dioxide To Air (Tonnes)	34,451,712	111,109.69
3. High Level Nuclear Waste To Land (Tonnes)	178	64,837.64
4. Coal Extraction/Open Cast (Tonnes)	13,523,556	36,580.00
5. Sulphur Dioxide To Air (Tonnes)	74,019	9,109.76
6. Bauxite Extraction (Tonnes)	1,557,726	6,138.76
7. Landfill Waste (Tonnes)	1,382,393	5,896.51
8. Methane To Air (Tonnes)	82,123	5,596.08
9. Nitrogen Oxide To Air (Tonnes)	91,649	5,167.81
10. Chromium To Land (Tonnes)	316	4,062.82

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

Indirect External Costs: All companies have environmental impacts through the goods and services that they purchase. These are known as supply chain or indirect impacts. In many cases, particularly for service companies, these impacts are greater than the direct impacts the company has. Trucost uses a comprehensive input-output model to analyse a company's indirect environmental impacts.

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Porsche AG

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Jul-04
Turnover (EUR m)	6,359
EBITDA (EUR m)	1,665
Quote Symbol / ISIN	POR3-FF / DE0006937733
Total External Environmental Costs (EUR m)	287
Direct External Environmental Costs (JPY m)	2
Indirect External Environmental Costs (JPY m)	285

Key Ratios

Total External Cost to Turnover	4.5%	Total External Cost to EBITDA	17.2%

Direct External Cost Ratios	% Turnover	0.0%
	% EBITDA	0.1%

Indirect External Cost Ratios	% Turnover	0.0%
	% EBITDA	0.1%

Direct External Environmental Costs

The direct external environmental costs are those incurred when Porsche emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Carbon Dioxide To Air (Tonnes)	AR*	38,698	1.00
2. Landfill Waste (Tonnes)	AR*	6,053	0.21
3. Xylene To Air (Tonnes)	TC	110	0.13
4. Styrene To Air (Tonnes)	TC	98	0.11
5. Dinitrogen Oxide To Air (Tonnes)	TC	11	0.08
6. Chromium To Air (Tonnes)	TC	<1	0.08
7. Water Abstraction (Cubic Metres)	PRE	205,117	0.07
8. Toluene To Air (Tonnes)	TC	29	0.03
9. Methyl Isobutyl Ketone To Air (Tonnes)	TC	27	0.03
10. Nitrogen Oxide To Air (Tonnes)	AR*	60	0.03

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Porsche's supply chain. The ten most significant indirect impacts are listed below..

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	241,689,054	88.33
2. Carbon Dioxide To Air (Tonnes)	3,171,768	81.67
3. High Level Nuclear Waste To Land (Tonnes)	17	48.49
4. Coal Extraction/Open Cast (Tonnes)	1,208,162	26.09
5. Sulphur Dioxide To Air (Tonnes)	6,790	6.67
6. Bauxite Extraction (Tonnes)	142,033	4.47
7. Landfill Waste (Tonnes)	127,633	4.35
8. Methane To Air (Tonnes)	7,563	4.11
9. Nitrogen Oxide To Air (Tonnes)	8,643	3.89
10. Chromium To Land (Tonnes)	28	2.89

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

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Peugeot SA

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (EUR m)	57,038
EBITDA (EUR m)	5,052
Quote Symbol / ISIN	UG-FR / FR0000121501
Total External Environmental Costs (EUR m)	2,864
Direct External Environmental Costs (EUR m)	49
Indirect External Environmental Costs (EUR m)	2,815

Key Ratios

Total External Cost to Turnover	5.0%	Total External Cost to EBITDA	56.7%

Direct External Cost Ratios	% Turnover	0.1%
	% EBITDA	1.0%

Indirect External Cost Ratios	% Turnover	4.9%
	% EBITDA	55.7%

Direct External Environmental Costs

The direct external environmental costs are those incurred when Peugeot emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Carbon Dioxide To Air (Tonnes)	ENV	866,536	19.76
2. Ethylene Glycol To Water (Tonnes)	ENV*	13,672	14.16
3. Landfill Waste (Tonnes)	ENV	126,676	3.82
4. Groundwater Abstraction (Cubic Metres)	ENV	10,970,976	3.55
5. Rivers & Streams Abstraction (Cubic Metres)	ENV	9,541,824	3.09
6. Incineration Waste (Tonnes)	ENV	42,505	2.22
7. Xylene To Water (Tonnes)	ENV*	715	0.74
8. Sulphur Dioxide To Air (Tonnes)	ENV	669	0.58
9. Nitrogen Oxide To Air (Tonnes)	ENV	967	0.39
10. Dinitrogen Oxide To Air (Tonnes)	ENV	34	0.24

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Peugeot's supply chain. The ten most significant indirect impacts are listed below..

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	6,310,506,673	2,042.85
2. Carbon Dioxide To Air (Tonnes)	82,244,855	1,875.81
3. High Level Nuclear Waste To Land (Tonnes)	428	1,101.99
4. Coal Extraction/Open Cast (Tonnes)	33,227,745	635.61
5. Sulphur Dioxide To Air (Tonnes)	178,149	155.06
6. Bauxite Extraction (Tonnes)	4,182,571	116.57
7. Landfill Waste (Tonnes)	3,338,026	100.69
8. Methane To Air (Tonnes)	194,216	93.59
9. Nitrogen Oxide To Air (Tonnes)	214,465	85.52
10. Chromium To Land (Tonnes)	791	71.96

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs. **Indirect External Costs**: All companies have environmental impacts through the goods and services that they purchase. These are known as supply chain or indirect impacts. In many cases, particularly for service companies, these impacts are greater than the direct impacts the company has. Trucost uses a comprehensive input-output model to analyse a company's indirect environmental impacts.

Source: The source of direct external cost data is identified and divided into estimates and company disclosures. Trucost estimates a company's direct impacts using an analysis of the business activities they are involved in. Trucost also searches for any public disclosures that have been made by the company and incorporates them where appropriate.

TC = Trucost Estimate; ENV = Disclosure in Environmental / CSR Report; AR = Disclosure in Annual Report & Accounts; * = derived from labelled source; OTH = Other source / Company Communication; PRE = Data derived from previous year

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Renault SA

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (EUR m)	40,715
EBITDA (EUR m)	7,036
Quote Symbol / ISIN	RNO-FR / FR0000131906
Total External Environmental Costs (EUR m)	1,907
Direct External Environmental Costs (JPY m)	33
Indirect External Environmental Costs (JPY m)	1,874

Key Ratios

Total External Cost to Turnover	4.7%	Total External Cost to EBITDA	27.1%

Direct External Cost Ratios	% Turnover	0.1%
	% EBITDA	0.5%

Indirect External Cost Ratios	% Turnover	4.6%
	% EBITDA	26.6%

Direct External Environmental Costs

The direct external environmental costs are those incurred when Renault emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Carbon Dioxide To Air (Tonnes)	AR	745,255	17.00
2. Water Abstraction (Cubic Metres)	ENV	19,000,000	6.15
3. Landfill Waste (Tonnes)	AR	157,395	4.75
4. Xylene To Air (Tonnes)	TC	821	0.85
5. Styrene To Air (Tonnes)	TC	733	0.76
6. Incineration Waste (Tonnes)	AR	11,847	0.62
7. Chromium To Air (Tonnes)	TC	6	0.53
8. Sulphur Dioxide To Air (Tonnes)	AR	503	0.44
9. Nitrogen Oxide To Air (Tonnes)	AR	788	0.31
10. Dinitrogen Oxide To Air (Tonnes)	TC	33	0.23

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Renault's supply chain. The ten most significant indirect impacts are listed below..

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	1,794,433,836	580.90
2. Carbon Dioxide To Air (Tonnes)	23,581,875	537.85
3. High Level Nuclear Waste To Land (Tonnes)	124	317.81
4. Coal Extraction/Open Cast (Tonnes)	8,986,148	171.90
5. Sulphur Dioxide To Air (Tonnes)	50,454	43.91
6. Bauxite Extraction (Tonnes)	1,061,282	29.58
7. Landfill Waste (Tonnes)	950,924	28.68
8. Methane To Air (Tonnes)	55,918	26.95
9. Nitrogen Oxide To Air (Tonnes)	64,185	25.59
10. Chromium To Land (Tonnes)	209	19.06

Definitions
Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

Indirect External Costs: All companies have environmental impacts through the goods and services that they purchase. These are known as supply chain or indirect impacts. In many cases, particularly for service companies, these impacts are greater than the direct impacts the company has. Trucost uses a comprehensive input-output model to analyse a company's indirect environmental impacts.

Source: The source of direct external cost data is identified and divided into estimates and company disclosures. Trucost estimates a company's direct impacts using an analysis of the business activities they are involved in. Trucost also searches for any public disclosures that have been made by the company and incorporates them where appropriate.

TC = Trucost Estimate; ENV = Disclosure in Environmental / CSR Report; AR = Disclosure in Annual Report & Accounts; * = derived from labelled source; OTH = Other source / Company Communication; PRE = Data derived from previous year

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Toyota Motor Corp.

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Mar-04
Turnover (JPY m)	17,294,760
EBITDA (JPY m)	2,756,403
Quote Symbol / ISIN	7203-TO / JP3633400001
Total External Environmental Costs (JPY m)	806,652
Direct External Environmental Costs (JPY m)	8,811
Indirect External Environmental Costs (JPY m)	797,841

Key Ratios

Total External Cost to Turnover	4.7%	Total External Cost to EBITDA	29.3%

Direct External Cost Ratios	% Turnover	0.1%
	% EBITDA	0.3%

Indirect External Cost Ratios	% Turnover	4.6%
	% EBITDA	28.9%

Direct External Environmental Costs

The direct external environmental costs are those incurred when Toyota emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost JPY Millions
1. Carbon Dioxide To Air (Tonnes)	ENV	1,570,000	5,063.38
2. Water Abstraction (Cubic Metres)	ENV	29,600,000	1,354.95
3. Nitrogen Oxide To Air (Tonnes)	TC	13,756	775.65
4. Sulphur Dioxide To Air (Tonnes)	TC	4,451	547.80
5. Chromium To Air (Tonnes)	TC	18	230.77
6. Xylene To Air (Tonnes)	ENV	1,505	220.45
7. Toluene To Air (Tonnes)	ENV	1,155	169.19
8. Incineration Waste (Tonnes)	ENV	13,500	99.72
9. Ethylbenzene To Air (Tonnes)	ENV	595	87.16
10. CFCs To Air (Tonnes)	TC	4	32.47

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Toyota's supply chain. The ten most significant indirect impacts are listed below...

Emission/Resource	Quantity	External Cost JPY Millions
1. Water Abstraction (Cubic Metres)	5,403,410,066	247,343.23
2. Carbon Dioxide To Air (Tonnes)	71,018,591	229,040.96
3. High Level Nuclear Waste To Land (Tonnes)	372	135,281.26
4. Coal Extraction/Open Cast (Tonnes)	27,063,399	73,204.05
5. Sulphur Dioxide To Air (Tonnes)	151,939	18,699.61
6. Bauxite Extraction (Tonnes)	3,197,526	12,600.96
7. Landfill Waste (Tonnes)	2,864,303	12,217.50
8. Methane To Air (Tonnes)	168,319	11,469.74
9. Nitrogen Oxide To Air (Tonnes)	193,276	10,898.24
10. Chromium To Land (Tonnes)	631	8,116.87

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs. **Indirect External Costs**: All companies have environmental impacts through the goods and services that they purchase. These are known as supply chain or indirect impacts. In many cases, particularly for service companies, these impacts are greater than the direct impacts the company has. Trucost uses a comprehensive input-output model to analyse a company's indirect environmental impacts.

Source: The source of direct external cost data is identified and divided into estimates and company disclosures. Trucost estimates a company's direct impacts using an analysis of the business activities they are involved in. Trucost also searches for any public disclosures that have been made by the company and incorporates them where appropriate.

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Volkswagen AG

Trucost Company Summary

TRUCOST
taking the environment into account

Stock Sector	Motor vehicles
Accounting Year End	31-Dec-04
Turnover (EUR m)	88,963.00
EBITDA (EUR m)	10,697.00
Quote Symbol / ISIN	VOW-FF / DE0007664005
Total External Environmental Costs (EUR m)	4,219.49
Direct External Environmental Costs (EUR m)	221.63
Indirect External Environmental Costs (EUR m)	3,997.85

Key Ratios

Total External Cost to Turnover	**4.7%**	**Total External Cost to EBITDA**	**27.1%**

Direct External Cost Ratios	**% Turnover**	**0.1%**
	% EBITDA	**0.5%**

Indirect External Cost Ratios	**% Turnover**	**4.6%**
	% EBITDA	**26.6%**

Direct External Environmental Costs

The direct external environmental costs are those incurred when Volkswagen emits pollutants or uses natural resources as part of their own activities. The ten most significant direct impacts are listed below.

Emission/Resource	Source	Quantity	External Cost EUR Millions
1. Carbon Dioxide To Air (Tonnes)	TC	5,932,567	135.31
2. Water Abstraction (Cubic Metres)	TC	163,138,829	52.81
3. Landfill Waste (Tonnes)	TC	440,155	13.28
4. Nitrogen Oxide To Air (Tonnes)	TC	17,639	7.03
5. Sulphur Dioxide To Air (Tonnes)	TC	3,123	2.72
6. Dinitrogen Oxide To Air (Tonnes)	TC	340	2.41
7. Xylene To Air (Tonnes)	TC	1,718	1.78
8. Styrene To Air (Tonnes)	TC	1,533	1.59
9. Chromium To Air (Tonnes)	TC	12	1.11
10. Toluene To Air (Tonnes)	TC	448	0.46

Indirect External Environmental Costs

The indirect external environmental costs are those that are incurred as a result of the activities carried out by Volkswagen's supply chain. The ten most significant indirect impacts are listed below.

Emission/Resource	Quantity	External Cost EUR Millions
1. Water Abstraction (Cubic Metres)	3,816,417,343	1,235.46
2. Carbon Dioxide To Air (Tonnes)	50,469,431	1,151.09
3. High Level Nuclear Waste To Land (Tonnes)	265	681.68
4. Coal Extraction/Open Cast (Tonnes)	19,111,427	365.58
5. Sulphur Dioxide To Air (Tonnes)	108,149	94.13
6. Bauxite Extraction (Tonnes)	2,233,682	62.25
7. Landfill Waste (Tonnes)	2,017,450	60.86
8. Methane To Air (Tonnes)	119,191	57.44
9. Nitrogen Oxide To Air (Tonnes)	138,093	55.07
10. Chromium To Land (Tonnes)	442	40.20

Definitions

Total External Costs: The sum of the direct and indirect external environmental costs (see below) expressed in the company's domestic currency.

Direct External Costs: Direct external environmental impacts are those impacts that companies have on the environment through their own activities. For example, the water that a company uses from a river would be a direct impact, whereas water provided by a utility company would be an indirect impact. Trucost analyses these direct environmental impacts in quantity terms (i.e. tonnes, cubic metres etc), and financial terms, so that they can be ranked accordingly as direct external costs.

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APPENDIX: SUMMARY OF CAFE FINES COLLECTED

CAFE Fines

Model Year	Manufacturer	Amount	Date	Fleet
1983	Jaguar Cars, Inc.	$57,970	12/85	IP
1984	Jaguar Cars, Inc.	$5,958,020	12/85	IP
1985	Aston Martin Lagonda Ltd.	$2,550	7/87	IP
1985	Jaguar Cars, Inc.	$8,799,010	7/87	IP
1985	Porsche Cars North America, Inc.	$1,253,580	7/87	IP
1985	Mercedes-Benz of North America, Inc.	$5,509,400	12/88	IP
1986	Mercedes-Benz of North America, Inc.	$20,214,700	12/88	IP
1986	Peugeot Motors of America, Inc.	$793,080	2/89	IP
1986	Jaguar Cars, Inc.	$8,040,550	2/89	IP
1986	Porsche Cars North America, Inc.	$823,440	2/89	IP
1986	Sun International	$45	5/89	IP
1987	BMW of North America, Inc.	$1,088,895	6/89	IP
1987	Jaguar Cars, Inc.	$5,320,135	6/89	IP
1987	Mercedes-Benz of North America, Inc.	$20,526,490	6/89	IP
1987	Peugeot Motors of America, Inc.	$767,600	6/89	IP
1987	Porsche Cars North America, Inc.	$948,480	6/89	IP
1987	Range-Rover of North America, Inc.	$272,955	6/89	LT
1987	Sterling Motor Cars	$2,056,625	8/89	IP
1988	Range-Rover of North America, Inc.	$553,980	7/89	LT
1988	BMW of North America, Inc.	$16,411,380	8/89	IP
1988	Sterling Motor Cars	$1,248,120	8/89	IP
1988	Mercedes-Benz of North America, Inc.	$18,295,455	12/89	IP
1988	Jaguar Cars, Inc.	$5,582,070	03/90	IP
1988	Peugeot Motors of America, Inc.	$482,280	03/90	IP
1988	Porsche Cars North America, Inc.	$1,048,905	05/90	IP
1989	Mercedes-Benz of North America, Inc.	$20,415,045	04/90	IP
1989	Porsche Cars North America, Inc.	$1,875,125	05/90	IP
1989	Peugeot Motors of America, Inc.	$487,800	07/90	IP
1989	Volvo Cars of North America	$1,036,115	07/90	IP
1989	BMW of North America, Inc.	$14,923,580	07/90	IP
*	Maserati Automobiles of America, Inc.	$120,000	01/91	IP
1989	Range-Rover of North America, Inc.	$778,140	05/91	LT
1989	Jaguar Cars, Inc.	$6,311,895	07/91	IP
1990	Range-Rover of North America, Inc.	$656,370	05/91	LT
1990	Volvo Cars of North America	$12,244,440	06/91	IP
1990	BMW of North America	$14,878,160	07/91	IP
1990	Porsche Cars North America, Inc.	$2,033,770	07/91	IP
1990	Mercedes-Benz of North America, Inc.	$17,556,105	09/91	IP
1990	Callaway Cars, Inc.	$20,400	01/92	DP
1989	PAS, Inc.	$294,500	02/92	DP

Model Year	Manufacturer	Amount	Date	Fleet
1990	Peugeot Motors of America, Inc.	$72,500	03/92	IP
1991	BMW of North America	$11,249,230	06/92	IP
1987	Fiat Auto S.p.A.	$279,350	07/92	IP
1988	Fiat Auto S.p.A.	$897,260	07/92	IP
1989	Fiat Auto S.p.A.	$670,120	07/92	IP
1991	Mercedes-Benz of North America, Inc.	$19,169,540	12/92	IP
1991	Peugeot Motors of America, Inc.	$192,660	12/92	IP
1991	Volvo Cars of North America	$7,768,420	12/92	IP
1990	Fiat Auto S.p.A.	$705,220	05/93	IP
1991	Fiat Auto S.p.A.	$796,575	05/93	IP
1992	Fiat Auto S.p.A.	$466,750	05/93	IP
1989	Sterling Motor Cars	$588,195	07/93	IP
1990	Sterling Motor Cars	$162,000	07/93	IP
1991	Vector Aeromotive Corp.	$1,740	07/93	DP
1992	Peugeot Motors of America, Inc.	$58,375	09/93	IP
1991	Range-Rover of North America, Inc.	$520,520	10/93	LT
1992	Range-Rover of North America, Inc.	$607,620	10/93	LT
1991	Sterling Motor Cars	$254,840	12/93	IP
1991	Porsche Cars North America, Inc.	$1,871,470	02/94	IP
1992	Porsche Cars North America, Inc.	$781,575	02/94	IP
1992	Volvo Cars of North America	$5,361,515	04/94	IP
1992	BMW of North America	$12,888,750	05/94	IP
1992	Vector Aeromotive Corp.	$1,740	05/94	DP
1993	Volvo Cars of North America	$5,764,800	06/94	IP
1993	Panoz Auto Development Corp.	$3,080	07/94	DP
1993	Fiat Auto S.p.A.	$194,220	07/94	IP
1993	Vector Aeromotive Corp.	$870	07/94	DP
1991	Fiat Auto S.p.A. (revised)	$416,385	08/94	IP
1992	Fiat Auto S.p.A. (revised)	-$2,250	08/94	IP
1993	Porsche Cars North America, Inc.	$668,500	10/94	IP
1993	Peugeot Motors of America, Inc.	$910	10/94	IP
1990	Callaway Cars, Inc. (refund reported by GM)	-$20,400	12/94	DP
1992	Mercedes-Benz of North America, Inc.	$18,122,440	12/94	IP
1993	Mercedes-Benz of North America, Inc.	$13,531,590	12/94	IP
1994	Mercedes-Benz of North America, Inc.	$11,254,080	12/94	IP
1995	Mercedes-Benz of North America, Inc.	$7,498,995	12/94	IP
1991	Maserati Automobiles of America, Inc.	$1,600	12/94	IP
1990	Consulier Industries	$50	01/95	DP
1991	Consulier Industries	$50	01/95	DP
1992	Consulier Industries	$50	01/95	DP
1993	Range-Rover of North America, Inc.	$1,094,660	01/95	LT
1993	Autokraft Ltd.	$2,590	08/95	DP
1993	BMW of North America	$7,427,160	09/95	IP
1994	Fiat Auto S.p.A.	$387,375	12/95	IP

Model Year	Manufacturer	Amount	Date	Fleet
1995	Mercedes-Benz of North America, Inc.	$6,525,085	12/96	IP
1994	Porsche Cars North America, Inc.	$804,600	12/96	IP
1995	Porsche Cars North America, Inc.	$1,949,520	12/96	IP
1994	BMW of North America	$10,140,120	12/96	IP
1995	BMW of North America	$13,136,530	12/96	IP
1994	Volvo Cars of North America	$7,173,630	12/96	IP
1995	Volvo Cars of North America	$6,375,675	12/96	IP
1994	Range-Rover of North America, Inc.	$1,734,915	01/97	LT
1995	Range-Rover of North America, Inc.	$4,499,078	01/97	LT
1995	Fiat Auto S.p.A.	$801,220	07/97	IP
1994	Panoz Auto Development Corp.	$3,850	08/97	DP
1995	Panoz Auto Development Corp.	$1,395	08/97	DP
1996	Fiat Motors of North America	$194,480	10/29/98	IP
1997	Fiat Motors of North America	$542,340	10/29/98	IP
1996	BMW of North America	$289,840	11/06/1998	IP
1997	BMW of North America	$11,834,910	11/06/1998	IP
1996	Volvo Cars of North America	$5,534,550	11/09/1998	IP
1997	Volvo Cars of North America	$5,162,135	11/09/1998	IP
1996	Mercedes-Benz of North America, Inc.	$6,825,610	11/09/1998	IP
1997	Mercedes-Benz of North America, Inc.	$11,731,035	11/09/1998	IP
1996	Porsche Cars North America, Inc.	$2,127,600	11/13/98	IP
1997	Porsche Cars North America, Inc.	$2,525,820	11/13/98	IP
1996	Range-Rover of North America, Inc.	$4,329,850	11/19/98	LT
1997	Range-Rover of North America, Inc.	$4,195,032	11/19/98	LT
1997	Range-Rover of North America, Inc.	$68	1/29/99	LT
1997	Volkswagen of America, Inc.	$176,220	04/09/1999	LT
1998	Fiat Motors of North America	$527,450	4/28/99	IP
1997	Lotus Cars USA, Inc.	$36,890	5/27/99	IP
1998	Mercedes-Benz of North America, Inc.	$1,683,525.00	07/02/1999	IP
1998	BMW of North America	$13,851,569.00	12/22/99	IP
1998	Porsche Cars North America, Inc.	$1,613,865.00	3/24/00	IP
1998	Rover Group, Ltd.	$3,849,037.50	04/12/2000	LT
1998	Mercedes-Benz of North America, Inc.	$168,352.50	5/19/00	IP
1998	Lotus Cars USA, Inc.	$34,782.00	6/13/00	IP
1999	Porsche Cars North America, Inc.	$4,884,627.00	7/28/00	IP
1999	BMW of North America	$13,147,249.50	08/04/2000	IP
1997	Panoz Auto Development Corp.	$7,400.00	08/08/2000	DP
1998	Panoz Auto Development Corp.	$11,192.50	08/08/2000	DP
1999	Mercedes-Benz of North America, Inc.	$8,141,430.00	12/19/00	IP
1999	Volkswagen of America, Inc.	$224,840.00	2/15/01	LT
1999	Fiat Motors of North America	$1,066,395.00	04/05/2001	IP
2000	BMW of North America	$26,408,646.00	6/18/01	IP
2000	BMW of North America	$971,696.00	6/18/01	LT
2000	Porsche Cars North America, Inc.	$3,720,816.00	6/25/01	IP
2000	Volkswagen of America, Inc.	$276,309.00	8/22/01	LT

Model Year	Manufacturer	Amount	Date	Fleet
2000	Fiat Motors of North America, Inc.	$686,521.00	12/06/2001	IP
1999	Lotus Cars USA, Inc.	$51,909.00	12/10/2001	IP
2000	Lotus Cars USA, Inc.	$43,758.00	4/30/02	IP
2001	Volkswagen of America, Inc.	$173,118.00	08/12/2002	LT
2001	Porsche Cars North America, Inc.	$4,997,190.00	8/14/02	IP
2001	Fiat Motors of North America, Inc.	$817,443.00	9/16/02	IP
2000	Mercedes-Benz USA, LLC.	$18,959,292.00	9/19/02	IP
2001	BMW of North America	$27,985,925.00	10/10/2002	IP
2001	Lotus Cars USA, Inc.	$35,744.50	6/13/03	IP
2002	Lotus Cars USA, Inc.	$36,850.00	6/13/03	IP
2002	Fiat Motors of North America, Inc.	$1,344,222.00	5/29/03	IP
2002	BMW of North America	$14,066,123.50	8/26/03	IP
2002	Porsche Cars North America, Inc.	$4,357,782.00	03/03/2004	IP
2003	Ferrari Maserati North America, Inc.	$1,139,710.00	07/01/2004	IP
2003	Porsche Cars North America, Inc.	$3,348,609.00	12/22/04	IP
2003	Porsche Cars North America, Inc.	$189,634.50	12/22/04	LT
	Total Fines Collected	**$618,874,891.50**		

* modified penalty for MY 1982, 1983, 1986, 1987, 1989, and 1990 to be paid in 16 quarterly payments of $7,500 starting 1/91

APPENDIX

CAFE Group Performance - Light Trucks (1996-2004)

		MOTOR YEAR								
GROUP	Données	1996	1997	1998	1999	2000	2001	2002	2003	2004
BMW	VOLUME	---	---	---	---	5 521	54 534	40 993	43 552	77
	Average	---	---	---	---	17.5	19.2	20.1	20.0	21.5
DCX	VOLUME	1 539 430	1 492 617	1 696 580	1 809 984	1 803 967	1 812 945	1 771 152	1 540 670	1 654 759
	Average	20.2	20.2	20.7	20.8	21.4	20.8	21.5	22.2	20.7
FORD	VOLUME	1 489 446	1 995 575	2 114 353	1 988 008	1 954 590	1 988 290	2 060 578	1 956 347	1 841 316
	Average	20.9	20.3	20.3	20.8	21.0	20.4	20.7	28.2	21.1
GM	VOLUME	1 649 696	1 810 805	1 826 146	2 027 543	2 257 796	2 002 858	2 460 680	2 455 636	2 384 914
	Average	20.8	20.5	21.2	20.4	21.0	20.7	21.2	28.3	21.2
HONDA	VOLUME	---	73 948	96 828	16 137	236 518	281 606	335 916	560 024	516 395
	Average	---	26.9	26.9	26.1	25.4	25.0	25.4	30.4	24.5
KIA-HYUNDAI	VOLUME	8 638	235	26 455	38 232	66 519	109 015	179 438	192 867	222 535
	Average	23.4	23.7	24.4	24.4	23.5	23.9	22.8	21.6	22.5
PORSCHE	VOLUME	---	---	---	---	---	---	---	1 277	24 027
	Average	---	---	---	---	---	---	---	32.4	18.3
RENAULT-NISSAN	VOLUME	186 756	282 844	197 082	170 577	355 867	356 816	287 302	280 327	495 338
	Average	22.9	22.3	22.3	21.2	20.8	20.7	20.7	24.1	21.1
Toyota	VOLUME	306 511	370 873	457 236	457 316	612 868	652 229	747 968	727 041	1 081 706
	Average	23.1	22.6	23.5	22.9	21.8	22.1	22.1	29.8	22.7
VAG	VOLUME	---	1 602	---	2 555	2 791	10 492	10 557	9 918	45 436
	Average	---	18.5	---	19.1	18.9	20.4	20.6	14.5	19.3

Source : NHTSA, 2005

CAFE Group Performance - Domestic Products (1978-1990)

		MOTOR YEAR												
GROUP	Données	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
DCX	VOLUME	1 155 014	97 037	626 666	747 851	609 184	747 748	989 375	1 136 123	918 004	1 180 974	967 067	874 631	652 313
	Average	18.4	20.5	22.3	26.8	27.6	26.9	27.8	27.8	27.8	27.5	28.5	28.0	27.4
FIAT	VOLUME	61 131	---	---	---	---	---	---	---	---	---	---	---	---
	Average	18.4	---	---	---	---	---	---	---	---	---	---	---	---
FORD	VOLUME	50 706	2 458 049	1 416 706	1 367 193	1 373 700	1 287 328	2 062 323	2 082 476	2 045 464	1 884 477	2 141 053	2 002 593	1 645 391
	Average	19.0	19.2	22.9	24.1	25.0	24.3	25.8	26.5	27.0	26.9	26.6	26.6	26.3
GM	VOLUME	---	5 102 362	4 508 031	4 003 568	3 402 306	3 503 997	4 844 819	4 538 801	4 463 512	3 503 956	3 461 080	3 337 532	2 815 394
	Average	---	19.1	22.6	23.8	24.6	24.0	24.9	25.8	26.6	26.9	27.6	27.3	27.1
HONDA	VOLUME	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	---	---	---	---	---	---	---	---	---	---	---	---	---
RENAULT-NISSAN	VOLUME	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	---	---	---	---	---	---	---	---	---	---	---	---	---
Toyota	VOLUME	---	---	---	---	---	---	---	---	---	---	---	---	---
	Average	---	---	---	---	---	---	---	---	---	---	---	---	---

CAFE Group Performance - Domestic Products (1991-2004)

GROUP	Données	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
DCX	VOLUME	615 534	519 521	65 421	684 359	850 676	675 732	709 115	674 093	682 489	812 907	739 681	671 372	498 296	641 474
	Average	27.5	27.8	27.8	26.3	28.4	27.6	27.6	28.8	27.2	27.9	27.9	27.7	29.7	29.7
FIAT	VOLUME	7 581	---	---	---	---	---	---	---	---	---	---	---	---	
	Average	27.6	---	---	---	---	---	---	---	---	---	---	---	---	
FORD	VOLUME	91 356	1 311 548	2 048 832	1 669 254	2 002 305	1 522 819	1 664 228	1 597 670	1 638 848	1 608 378	1 309 834	1 190 157	1 136 369	83 168
	Average	27.1	27.4	28.4	27.8	27.8	26.6	27.2	27.8	27.6	28.3	27.7	27.9	21.3	26.5
GM	VOLUME	---	2 884 543	2 701 721	2 903 926	3 039 085	2 609 778	2 434 575	2 408 597	2 505 485	2 510 986	2 184 214	2 106 105	1 872 984	1 854 104
	Average	---	26.7	27.4	27.7	27.4	28.1	28.2	27.8	27.7	27.9	28.3	28.8	21.3	29.0
HONDA	VOLUME	---	---	---	---	---	614 565	44 955	797 432	349 715	837 105	794 448	815 785	378 129	45 061
	Average	---	---	---	---	---	33.0	28.5	32.7	33.5	31.4	32.7	32.4	31.9	31.1
RENAULT-NISSAN	VOLUME	---	---	---	---	---	---	---	159 224	174 349	147 978	137 253	192 701	225 388	209 167
	Average	---	---	---	---	---	---	---	29.9	29.9	28.1	27.9	28.9	21.9	27.9
Toyota	VOLUME	---	---	---	---	6 037	65 924	73 991	76 189	61 819	296 021		254 673	17 504	756 543
	Average	---	---	---	---	28.5	28.3	28.8	28.0	28.3	33.3		33.6	32.4	33.2

Source : NHTSA, 2005

CAFE Group Performance - Imported Products (1978-1990)

		MOTOR YEAR												
GROUP	Données	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
BMW	VOLUME	32 749	37 943	36 408	36 673	37 957	50 261	10 598	87 139	86 072	94 336	77 548	69 555	57 045
	Average	19.8	19.8	26.3	26.9	26.9	26.1	26.5	26.2	25.7	24.8	21.6	22.2	22.1
DCX	VOLUME	135 334	165 629	198 960	193 077	156 627	190 326	201 429	239 604	212 307	342 627	253 136	339 035	89 247
	Average	29.4	28.3	31.2	31.0	30.8	31.1	31.5	30.2	34.0	29.4	27.8	28.0	24.4
FIAT	VOLUME	5 803	13 506	42 205	28 341	10 847	2 821	6 270	5 682	8 030	10 681	5 278	3 391	1 968
	Average	21.5	23.9	27.2	28.0	25.6	22.8	23.3	21.7	26.6	23.7	22.6	21.8	20.1
FORD	VOLUME	2 695 637	172 293	283 383	236 655	262 325	98 506	291 008	333 395	367 720	239 015	519 739	696 347	422 052
	Average	36.8	24.3	25.4	29.6	28.2	25.7	28.7	29.2	27.2	28.7	31.3	29.7	29.3
GM	VOLUME	5 188 972	14 697	15 331	19 045	32 037	38 586	58 765	158 216	382 726	389 283	476 180	289 735	306 431
	Average	33.7	21.7	24.3	35.6	30.8	28.5	27.4	37.5	39.8	36.2	36.4	34.3	32.3
HONDA	VOLUME	250 829	323 261	349 641		353 607	401 744	48 297	541 872	629 534	7 644	848 142	754 499	894 186
	Average	21.1	29.0	30.1		33.9	36.0	35.8	34.5	33.3	33.2	32.1	31.6	30.8
KIA-HYUNDAI	VOLUME	---	---	---	---	---	---	---	---	127 183	231 537	296 987	216 667	116 629
	Average	---	---	---	---	---	---	---	---	35.5	34.8	34.5	33.4	33.3
PORSCHE	VOLUME	---	---	---	---	---	---	---	20 893	27 448	31 616	16 137	10 715	7 013
	Average	---	---	---	---	---	---	---	26.3	26.5	11.4	24.7	23.0	21.7
PSA	VOLUME	10 117	12 869	9 418	15 765	12 687	11 797	19 301	20 847	13 218	808	4 019	9 756	725
	Average	10.8	23.8	28.1	28.7	28.0	25.6	25.0	25.2	25.4	25.4	23.6	25.5	25.5
RENAULT-NISSAN	VOLUME	420 524	399 792	537 222	486 417	482 505	503 567	504 028	50 579	438 411	812 888	441 949	478 408	491 103
	Average	24.8	26.8	32.2	31.4	31.2	33.4	32.5	23.0	25.7	23.5	30.8	30.4	28.5
Toyota	VOLUME	492 833	452 596	674 478	580 215	542 336	547 199	539 959	124 001	634 684	642 246	660 876	735 055	74 152
	Average	20.7	24.0	27.4	31.8	30.9	33.3	33.5	23.9	27.4	27.8	33.0	32.1	30.8
VAG	VOLUME	291 002	---	390 368	333 215	221 959	1 479	2 713	19 099	267 410	235 233	200 569	147 685	146 505
	Average	21.7	---	32.3	34.5	33.4	30.7	29.1	21.3	19.1	19.0	30.5	30.4	29.1

CAFE Group Performance - Imported Products (1991-2004)

GROUP	Données	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BMW	VOLUME	52 322	7 461	64 973	84 782	119 704	58 438	131 944	119 927	113 829	177 836	203 534	196 729	230 176	2 305
	Average	23.2	23.9	25.1	25.1	25.3	27.3	25.7	25.4	25.4	24.8	25.0	26.2	26.8	26.3
DCX	VOLUME	739 596	269 323	206 835	309 480	441 795	333 100	189 094	248 336	326 061	375 117	215 072	266 903	294 104	864 751
	Average	28.9	26.7	27.6	28.4	28.4	27.9	26.0	28.3	28.4	27.6	26.5	26.6	26.3	26.6
FIAT	VOLUME	4	1 858	1 079	1 033	1 358	286	786	685	1 405	898	1 077	1 971	1 594	2 298
	Average	30.5	22.5	23.9	20.0	15.7	13.9	13.7	13.5	13.7	13.6	13.7	15.1	27.9	15.0
FORD	VOLUME	613 756	562 263	384 689	454 751	328 212	216 240	210 332	203 679	232 399	297 683	236 797	279 827	207 599	265 537
	Average	30.8	27.4	#VALEUR!	27.6	30.6	30.1	29.7	27.2	28.5	27.4	27.9	28.1	28.9	27.8
GM	VOLUME	1 685 364	119 110	79 210	21 073	107 749	110 171	181 706	86 317	105 128	12 628	126 691	50 790	50 541	120 671
	Average	31.8	31.4	30.6	25.9	36.7	37.2	32.1	29.4	26.5	27.3	28.5	27.9	34.2	29.5
HONDA	VOLUME	882 466	766 617	691 903	779 072	795 598	135 318	832 909	101 334	408 055	69 844	42 271	71 567	498 229	292 329
	Average	32.9	31.3	32.5	32.4	32.7	28.3	32.4	28.1	29.4	29.3	29.8	29.8	24.7	37.4
KIA-HYUNDAI	VOLUME	133 747	105 082	10 763	123 581	144 781	111 473	146 728	94 920	187 020	352 399	289 166	466 732	447 405	314 958
	Average	34.9	31.3	31.3	33.0	31.2	32.0	31.3	30.9	30.8	30.3	31.3	30.7	22.9	29.6
PORSCHE	VOLUME	6 037	3 065	2 674	298	8 123	7 092	11 748	9 781	26 121	21 141	2 391	22 009	17 907	13 963
	Average	13.3	22.4	22.5	22.1	22.7	21.5	23.2	24.5	24.1	24.3	23.7	23.9	18.0	23.3
PSA	VOLUME	3 211	467	14	---	---	---	---	---	---	---	---	---	---	
	Average	21.3	25.0	26.2	---	---	---	---	---	---	---	---	---	---	
RENAULT-NISSAN	VOLUME	---	389 065	---	491 253	520 834	488 719	520 268	254 601	229 169	301 193	257 247	251 455	281 994	261 639
	Average	---	30.2	---	30.1	29.5	30.5	29.9	30.7	29.9	28.3	28.7	29.5	28.9	29.1
Toyota	VOLUME	---	804 113	763 011	760 291	735 266	704 364	738 059	75 533	951 532	748 256	98 639	757 715	1 107 167	236 648
	Average	---	29.1	29.1	29.2	30.4	29.8	30.1	30.7	29.9	28.9	30.6	29.3	21.9	32.4
VAG	VOLUME	4 729	84 631	60 503	74 415	140 051	156 536	163 189	219 273	34 483	391 571	45 894	411 475	420 273	307 959
	Average	34.6	29.2	27.2	28.5	29.0	28.6	29.0	29.0	28.6	28.8	28.5	29.5	21.3	28.7

Source : NHTSA

CAFE Group Performance - All Products (1978-1990)

		MOTOR YEAR												
GROUP	Données	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
BMW	VOLUME	32 749	37 943	36 408	36 673	37 957	50 261	10 598	87 139	86 072	94 336	77 548	69 555	57 045
	Average	19.8	19.8	26.3	26.9	26.9	26.1	26.5	26.2	25.7	24.8	21.6	22.2	22.1
DCX	VOLUME	1 290 348	350 484	1 019 818	1 086 489	970 252	1 121 805	1 631 534	1 974 599	1 687 639	2 505 374	2 204 986	2 245 992	1 642 593
	Average	19.6	23.7	23.5	26.6	26.5	26.2	26.0	25.8	26.2	25.4	25.2	24.9	24.0
FIAT	VOLUME	66 934	13 506	42 205	28 341	10 847	2 821	6 270	5 682	8 030	10 681	5 278	3 391	1 968
	Average	18.7	23.9	27.2	28.0	25.6	22.8	23.3	21.7	26.6	23.7	22.6	21.8	20.1
FORD	VOLUME	2 746 343	2 663 667	2 164 332	2 266 638	2 176 557	2 180 577	3 477 267	3 349 197	3 792 019	3 362 512	4 093 684	3 995 210	3 186 125
	Average	36.5	19.5	22.3	23.3	23.7	22.8	24.3	24.8	24.8	25.0	25.3	25.2	24.7
GM	VOLUME	5 188 972	5 613 214	5 180 788	4 617 967	4 202 163	4 405 664	5 758 391	6 124 115	5 415 035	5 100 674	5 586 633	5 198 043	4 461 869
	Average	33.7	19.0	22.1	23.2	24.0	23.4	24.3	24.9	26.8	26.1	26.2	25.6	25.3
HONDA	VOLUME	250 829	323 261	349 641	396 375	353 607	401 744	48 297	541 872	629 534	7 644	848 142	754 499	894 186
	Average	21.1	29.0	30.1	31.6	33.9	36.0	35.8	34.5	33.3	33.2	32.1	31.6	30.8
KIA-HYUNDAI	VOLUME	---	---	---	---	---	---	---	---	127 183	231 537	296 987	216 667	116 629
	Average	---	---	---	---	---	---	---	---	35.5	34.8	34.5	33.4	33.3
PORSCHE	VOLUME	---	---	---	---	---	---	---	20 893	27 448	31 616	16 137	10 715	7 013
	Average	---	---	---	---	---	---	---	26.3	26.5	11.4	24.7	23.0	21.7
PSA	VOLUME	10 117	12 869	9 418	15 765	12 687	11 797	19 301	20 847	13 218	808	4 019	9 756	725
	Average	10.8	23.8	28.1	28.7	28.0	25.6	25.0	25.2	25.4	25.4	23.6	25.5	25.5
RENAULT-NISSAN	VOLUME	420 524	478 544	663 195	594 352	613 039	528 989	567 750	718 289	771 069	1 049 640	596 628	623 914	650 871
	Average	24.8	26.2	30.8	30.8	30.5	33.0	31.6	28.9	24.8	23.6	28.7	28.8	27.7
Toyota	VOLUME	492 833	564 412	723 252	711 843	611 860	647 341	817 530	929 202	1 071 604	999 932	945 750	1 008 333	308 053
	Average	20.7	23.0	26.9	30.8	30.0	32.3	30.6	30.8	26.5	26.8	30.4	29.7	24.1
VAG	VOLUME	291 002	212 640	428 823	333 215	251 212	11 837	23 887	276 530	277 772	247 856	204 307	151 439	153 861
	Average	21.7	28.2	31.7	34.5	32.7	22.6	21.7	29.9	19.6	19.8	30.3	30.2	28.7

CAFE Group Performance - All Products (1990-2004)

GROUP	Données	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BMW	VOLUME	53 175	7 461	64 973	84 782	119 704	58 438	131 944	119 927	113 829	183 357	258 068	237 722	273 728	2 382
	Average	23.1	23.9	25.1	25.1	25.3	27.3	25.7	25.4	25.4	24.6	23.8	25.1	25.7	26.1
DCX	VOLUME	1 540 365	1 642 421	1 405 245	2 309 741	2 569 461	2 548 262	2 390 826	2 619 009	2 818 534	2 991 991	2 767 698	2 709 427	2 333 070	3 160 984
	Average	27.3	24.2	22.5	23.2	24.3	23.2	22.9	23.5	23.3	23.9	23.1	23.5	24.3	24.1
FIAT	VOLUME	7 585	1 858	1 079	1 033	1 358	286	786	685	1 405	898	1 077	1 971	1 594	2 298
	Average	27.6	22.5	23.9	20.0	15.7	13.9	13.7	13.5	13.7	13.6	13.7	15.1	27.9	15.0
FORD	VOLUME	2 662 049	3 166 574	3 949 865	3 835 767	3 975 104	3 228 505	3 870 135	3 915 702	3 859 255	3 860 651	3 534 921	3 530 562	3 300 315	2 190 021
	Average	23.9	24.6	#VALEUR!	24.7	25.2	24.2	23.8	23.7	24.2	24.5	23.6	23.7	25.9	22.1
GM	VOLUME	4 597 797	4 474 523	4 319 197	4 845 550	5 236 346	4 369 645	4 427 086	4 321 060	4 638 156	4 781 410	4 313 763	4 617 575	4 379 161	4 359 689
	Average	25.1	24.7	24.9	24.7	24.7	25.6	25.2	25.0	24.5	24.6	24.8	24.7	25.4	24.8
HONDA	VOLUME	882 466	766 617	691 903	779 072	795 598	749 883	951 812	995 594	773 907	1 143 467	1 118 325	1 223 268	1 436 382	853 785
	Average	32.9	31.3	32.5	32.4	32.7	32.2	31.8	31.7	31.2	30.0	30.7	30.3	28.8	29.3
KIA-HYUNDAI	VOLUME	133 747	105 082	10 763	123 581	155 254	120 111	146 963	121 375	225 252	418 918	398 181	646 170	640 272	537 493
	Average	34.9	31.3	31.3	33.0	30.7	31.4	31.3	29.5	29.7	29.2	29.3	28.5	22.5	26.6
PORSCHE	VOLUME	6 037	3 065	2 674	298	8 123	7 092	11 748	9 781	26 121	21 141	2 391	22 009	19 184	37 990
	Average	13.3	22.4	22.5	22.1	22.7	21.5	23.2	24.5	24.1	24.3	23.7	23.9	19.0	20.1
PSA	VOLUME	3 211	467	14	---	---	---	---	---	---	---	---	---	---	---
	Average	21.3	25.0	26.2	---	---	---	---	---	---	---	---	---	---	---
RENAULT-NISSAN	VOLUME	577 373	508 795	551 703	715 664	555 136	675 475	803 112	610 907	574 095	805 038	751 316	731 458	787 709	966 144
	Average	22.7	28.7	27.6	27.8	29.1	28.4	27.2	27.8	27.3	24.9	24.8	25.9	25.2	24.7
Toyota	VOLUME	392 046	1 069 268	1 062 589	1 113 790	1 032 746	1 076 799	1 182 923	608 958	1 470 667	1 657 145	750 868	1 760 356	1 851 712	2 074 897
	Average	20.4	27.3	27.2	27.0	27.8	27.8	27.7	25.0	27.7	27.1	23.2	26.9	25.1	27.6
VAG	VOLUME	115 165	84 631	61 568	74 667	141 865	156 536	164 791	219 273	37 038	394 362	56 386	422 032	430 191	353 395
	Average	21.3	29.2	27.1	28.5	28.9	28.6	28.9	29.0	27.9	28.7	27.0	29.3	21.1	27.5

Source : NHTSA2005

APPENDIX: Why oil price should go up?

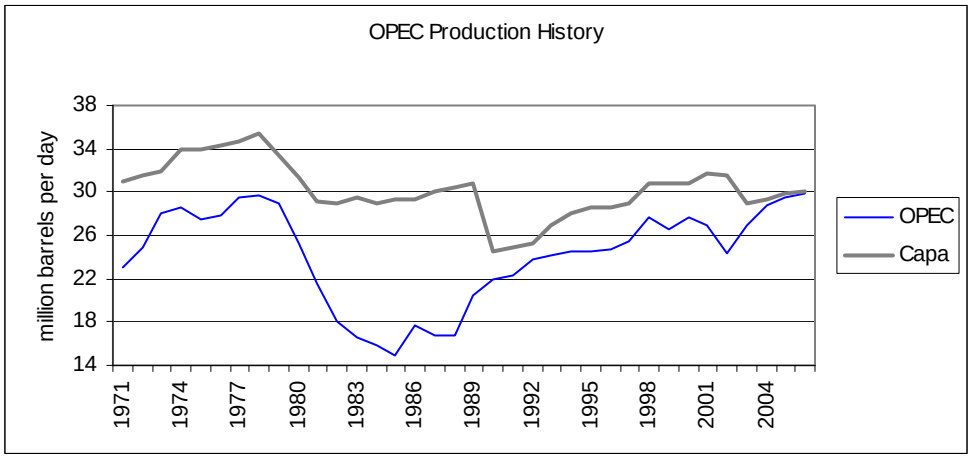
Oil Prices – calling the Saudi and OPEC bluff

▪ New capacity will not reduce the strain on supply

The call on OPEC is clear and will grow

On paper, and in many forecasts such as those of the IEA, new production from non-OPEC sources is expected to reduce the strain on supply which is partly behind the high oil price. Announcements of new capacity of around 1.4mbd in 2005, 0.8mbd in 2006, and 2.6mbd in 2007 should be expected to help match increases in demand. However, an assessment of each project's timing (including delays on some key developments) and production profile shows that actual capacity will remain an issue well into 2008. The call on OPEC is clear, and growing.

A review of OPEC production and estimated capacity since 1971 brings the unprecedented lack of spare capacity into stark relief:



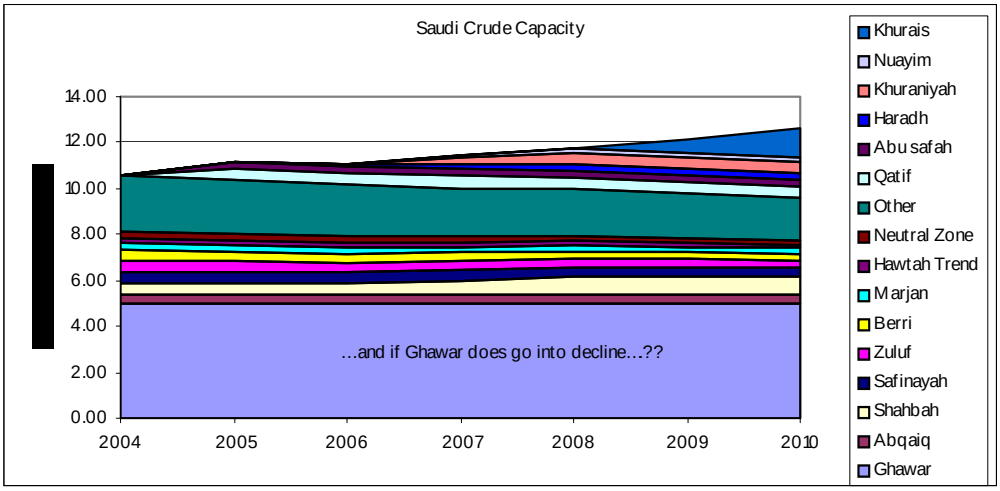
Source: CM-CIC Securities / ESN estimates.

Saudi Arabia's capacity assertions ring hollow

Lack of additional Saudi volumes looks geological, not commercial

We struggle to see where additional supply can come from in OPEC in 2006. Saudi Arabia has maintained a public position that it has over 1.5mbd spare capacity. It has not been in anyone's interests to challenge this position publicly. Saudi Arabia does indeed have some "surge capacity" of around 0.5mbd, but this has never been sustained for longer than three or four months. Moreover, the evidence behind its higher assertions is looking increasingly frail – if such capacity were indeed available, the Saudis would already be using it with oil priced above USD60 per barrel. The Saudis most recent explanation for the failure to produce this upside is that incremental production is "the wrong sort of oil" - heavy crude when the main demand is for light. Other heavy oil producers such as Venezuela, who are already at capacity, confirm that such additional volumes would indeed be positive - the widening of the light/heavy differential would begin to pull down Brent/WTI. The lack of additional volumes from Saudi looks increasingly geological rather than commercial.

Saudi spare capacity



Source: CM-CIC Securities / ESN estimates.

Saudi Arabia's new projects will not bridge the gap

Saudi capacity will decline in 2006

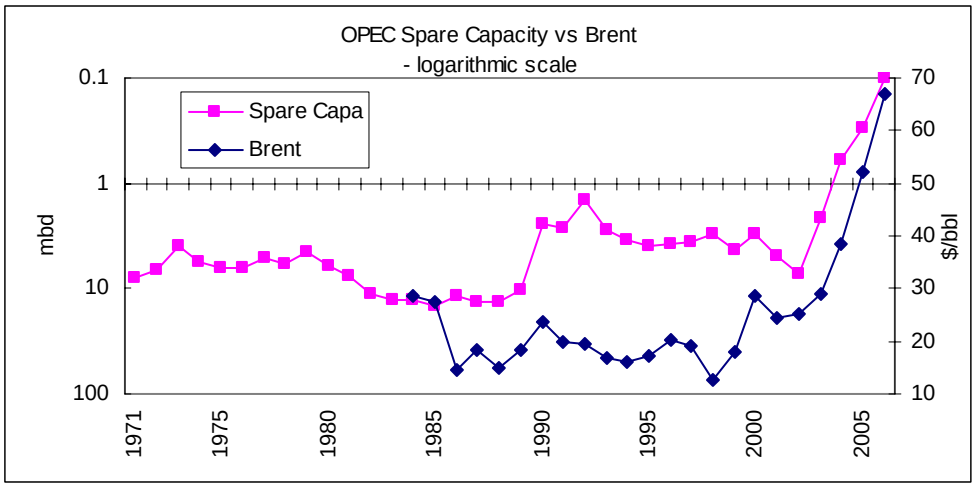
Saudi Arabia has responded to demands for increased demand by making several announcements of new projects to increase capacity. It added two new expansions (Qatif and Abu Safah) at the end of 2004, but we do not believe that these moves will be sufficient for 2006. The Haradh field is to be expanded but only by around 0.15 mbd in 2006, not enough to offset the decline on mature fields confirmed by Saudi Aramco as averaging 5% each year. The next set of projects do not commission until 2007 (Shaybah, Nuayim and Khursaniyah) and 2009 (Khurais). Saudi capacity is declining in 2006 just at the time when the market requires it more than ever.

Why Saudi spare capacity is critical

Key driver for price

This focus on Saudi spare capacity is critical. Until fairly recently, there has been a very poor correlation between OPEC spare capacity and the oil price – the driver was traditionally the level of inventories especially in the US. However, since 1999, when OPEC grasped control of the price (and more operating issues began to become clearer), these two have been effectively linked, and OPEC spare capacity has replaced US or global inventories as the key driver of price. This is most visible using a logarithmic scale for OPEC spare capacity.

OPEC spare capacity vs. brent – logarithmic scale (1971-2005)



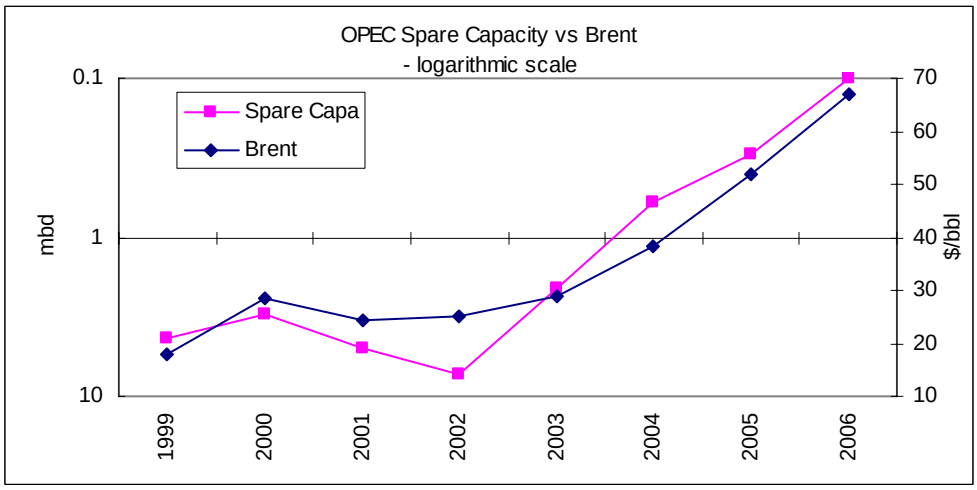
Source: CM-CIC Securities / ESN estimates.

Spare capacity is down to 0.2mbd and is falling…

0.1 mbd by 2006

This level of correlation was initially achieved by commercial decisions in line with OPEC (especially Saudi) policy, but for some time, the constraint has been geological not commercial/political. We now estimate that spare effective capacity is down to only around 0.2 million barrels. Next year's futures price of $67 per barrel is consistent with our estimate of only 0.1 mbd in 2006.

OPEC spare capacity vs. brent – logarithmic scale (1999-2006)

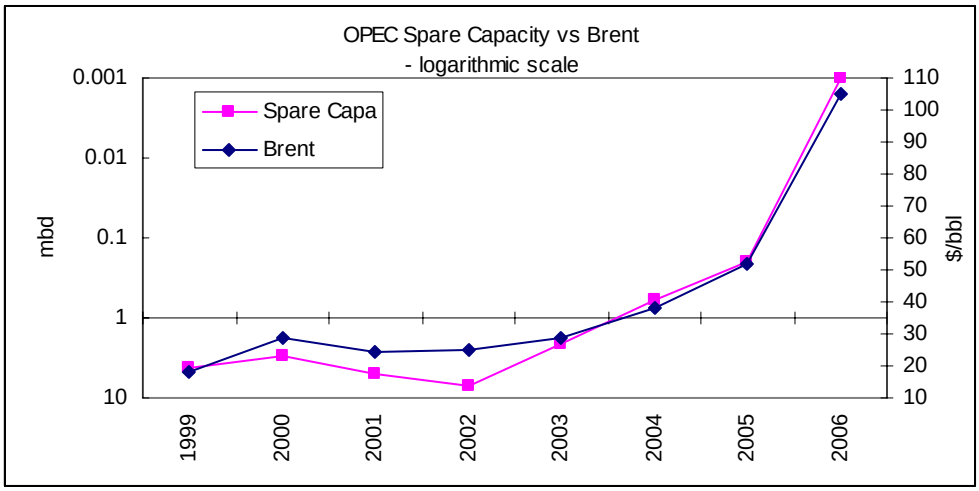


Source: CM-CIC Securities / ESN estimates.

A small change in spare capacity has an exaggerated price on crude

No, spare capacity - $100 per barrel

Because of the sensitivity of the logarithmic scale, even a small change in the level of spare capacity has an increasingly exaggerated effect on the crude price. Closing the spare capacity from only 0.1 mbd to near zero implies an oil price of over $100 per barrel. This is a minute figure, well within the margin of error, and easily overturned by even a fairly small disruption to supply, either within OPEC or outside.



Source: CM-CIC Securities / ESN estimates.

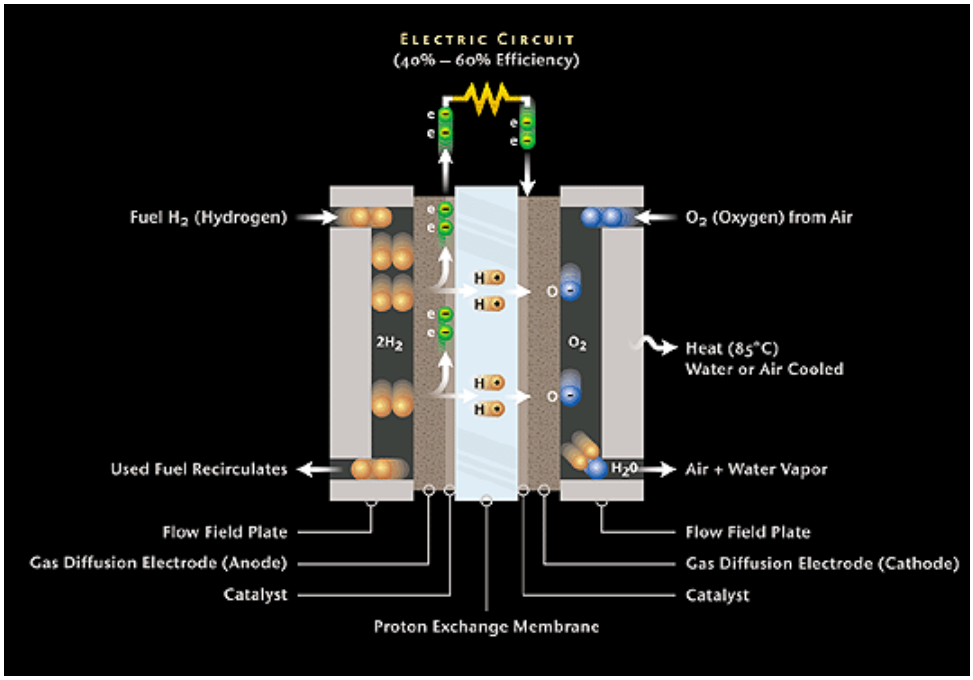
High oil prices are already impacting demand, but not by enough to balance supply. Our demand growth model, a simple but relatively effective predictor based on crude prices and GDP, suggests that growth in 2006 and 2007 will be down 1% and 2% points respectively since we ran this earlier in the year at $38. However, to balance the projected supply over this period and into 2008, demand growth should not exceed 2% CAGR (it was 3% last year and 3.6% in 2003). The oil price implied as necessary to constrain demand to this level is in excess of $60 per barrel.

APPENDIX: Alternative Fuel Vehicles – brief overview

A Fuel Cell Electric Vehicle

A fuel cell combines hydrogen fuel and oxygen to produce electricity used to power an electric motor that moves the vehicle. The only exhaust is water. A number of fuel cell powered electric vehicles are on the roads worldwide, including passenger cars, delivery trucks, buses and military vehicles. Researchers are working to bring down fuel cell and related component costs and to improve durability to enable full commercialization. California boasts the largest number of fuel cell fleets, and there are demonstration projects nationwide, including Washington, DC

How a Cell Fuel works



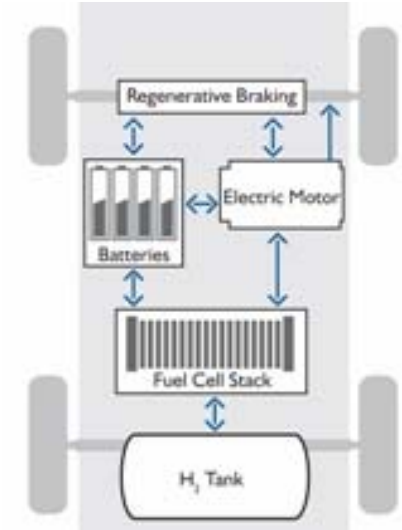
Source: Ballard, 2005

Development and evolution

170 year history

The fuel cell was first developed in 1839 by Sir William Grove, a Welsh physicist and patent attorney. However, it was not until the 1960s that they saw widespread use, when NASA used them to generate electricity for space missions. In 1983, Ballard Power Systems began the development of a Proton Exchange Membrane (PEM) fuel cell – the company is now recognised as the world leader in developing, manufacturing and marketing zero-emission PEM fuel cells.

Fuel Cell Vehicle Principle

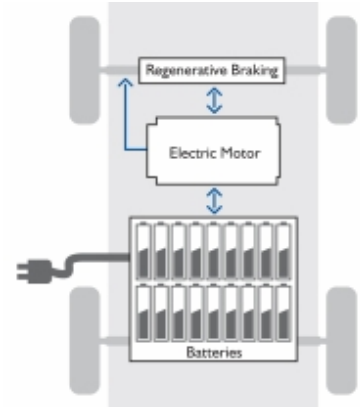


Source : EDTA

Battery Electric vehicle

A battery electric vehicle uses batteries to power an electric motor to propel the vehicle. BEVs produce no tailpipe emissions. The batteries are recharged from the grid and from regenerative braking. Types of battery electric vehicles in widespread use today include low-speed, neighbourhood electric vehicles, airport ground support equipment, and off-road industrial equipment such as fork lifts.

Battery Electric Vehicle Principle



Source: EDTA

Opportunities for new innovative small players: Bolloré and the Electric Blue Car

June 2004: Launch of an electric car in partnership with Pininfarina

Bolloré has announced a cooperation agreement with Pininfarina to develop an electric car prototype functioning on polymer metal lithium batteries (developed by Bolloré's Batscap). The vehicle will be developed by Matra Automobile (Pininfarina) and specifically by Philippe Guédon (who was behind the Renault Espace). The new car aims for an autonomy of 200 to 300km and a maximum speed of 130km/h. It marks the first time that the Bolloré group has gone from the development phase for its battery to an industrial production phase. Whilst automobile professionals remain sceptical (for the moment) about the electric vehicle, Pininfarina is the first "big name" to embark on a project with Bolloré. We estimate that the group has committed between EUR60m-100m in capital for the project over 1998-2004. Further major announcements are planned for November 2005.

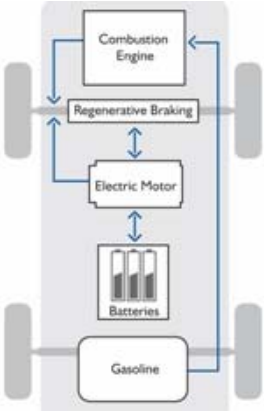
▪ Hybrid Electric Vehicles

A hybrid electric vehicle uses both an electric motor and an internal combustion engine to propel the vehicle. A hybrid is designed to capture energy that is normally lost through braking and coasting to recharge the batteries (regenerative braking), which in turn powers the electric motor - without the need for plugging in.

A 'parallel' hybrid electric vehicle uses the electric motor or the internal combustion engine to propel the vehicle. A 'series' hybrid electric vehicle uses the electric motor to provide added power to the internal combustion engine when it needs it most, for example, in stop-and-go driving and acceleration. Hybrid electric vehicles have the potential to use electricity to power onboard accessories or to provide outlets to plug in appliances or tools. All have the potential to achieve greater fuel economy than conventional gasoline-engine vehicles.

The hybrid market is growing--there are a variety of hybrid electric vehicles available to consumers today, with more models on the way. Cities across the country are already benefiting from the use of hybrid electric buses in their communities

The Hybrid Fuel Vehicle Principle



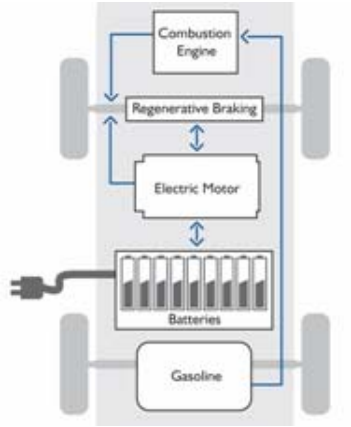
Source : EDTA 2005

Plug-in Hybrid Vehicles

As with other hybrids, a plug-in hybrid vehicle has the ability to run on either electricity or an internal combustion engine. Plug-in hybrids have a larger battery than the batteries of conventional hybrids that can be recharged by plugging into an appropriate outlet.

Recharged vehicles can provide 20-60 miles of all electric, zero emission range without engine power. Plug-in hybrids are being tested in prototype form and may soon be available for sale.

Plug-In Hybrid Vehicle Principle



Source: EDTA

Flex-Fuel Vehicles

A flexible fueled vehicle (FFV) has a single fuel tank, fuel system, and engine. The vehicle is designed to run on unleaded gasoline and an alcohol fuel (usually ethanol) in any mixture. The engine and fuel system in a flex-fuel vehicle must be adapted slightly to run on alcohol fuels because they are corrosive. There must also be a special sensor in the fuel line to analyze the fuel mixture and control the fuel injection and timing to adjust for different fuel compositions. The flex-fuel vehicle offers its owner an environmentally beneficial option whenever the alternative fuel is available.

Flex-fuel technology was created by Ford Motor Company in the mid-1980s. Flexible fueled vehicles (also called variable fuel vehicles) have been produced by Ford (Ranger, Crown Victoria and Taurus), GM (Chevy S-10 and GMC Sonoma), and Daimler-Chrysler (Plymouth Voyager and Dodge Caravan).

A 1988 law in the United States called the "Alternate Automotive Fuels Act" encouraged the development of this technology, allowing the use of alcohol-gasoline blends of up to an 85% alcohol limit. This limit was established with the objective of facilitating starting engines in extremely cold conditions, common in several regions in that country. The technology is based on checking the alcohol content in a gasoline blend through sensors and on the automatic adjustment of engine operation to the most favorable conditions for the blend in

question. One could say that this technology transformed the conventional gasoline engine into an "intelligent" engine.

When Ford introduced a “Flex-Fuel” prototype in the beginning of 2002, simultaneously with a growing interest in new incentives to expand the use of alcohol, there was renewed interest in the new technology, encouraging several areas in the Federal Government to evaluate its merits. Finally, in August 2002, the IPI tax reclassification for vehicles provided the definition that “Flex-Fuel” vehicles would receive the same fiscal treatment as alcohol vehicles.

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