

Taking Stock

Adding Sustainability Variables to Asian Sectoral Analysis

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Auto

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Sustainability

Sustainability is a systemic concept, relating to the continuity of economic, social, institutional and environmental aspects of development. In the terms of the 1987 Brundtland Report of the UN's World Commission on Environment and Development, sustainability is: "Meeting the needs of the present generation without compromising the ability of future generations to meet their needs." The key concept for investors is the need to address a range of environmental, social, and governance (ESG) factors which will inevitably shape long-term returns as markets respond to changing resource requirements and public priorities.

INTRODUCTION

The auto sector in ex-Japan Asia has seen significant changes in recent years, as the strengthening economy across the region has powered enormous growth in demand for vehicles and the consequent establishment of local production capacity. A burgeoning middle class, especially in populations as large as those of India or China, and higher per capita GDP have both encouraged international auto companies to increase production in the region and fostered the growth of domestic auto and auto components companies.

As yet, most domestic Asian auto makers, excepting Japan, are lagging in technology and product development, and they rely on multinational joint ventures ("JV"s) to supply research and development ("R&D") and technological capability. The lack of a mature and vertically integrated supply chain in Asia exacerbates this dependence on foreign JV partners.

Most domestic auto makers in Asia are lagging in technology and product development

As in other industry sectors in Asia, the role of government is critical both to the growth of the auto sector and its competitive dynamics. At the country level, government controls market access and environmental standards and, in most cases, dominates the activities of heavy industry and the oil and gas sector, which supply vital inputs to the auto sector.

...and they rely on multinational JVs to supply research and development

The region-wide growth in vehicle ownership and use, albeit from a low base, has several significant implications from a sustainability standpoint, not least pollution and traffic concerns. The auto sector has become one of the biggest generators of carbon emissions in Asia. In contrast to some industry sectors in the region, key issues and value drivers affect auto makers far more at the product level than the manufacturing level, and it is the environmental and social impacts of motor vehicles in use in Asia that are currently precipitating the most material regulatory, technological and consumer change.

Driven by international pressure on greenhouse gas emissions and domestic public concern about pollution, governments across the region have enacted tougher regulations on auto emissions and fuel efficiency, which are likely to have serious cost implications for local auto makers. The constraints governing the auto sector in the region — lagging technology and government control, especially of the fuel chain — will strongly influence the ability of companies in Asia both to comply with the new standards and to respond to industry-wide opportunities generated by regulatory change.

In the longer term, pollution concerns are likely to drive the development of new auto technologies, which may be based on cleaner diesel, alternative fuels, hybrid or fuel cell platforms. While Asian auto makers are coming under strong political pressure to produce more fuel efficient cars, the reality is that the high quality fuel required to run these vehicles properly is not currently available in many parts of the region and that major capital investment will be required to change this. Also in the longer term, it is likely that a far greater intolerance of dysfunctional road transport systems will lead to the wider introduction of demand management options, such as road pricing, tax incentives or comprehensive public transport systems, in an effort to reduce the overall vehicle volume growth in the region.

In the longer term, demand management options are likely to be more widely adopted across the region

In this report, we assess these issues in the context of Asia's most broadly held large- and mid-capitalization listed auto companies. We believe that the most important sustainability themes for investors in the Asian auto sector will be:

- **Auto-emissions and fuel efficiency** The importance of auto emissions and fuel efficiency as a proxy for sustainability
- **Meeting tougher emissions standards** The availability in practice of cleaner and alternative fuels
- **Building new alliances** Maturation of regional technological and supply chain capabilities, coupled with careful management of international JV partnerships which can deliver technological competitive advantage
- **Technology and innovations** Development in the longer term of viable lower carbon technologies, which could lead to a fundamental restructuring of the competitive dynamics of the industry

COUNTRY AND SECTOR DYNAMICS

What the sector looks like today

The listed universe of ex-Japan Asia auto manufacturers is fragmented and populated by a mixture of small caps, minority public floats and lightly traded stocks, with the exception of one or two significant global players, such as Hyundai Motor Company ("Hyundai") and its subsidiary Kia Motors Corporation ("Kia") in Korea.

Figure 1 Larger Regional Listed Auto Companies

Market	Company	Market Cap* (US\$mm)
China	Denway Motors	2,497
	Brilliance China	544
	Qingling Motors	384
	Geely Auto	173
India	Tata Motors	5,454
	Maruti Udyog	4,082
	Mahindra & Mahindra	2,643
Indonesia	Astra	25
Korea	Hyundai	21,289
Malaysia	Proton	951
Taiwan	China Motor	1,380

* As at 30 December 2005, or last official day of trading

Source: Bloomberg, December 2005

Most ex-Japan Asian auto companies are vehicle assembly operations, with very little service infrastructure or in-house technological capability. Alliances and JVs shape the sector in Asia as local companies are dependent in most cases on foreign partner technology.

In addition to the listed auto makers in the region, there is a proliferation of unlisted JVs which have significant production capacity and play a leading role in the competitive dynamics of the region, such as Shanghai Automotive Industry Corporation's ("SAIC") partnerships in China with America's General Motors and with Germany's Volkswagen ("VW"). In some cases, especially in China, state owned auto companies may have a listed arm, but whether these should be viewed as true stand-alone entities is debatable. There are also a number of small to medium-sized auto makers and auto parts manufacturers, housed within diversified conglomerates around Asia.

In addition to the listed auto makers in the region, there is a proliferation of unlisted JVs

Cross-cutting issues

An analysis of sustainability issues in the Asian auto sector should consider three cross-cutting issues which are shaping the industry and the ability of both auto companies and investors to respond to critical sustainability themes.

- **High demand growth**
- **Regulatory environment drives decision making**
- **Limited disclosure**

High demand growth The last five years have seen an enormous growth in demand for vehicles across Asia. Growth began to build up during the 1990s as GDP levels in the region increased, but was temporarily derailed by the Asian financial crisis of 1997/98, which greatly suppressed demand and caused automakers to slow their capacity development. In recent years, however, that downturn has reversed and sales growth has far surpassed levels seen in the 1990s.

Growth began to build up during the 1990s, as GDP levels in the region increased, but was temporarily derailed by the Asian financial crisis

Figure 2 International Passenger Car Sales Outlook (millions of units)

		2004	2005f	2006f
US		16.9	16.9	16.8
	<i>growth</i>		0.2%	-0.6%
W Europe		14.5	14.4	14.5
	<i>growth</i>		-1.0%	1.0%
Asia		10.3	11.0	11.5
	<i>growth</i>		6.8%	4.8%
China		2.3	2.6	2.8
	<i>growth</i>		12.2%	8.2%
India		1.0	1.1	1.2
	<i>growth</i>		10.4%	9.4%

Source: Scotiabank, 2005

As sales growth slows in developed markets, where demand for new cars has been growing on average at 1% per year for the past 10 years¹, auto makers are increasingly looking to Asia to generate revenues.

Low vehicle penetration of the population in Asia, combined with rising per capita incomes, has both attracted global auto makers to Asia and encouraged the development of a growing domestic auto and auto parts industry.

Figure 3 2003 Per Capita Passenger Car Penetration (per 1000 population)

US	813	Euro zone	590
South Korea	180	Malaysia	147
Singapore	122	Thailand	27
China	13	Indonesia	12
Philippines	10	India	8.5

Source: Wards Automotive, World Bank, Society of Indian Automobile Manufacturers, Smith Barney 2005, Scotiabank 2005

China and India dominate both the demand and supply growth profile for the region.

1) China

China is already the third biggest auto market in the world and has become the battleground for global auto producers hoping to take advantage of its strong growth potential. The total market grew 15.5% in 2004 to 5.1 million units, with the passenger car market accounting for half that total. Chinese government measures to cool down its overheating economy markedly slowed the pace of sales growth in the second half of 2004 (compared to full year growth in 2003 of close to 70%), but the market has recovered in 2005. Total growth in 2005 is estimated at 10-12%².

By 2010, the Chinese market is expected to exceed 8 million units, making it the world's second-largest auto market behind the United States

By 2010, the Chinese market is expected to exceed 8 million units, making it the world's second-largest auto market behind the United States³. The Chinese passenger car market, in particular, has strong long term growth potential, commensurate with the country's economic and per capita income growth. In 2003, nearly 1.9 million new cars were sold in China, of which about a quarter were priced between US\$15,000 and US\$22,000.

Figure 4 Chinese Car Sales by Price Range 2003

Price Range (US\$)	Market Share
4,200–8,500	18.8%
8,500–12,000	13.5%
12,000–15,000	21.0%
15,000–22,000	25.9%
22,000–32,000	17.2%
32,000 and up	3.5%
Total Cars Sold	1.9 million

Source: Crain Communications, Automotive News, March 15 2004

Cars have become a great deal more affordable for a large number of city dwellers, especially in Beijing and Shanghai, where a significant percentage of the population is already considered middle class. As GDP per capita increases in the country, penetration by the auto makers of the addressable universe of potential car buyers in China has fallen from 75% in 1999 to 32.8% in 2005⁴, giving them significant growth opportunities.

In order to capture this potential and establish market share, most auto makers have huge capital expenditure plans for China. Among the listed Asian companies, for example, the combined annual capacity of Hyundai and Kia in China is expected to increase from 280,000 units in 2004 to 730,000 units in 2007 and 1 million units in 2008⁵.

2) India

Although a much smaller market than China, India emerged as the fastest growing car market in the world in 2004, with over 20% growth. India's potential is also considerable, given the current low penetration of cars into the population and, as in China, a burgeoning middle class, especially in the cities. It is expected by Goldman Sachs to become the world's fourth largest market by 2020. The commercial vehicles segment is also robust, with annual increases of over 20% for the past three years. The total production of vehicles in India, including exports, increased from 4.2 million units in 1998-9 to 7.3 million in 2003-4 and is expected to exceed 10 million before 2010.

3) ASEAN

The markets of South East Asia are fragmented and vary according to local economic strength and government attitude to the industry. For example, the 2003 per capita penetration of cars in Singapore may seem low at 122 per 1,000 people, given the relatively high per capita GDP of the country, but reflects the high taxation regime and strong public transport network in Singapore. Conversely, in Indonesia in the first half of 2005, sales of cars and trucks rose 31% to around 300,000 units, and the Association of Indonesian Automotive Manufacturers forecast domestic vehicle sales of 550,000 for full year 2005, up 14% from 2004. These figures are driven by the strength of the economy and growing personal wealth, but also reflect the fact that the government heavily subsidises the price of transportation fuel for domestic users, which adds to the affordability of vehicle use.

Regulatory environment drives decision making Investors in Asian listed companies will be familiar with the fact that the regulatory environment is crucial to corporate decision-making, together with the fact that government plays a dominant role in the key industries which feed into most manufacturing sectors. In the auto sector across the region, government in practice dominates all key policy decisions at country level, from emissions levels and fuel efficiency to product mix and capacity expansion. In addition, government control of core industries such as oil and gas or steel production can lead to market distortions, supply constraints and pricing anomalies, which directly impact on

the auto makers and on their ability to factor sustainability issues into their strategies.

Government controls market entry: foreign auto makers may only manufacture in China as JVs with domestic companies

Government involvement in the sector is overt in China, where there is a stated policy to encourage car ownership among the population and to develop car manufacturing as a "pillar industry" of the Chinese economy. Government controls market entry: foreign auto makers may only manufacture in China as JVs with domestic companies, in which the foreign partner cannot own more than 50% and to which it must contribute technology.

Moreover, the Chinese government regularly attempts to influence the size, competitive dynamics and product mix of the auto sector. Most notably, the government actively intervened in the second half of 2004 with policies to cool the growth of the economy, which had a dramatic effect on sales volume in the sector. Policy directives were also introduced to slow the rise in new investment by local companies and tackle overcapacity in the industry.

In India, regulation is also complex and government policy plays a key role in influencing sector competitiveness. The recent strength of India's auto industry can be attributed largely to a shift in government policies since 2000 to encourage competitive manufacturing, such as export promotion zones, lower tariffs and relaxation of selected regulations.

Throughout Asia, governments usually control the major heavy industries, either via direct government ownership or with complex regulatory systems and limited market access. In many cases, pricing is set by government policy rather than the market. In the oil and gas industry, the effects of this government control are especially pronounced and impact directly on the availability of fuel supply for the auto industry.

There is very little information available on the "carbon intensity" of each company's product range and the degree to which its current profits are derived from high emissions vehicles

Limited disclosure Investors in the ex-Japan Asian auto sector face significant challenges in assessing the sustainability risks associated with individual auto makers. While the level of disclosure by multinational auto makers is relatively high, with all the majors issuing sustainability reports of some sort, Asian companies are not addressing these issues in detail. In particular, there is very little information available on the "carbon intensity" (usually defined as the amount of carbon emitted per unit of energy consumed) of each company's product range and the degree to which its current profits are derived from high emissions vehicles. Hyundai Motor is the exception among the Asian auto makers in that it issues a detailed sustainability report. Astra International in Indonesia also publishes an Astra Green Company report every year, which focuses on its environmental and health and safety management system.

Long-term sector outlook

It is likely that the sector in Asia will look somewhat different in the longer term along several different lines. It is probable, for example, that the number of listed Chinese companies will be much higher and that a sizable number of companies will be spun off from heavy industry conglomerates, just as Daewoo

Bus has emerged as a stand-alone player from the former Daewoo Motor, which was itself part of Daewoo Group in Korea.

Conversely, there is also likely to be consolidation in the industry in the region over the next few years. Both auto companies and policy makers in some countries have been forced to recognise the scale of existing overcapacity, and there has already been considerable merger activity among smaller unlisted companies, especially in China, affecting both auto makers and auto components manufacturers. SAIC's expansion over the last 24 months has generated particular media interest, as it has ventured overseas with its acquisitions of Korea's Ssangyong Motor and intellectual property from the defunct British MG Rover, reflecting a strategic push to access a new market and to upgrade its technological capabilities, independent of its JV partners in China.

In Asia's smaller countries, the large multinationals are expected to become more dominant and likely to become acquisitive, if local regulations allow. In China, an interesting question is developing as to whether foreign auto makers will be allowed to continue building brand name strength and long term market share in the country or whether, at some point, the foreign JVs will be unwound, as the government determines that domestic companies are financially and technologically ready to compete on their own against their former JV partners.

This sector-wide restructuring will be driven by a number of competitive factors: market access, technology and existing manufacturing capacity being among the most important. As the stronger local auto companies become more sophisticated in terms of marketing, brand building and service, new sources of potential competitive advantage are likely to emerge, such as auto financing. VW predicts the share of financed car purchases in China, for example, will grow to 40-50% by 2010.

THE INFLUENCE OF DOMESTIC POLITICS ON EMISSIONS

Polluting emissions have become a serious by-product of development in fast growing countries in Asia, resulting in domestic political pressure to find fixes which might be seen as proxies for longer term sustainable solutions. Air pollution statistics compiled by the World Health Organisation and the Asian Development Bank ("ADB") consistently rank major Asian cities among the most polluted in the world, with Beijing, New Delhi, Bombay, Bangkok and Shanghai among the worst. Although the Chinese government does not publish data about carbon emissions, most foreign analysts estimate that the country's carbon dioxide emission levels are now second only to the United States and are growing by 5-10% a year, the fastest increase of any major nation.

Figure 5 Annual Mean Pollutant Concentration of Selected Asia Cities, 2003

(mg/m³ except where stated)

City	Sulphur dioxide (SO ₂)		Nitrogen dioxide (NO ₂)		Respirable suspended particulate (PM ₁₀)	
	Mean	Air Quality Standard	Mean	Air Quality Standard	Mean	Air Quality Standard
Beijing ¹	0.061	(0.06)	0.072	(0.08)	0.141	(0.1)
Delhi ²	0.012	(0.06)	0.059	(0.06)	0.189	(0.06)
Hong Kong	0.017	(0.08)	0.06	(0.08)	0.058	(0.055)
Mumbai ³ (Bombay)	0.008	(0.06)	0.023	(0.06)	0.063	(0.06)
Seoul	0.005 ppm	(0.02)ppm	0.038 ppm	(0.05)ppm	0.07	(0.07)
Shanghai ⁴	0.043	(0.06)	0.057	(0.08)	0.097	(0.1)
Singapore	0.015	(0.08)	0.024	(0.1)	0.028	(0.05)
Taipei	0.003 ppm	(0.03ppm)	0.025 ppm	(0.53)ppm	0.044	(0.065)
Tokyo ⁵	0.002 ppm	na	0.027 ppm	na	0.032	na

Notes:

¹ urban area of Beijing

² Delhi, Town Hall

³ Mumbai, Kalbadevi (residential)

⁴ urban area of Shanghai

⁵ April 2003 to March 2004

ppm = parts per million by volume

na - not available

Source: "Air Pollution in Asia: Research Primer", CLSA & Civic Exchange, April 2005

The transportation sector is the leading source of ground-level nitrogen oxides (NO_x), respirable suspended particulates, carbon monoxide (CO), sulphur dioxide (SO₂) and various volatile organic compounds, all of which have significant negative effects on public health. Official estimates state that vehicle exhaust emissions will account for 79% of total air pollution in China in 2005.

Air quality concerns are a new issue for the automotive industry in Asia — accustomed as it has been to an attitude of "development first, environment later"

Air quality concerns are a new issue for the automotive industry in Asia, accustomed as it has been to an attitude of "development first, environment later", and one that has material financial impacts for the sector. Climate change policies are already in place in major automotive markets around the world, forcing auto manufacturers to lower the carbon emissions profile of new vehicles. With the implementation of the Kyoto Protocol and the development of proliferating regional initiatives on climate change, governments in Asia are increasingly unable to resist the pressure on them to introduce legislation which is, at least, complementary to that being introduced in developed countries.

Moreover, public opinion in developing countries themselves is becoming increasingly aware of the effects of auto emissions, at the same time as governments are beginning to recognise the measurable costs of pollution. For example, according to the United Nations Environment Programme, India spends an estimated US\$100 billion a year on the treatment of diseases caused by air pollution⁶. In China, the cost of air pollution was estimated at 7% of the

2004 GDP, or approximately US\$500 billion, and is estimated to grow to 13% of GDP by 2020⁷. The level of pollution in Asia's major cities leaves no doubt as to the negative contribution to air quality being made by motor vehicles.

Emissions standards tighter across the region

Auto emissions standards across the region have tightened considerably in recent years, at least on paper.

Figure 6 Selected Regional Auto Emissions Standards

Hong Kong	<ul style="list-style-type: none"> • 2001 adopted Euro III auto emissions standards • 2002 mandated use of ultra low sulphur diesel fuel • 2006 adoption of Euro IV emissions standards for new vehicles
Singapore	<ul style="list-style-type: none"> • 2001 adopted Euro II auto emissions standards • 2005 mandated use of ultra low sulphur diesel fuel • 2006 adoption of Euro IV auto emissions standards for diesel vehicles
South Korea	<ul style="list-style-type: none"> • 2005 adopted Euro III auto emissions standards • 2006 adoption of Euro IV auto emissions standards • 2006 adoption of ultra low sulphur diesel fuel
Malaysia	<ul style="list-style-type: none"> • 1991 use of leaded gasoline phased out • 2000 adopted Euro II auto emissions standards
China	<ul style="list-style-type: none"> • 2000 adopted Euro I auto emissions standards for light vehicles, Euro II for heavy vehicles • 2000 use of leaded gasoline phased out • 2005 equivalent Euro II auto emissions standards for passenger cars • 2008 equivalent Euro IV auto emissions standards for passenger cars
India	<ul style="list-style-type: none"> • 2000 all new cars to meet Euro I auto emissions standards • 2000 banned sale of leaded gasoline • 2005-10 equivalent Euro III auto emissions standards • 2010 equivalent Euro IV auto emissions standards
Indonesia	<ul style="list-style-type: none"> • 2004 announced phase out of leaded gasoline • 2007 adoption of Euro II auto emissions standards
Thailand	<ul style="list-style-type: none"> • 1995 use of leaded gasoline phased out • 2002 adopted Euro III auto emissions standards • 2007 adoption of Euro IV auto emissions standards
Philippines	<ul style="list-style-type: none"> • 2003 adopted Euro I auto emissions standards • 2004 use of leaded gasoline phased out

Source: Asian Development Bank, United Nations, Government of the HKSAR, 2005

To take China as an example, the government announced new fuel economy standards in 2004, which require 32 different car and truck weight-based classes to reduce the amount of fuel used per 100 kilometres in order to meet increasingly tougher targets, to come into force in 2005 and 2008. These standards will be more stringent than the US equivalent by 2007 and will match the European Union's "Euro IV" standards by 2008. Under the regulation, if vehicles do not meet the prescribed standards, they cannot be sold, but models approved by the government before July 2005 will have a one-year grace period for both phases. In another move to encourage the use of fuel-economy vehicles, in 2004 the State Tax Bureau proposed increasing the price of fuel via taxes of 30-50%.

In 2004, only 19% of US cars and 14% of US light trucks met China's 2008 standard. It is not possible, given the information available, to assess what percentage of vehicles sold by Asian auto makers would meet the standard, but it is probably safe to assume that it is a low number. The introduction of these new policies, therefore, will have a significant impact on auto makers seeking to sell vehicles in China. While smaller vehicles could mostly meet the 2005 standards with few changes, the rules for heavier vehicles may require the auto makers to modify existing technology, which would slow their introduction of new models in the country.

Governments can use an array of incentives and penalties to support new standards

In more sophisticated economies, governments possess an array of incentives and penalties with which to encourage the population to adopt new standards. For example, when the Singapore government announced the decision to adopt the "Euro IV" auto emission standards, it introduced a special incentive package in 2004 to encourage diesel vehicle owners to comply. Similarly, the Hong Kong government provided a one-off grant of HK\$40,000 for each replacement of a diesel taxi with one that runs on liquefied petroleum gas in a subsidy programme starting in August 2000. It subsequently offered a similar programme for diesel light buses⁸.

In the region's developing countries, however, implementing these policies is likely to be challenging. There is much precedent in China, for example, for the government's inability to enforce its own edicts. At the municipal level, local enforcement may be more rigorous in some cases. Beijing city government, for example, is paying particular attention to pollution issues as it prepares for the 2008 Olympics. More than eighty other cities in China have banned small, polluting vehicles from major roads and central areas.

Across Asia, there is a lack of capacity to implement and enforce mass emissions standards. Air monitoring networks, which are used to measure the pollutant concentration in the air, particularly at roadsides, are in their infancy in the region. Annual inspection of vehicles in use does take place in some urban areas, but inspection data is not widely available. Moreover, in most parts of the region, there is little education and scant incentive for local officials to attempt to enforce standards.

The relatively low incomes of average vehicle owners mean that vehicles tend to stay in service for a long period, which slows the rate at which emissions control technology spreads across a country's vehicle population via purchases of new vehicles. In many countries in the region, agricultural vehicles, trucks

and two- and three-wheelers make up the majority of the auto vehicle population. Their owners tend to be rural, less well educated and considerably less affluent than urban car buyers. Many of these vehicles, moreover, are notoriously polluting. For example, Sperling, Lin, & Hamilton's recent study of three-wheeled agricultural vehicles in China found that the typical vehicle uses 1960s era single cylinder technology, whose fuel efficiency is extremely low. These vehicles consume more than 20% of all diesel fuel in the country⁹.

Moreover, it is difficult to ensure that those vehicles which do possess advanced emissions control equipment are properly maintained and appropriately fuelled. There are few formal inspection and maintenance programmes at country level, and in most cases governments are not devoting adequate resources to enforce compliance.

Nevertheless, for Asian auto manufacturers, the correct response to new auto emissions and fuel efficiency legislation cannot be to rely on short- to medium-term lack of enforcement. For their contemporaries in the US and Europe, "environmental issues and costs demand a significant percentage of management attention and financial resources, and are a central concern of all R&D programmes. No automotive company can ignore the environmental aspects of its vehicles, and none do"¹⁰. In Asia, compliance with the new standards will require local auto companies to adopt improved combustion technologies, which is likely to involve significant costs.

Beginnings of demand management

In recent years, demand for vehicles has been fed by several factors, in addition to economic growth and greater per capital wealth. For example, subsidised petrol in many countries makes vehicles more affordable. The lack of public transport infrastructure, especially in rural areas, has encouraged public desire for individual car ownership. Governments in the region, both elected and unelected, are fully aware of the extent to which popularity depends upon delivering continued economic growth and improving domestic living standards - aspirations which increasingly include the family car.

However, in cities across Asia, the negative effects of mass vehicle usage have become apparent. In addition to pollution factors, traffic has become a significant burden upon the urban population. For example, a study begun in 1999 by the University of the Philippines' National Centre for Transportation Studies of traffic congestion in Manila found that an economic cost of about P100 billion per year was lost due to time wasted in traffic delays.

In cities across Asia, the negative effects of mass vehicle usage have become apparent

Most countries in the region are now beginning to implement some rudimentary elements of demand management and traffic rationalisation. For example, many cities have constructed new public transport systems, such as Bangkok's Skytrain, Kuala Lumpur's light rail systems and Manila's Metro Rail Transit. China has begun construction of the country's first high-speed passenger railway lines to connect major cities.

Studies in Asia have demonstrated that improvement of public transport services alone does not persuade significant numbers of car users to switch to public transport. For example, an analysis by the Ministry of Construction and the China Academy of Urban Planning and Design of 12 large cities in China showed that between 1993 and 1997 the number of public transit vehicles increased in these cities, but that the total number of passengers using public transport decreased in eight of them.

The government of Singapore has combined the "pull factor" of excellent public transport systems with two monetary "push factors", vehicle ownership control and vehicle usage control, to influence motorists to switch to alternative forms of transport. Under its vehicle ownership control policy, the government limits vehicle population growth to 3% per year, based on land and transport use projections, and potential buyers have to bid for the right to own a vehicle. Successful bidders are given a "certificate of entitlement" allowing them to own a vehicle for ten years. Vehicle usage control is managed through electronic road pricing ("ERP"). Since 1998, an electronic cordon has been placed around the most congested portion of the city and all vehicles entering this area pay a fee, which varies to reflect the traffic rush hours. ERP charges are adjusted every three months based on prevailing traffic speeds on the city roads and expressways.

Most developing countries probably do not have the resources to implement a demand management system as sophisticated as that in place in Singapore. However, it is likely that individual cities will seek to implement systems of some sort over the next decade, and there are multiple studies, many sponsored by multilateral agencies such as World Bank or ADB, under way around the region. To the extent that these schemes do have a material impact on sales of new vehicles, auto companies could see their profits affected by these kinds of initiatives in the future.

TRANSPORTATION FUEL STANDARDS AND AVAILABILITY

The availability, quality and cost of transportation fuels are key drivers that influence the auto sector across the region on many levels

The availability, quality and cost of transportation fuels are key drivers that influence the auto sector across the region on many levels. Much of the recently introduced legislation in Asia has focused on fuel efficiency standards and sought to encourage the adoption of fuel efficient vehicles and phasing out of older vehicles. While climate change and air quality concerns are undoubtedly a factor behind the introduction of this legislation, it is likely that a more immediate driver for countries in Asia has been recent energy market shocks.

Dramatic price hikes in the international oil markets over recent months have led both regulators and consumers to value fuel economy more highly. In fact, one of the most serious concerns for the Asian auto sector is that a prolonged period of higher fuel costs might dampen the growth of the market in the region as a whole, as running a vehicle becomes significantly less affordable for most of the population.

In China, higher international fuel prices seem to be translating directly into increased demand for economy model sedans, sales of which have been growing since October 2004¹¹. Low average income, concerns about petrol prices and densely crowded urban areas are steering consumers towards smaller, more efficient vehicles, such as Geely Auto's economy models (which also perform well by emissions standards). Hyundai has also secured market share in China with strong sales of its economy model, the Elantra, and global auto companies are also planning to increase production of economy models for sale in China, such as the Wuling Sunshine minivan, produced by a GM JV in Liuzhou.

While increased sales of economy model cars, which show better fuel efficiency, is very encouraging from a sustainability point of view, the implications for the auto makers of such a consumer preference have a negative side, in that the margins on these models are considerably lower than on the high-end models, such as the BMWs being marketed by Brilliance China.

Political impacts on fuel price and supply security

For many years, governments across the region have sought to mitigate the impact of international fuel costs on the standard of living of the local populations by heavily subsidising the cost of fuel, including the diesel and gasoline used by the transportation industry. Indonesia was until recently selling the cheapest gasoline in the region, at approximately 26 US cents per litre, but this was almost doubled in October 2005 to 44 cents per litre. The Indonesian government has also set a target for completely phasing out gasoline and diesel subsidies by the end of 2006, and kerosene subsidies by the end of 2007, however they face strong domestic pressure to continue subsidising fuel prices.

Figure 7 Retail Price of Transportation Fuel in Asia (US cents per litre)

	Diesel	Gasoline
China	50	51
India	71	93
Indonesia	44	46
Vietnam	47	63
Malaysia	34	43
Bangladesh	41	55
Singapore	70	120

Source: South China Morning Post, 31st August 2005, Indonesia prices updated as of 1 October, 2005

The cost to government of subsidies has risen enormously as a consequence of international price rises, combined with the fact that some Asian countries are now importing significant amounts of fuel. For example, in 2004 the cost of Indonesia's fuel subsidies rose fourfold to nearly US\$7 billion, an amount equal to nearly 3% of GDP. Despite the price increases in February and October 2005, the cost of subsidies in 2005 is estimated at US\$13.5 billion. While the

first priority of governments in the region is to maintain economic growth and improving domestic living standards, it has become apparent that this level of financial outlay on fuel subsidies is not manageable.

At the same time, governments in Asia are also becoming aware that overwhelming reliance on fossil fuels to power their economies may not be a viable strategy for the long term. China and India are increasingly dependent on imported crude oil to maintain their current growth rates — importing over 50% and over 70% of their crude, respectively — and are acutely aware of that fact. The major energy companies in both countries have adopted aggressive international acquisition strategies to secure oil resources and ensure the availability of supply in the domestic markets.

The less developed countries in the region, in particular, are beginning to examine alternative fuel sources, such as natural gas or biodiesel, in order to develop diversity of supply and reduce their exposure to international fuel prices. However, most countries do not have a specific transportation fuels policy, and there is generally a lack of incentives for clean fuels adoption in the region, although there is selective small-scale substitution of region specific alternative fuels for conventional fuels.

This regional backdrop of growing concern about fuel prices and security of supply is a critical issue for the auto makers. At a national level, these policy concerns are likely to drive further legislation on fuel economy, such as China's proposed fuel tax of 30-50% on car petrol, which may materially alter the fleet mix in the region towards the economy segment.

Regional fuel availability

The irony of the current fuel supply chain in Asia is that while the economy car segment may benefit from policy incentives and increased consumer interest, in the short to medium-term the high quality fuel required for proper operation of higher technology fuel efficiency vehicles is likely to be expensive¹².

Asian refiners are struggling to put enough capacity in place to process crude into saleable product

Energy markets in most Asian countries remain comprehensively regulated, meaning that market access in refining and petrochemicals, as well as downstream marketing activities, is closely controlled. The petrochemicals sector across Asia, both government and private sector, does not currently have the capacity to produce the volume of cleaner fuel theoretically required by an Asian auto industry producing fuel efficient cars. At present, Asian refiners are struggling simply to put enough capacity in place to process crude into saleable product, never mind making the investment required to meet increasingly stringent clean fuel standards.

With surging demand from both the power and auto sectors, China's refining capacity is under particular strain. Small refineries with a capacity of under 60,000 barrels per day, which sell poorly refined, high-sulphur products, are estimated to supply as much as 15% of China's diesel fuel. This drove a group of foreign auto manufacturers in 2004 to urge the Chinese government 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.

It is likely that only the introduction — and critically, enforcement — of more stringent government standards will lead to the uptake of more costly fuel by the auto sector at country level. The fact that enforcement of standards has been improving in India can be seen in the fact that the country has been importing approximately 80,000 barrels per day of "Euro II" standard refined diesel to meet stricter fuel standards in major cities since March 2005, as Indian refiners do not yet have the capacity to supply sufficient "Euro II" and "Euro III" fuel. The government intends that "Euro III" fuel be available in 11 major cities and "Euro II" fuel be available throughout India by the end of 2005¹³.

Once demonstrable demand for cleaner fuels, driven by regulation, is in place, refiners will be forced to start investing in the upgrading and infrastructure required to make low-sulphur, high quality fuels. However, government control of the pricing regime in most countries is likely to slow this process. In environments where refiners are not able to pass through the full costs of their investments to the end-users of the fuel, companies have little incentive to make such investments.

Similar issues underlie the new fuel initiatives emerging in several countries in the region. At present, Asian oil companies are generally absent from the high end of fuels technology. The international oil majors are pioneering new technologies such as gas-to-liquids, producing zero-sulphur diesel from natural gas. This could be a viable alternative for countries like Thailand, Indonesia and Malaysia, which have natural gas resources. Compressed natural gas ("CNG") fuelled vehicles are already in use in several countries in the region, but in practice are only used for government fleets. Some countries, such as the Philippines and Thailand, are also promoting biodiesel and ethanol-mix fuels.

For all of these new fuel alternatives, scalability is the big issue for developing countries. New fuel initiatives require enormous production and distribution infrastructure, and this requires committed investment. In heavily regulated markets, that investment is likely to have to come from government; but for poorer countries this may not be feasible.

For all of these new fuel alternatives, scalability is the big issue for developing countries

The issues for investors, therefore, are complex and difficult to assess, encompassing as they do many regional policy elements. Asian auto makers are coming under strong political pressure to produce fuel efficient, affordable cars. However, the reality is that currently the high quality fuel required to run these vehicles properly is not widely available in the region. Moreover, the regulatory regime in place in most countries may not reward suppliers for introducing the necessary capacity to change this.

Asian auto makers are coming under strong political pressure to produce fuel efficient, affordable cars

These prevailing conditions indicate that the material contribution that Asia can make in the short term to the goal of lowering global auto emissions globally will be the low-cost manufacture of fuel efficient vehicles for export to markets that have the capacity to supply the ultra low sulphur diesel needed to run them.

In the longer term, cleaner fuels and alternative fuels will become more available in the region, but this will require significant regulatory and commercial movement. Investors may consequently need to take a view on the likelihood and timing of deregulation of the oil and gas sector, in addition to specific issues with regard to development and enforcement of standards for auto makers.

IMPORTANCE OF ALLIANCES IN THE ASIAN AUTO SECTOR

Alliances and JVs shape the auto sector in ex-Japan Asia

Alliances and JVs shape the auto sector in ex-Japan Asia. Local companies are dependent in most cases on foreign partner technology and operate only as complete knockdown kit assembly operations with limited technological expertise. Even the Korean auto makers, which lead the ex-Japan sector, are technology receptors, with Hyundai being traditionally allied with Mitsubishi and Kia with Ford.

Figure 8 Regional Auto Sector —Selected JVs and Alliances

	Domestic Company	International partners	Asian partners
China	Brilliance China	BMW	
	Denway Motors	Honda	
	Dongfeng	Nissan	
	FAW	Toyota	
	Geely Auto		
	Jiangling Motors	Ford	
	Qingling Motors	Isuzu	
India	Mahindra & Mahindra		Jiangling Tractor (China)
	Maruti Udyog	Suzuki	
	Tata Motors		
Indonesia	Astra	Toyota	
Korea	Hyundai Motor Company	Mitsubishi	Beijing (China)
	Kia Motors	Ford	Dongfeng Yueda (China)
Malaysia	Proton	Mitsubishi	
Taiwan	China Motor	Daimler Chrysler, Mitsubishi	
	Yulon-Nissan	Nissan	

Source: Smith Barney et al, 2005

In order to respond to local preferences and bring new products to market quickly, some global auto companies are beginning to outsource product development to JVs

The industry generally has been characterised in recent years by increasingly rapid development of new products and a growing proliferation of models. This product volume has not necessarily been positive for overall profitability, but it has started to shape customer expectations of the frequency of new model launches. In order to respond to local preferences and bring new products to market quickly, some global auto companies are beginning to outsource product development to JVs: for example, Nissan outsources some development to its Taiwanese JV, Nissan Yulon. A few individual auto makers are also carrying out their own partial product development: for example, Geely Auto in China, which

Smith Barney describes as the only private sector Chinese sedan assembler with internally developed engines and automotive gearboxes¹⁴. While Geely's record of moving towards internal production of key components of the car is noteworthy, it should be recognised that its engine technology has been based on externally procured Japanese engines, whose product design is altered downwards to reflect conditions in China¹⁵.

However, as sustainability factors —fuel efficiency and emissions standards — are added into product development requirements, sophisticated R&D and strong capital resources become ever more critical to competitive success. Technology and capital is most likely to be supplied by the foreign JV partners.

In practice, this means that an investment in an Asian auto company inevitably incorporates JV risk and effectively becomes a play on the foreign partner's sustainability profile. Auto makers in ex-Japan Asia may benefit considerably from key technology alliances, such as Chinese State owned FAW Group Corporation's agreement with Toyota to produce the hybrid Prius sedan in China. However, where these alliances are not exclusive, as in Honda's JV with Denway Motors in China, competitive advantage for the local auto maker may be limited.

Immaturity of Asian supply chain

The reliance of auto companies in ex-Japan Asia on their JV partners for technology and product development is exacerbated by the immaturity of the auto supply chain in the region. In developed countries, auto makers are able to outsource development, manufacture and assembly of important sections of the car to sophisticated first tier supply chain companies. This reduces costs and also reduces product development time, which can be a significant competitive factor, as auto companies compete to bring new models to market first.

The reliance of auto companies in Asia on their JV partners for technology and product development is exacerbated by the immaturity of the auto supply chain in the region

According to Wards Automotive, in 2003 Asia had a 33% share of global production of autos and auto parts. However, this figure largely captures the growing activities of multinational JVs, together with a basic components industry in Asia. For example, manufacture of labour-intensive casted metal parts, such as engine and brake parts, is now being outsourced to Asian suppliers, especially in China and India, which can offer a cost advantage.

The trend of outsourcing these generic auto parts to Asia is accelerating as production volumes increase in the region. For example, GM and Ford have announced plans to relocate US\$8 billion in parts purchasing to Asia by 2010. However, as yet, the Asian auto supply chain suffers from a lack of vertical integration and there is little capacity to provide the sort of R&D and product development support that Western supply chains currently offer. R&D expenditure in China's auto parts industry, for example, represents less than 2% of the industry's overall revenue, according to Merrill Lynch¹⁶, and few Chinese auto parts brands are considered competitive.

Within ex-Japan Asia, Korean auto parts companies are probably the most technologically advanced, largely as a result of their supporting role for the Korean auto makers: for example, Hyundai accounts for 50% of sales of Halla Climate Control, which is considered a leader in compressor technology (used in air conditioning systems). Hyundai Mobis is the listed auto parts arm of the Hyundai Group, which exclusively supplies Hyundai and Kia. As yet, it has lacked core technology and it focuses on body frames and various automobile modules, but the company is now also pursuing technology driven alliances, such as that agreed with Robert Bosch GmbH in 2004.

India is beginning to develop regional expertise in auto engineering design and has become the ninth country in the world to design its own vehicle. Firms such as Dilip Chhabria Design in Bombay are designing and building concept cars, prototypes and limited production runs.

In the medium term, it seems likely that the auto parts industry in Asia will increase in sophistication

In the medium term, it seems likely that the auto parts industry in Asia will increase in sophistication as production volumes increase in the region, driven in part by global auto makers' desire to access cheaper component manufacturers in the region but also to replicate the kinds of supply chain structures which they find valuable in their home markets. Some global auto supply chain companies are already responding by establishing a strong presence in Asia. US auto parts supplier, Visteon Corporation, for example, has recently announced several strategic acquisitions and JVs in the region. Paradoxically, the potential bankruptcy of another leading US auto parts supplier, Delphi Corporation, could accelerate this process as the more advanced auto parts makers in Asia may have an opportunity to seize parts of its supply chain business.

For ex-Japan auto companies, capital is a critical constraint on their ability to scale up internal R&D and product development activities. As companies come to the public markets — a process which is already well under way in China - it is likely that those which make a strategic decision to apply significant amounts of the capital raised to technology improvement will put themselves in a strong position versus the competition. As both auto makers and components companies increase in sophistication, there is likely to be a movement towards vertical integration and strategic alliances across the industry chain. Already, some companies in Asia are moving in this direction, notably Visteon and China's third largest auto maker, ChangAn, which have announced a JV not only to manufacture components, but also to carry out complete engine management system development.

These industry regroupings may have significant impacts on the ability of the Asian auto makers to respond to changing industry regulation as well as consumer preferences. Auto companies with access to capital and technology, either internally or via strategic alliances across the supply chain, are likely to outperform.

THE LONGER TERM: POSSIBILITIES AND REALITIES OF NEW TECHNOLOGY

In the longer term, it is reasonably safe to assume that auto emissions and fuel efficiency standards will continue to tighten around the world and that worsening pollution and traffic in developing countries will encourage public support for such standards. Asian auto companies that aim to export vehicles to Europe or the United States — such as Brilliance China, which plans to sell sedans in Germany this year — must also comply with export market emissions standards that may be more stringent than those at home.

In response to heightening standards, alternative and lower carbon technologies are now emerging, which may transform the auto industry. Those auto makers which are able to develop lower carbon technologies ahead of competitors hope that they will reap the benefits of technological leadership, brand differentiation and enhanced profits.

In response to heightening standards, alternative and lower carbon technologies are now emerging, which may transform the auto industry

It is possible to group the main lower carbon technologies under development into four main categories.

- "Incremental technologies" i.e. modifications to the conventional gasoline-powered, internal combustion engine
- Diesel (or compression ignition) technology
- Hybrid and electric technology
- Fuel cell technology

So far, there is a great deal of uncertainty as to which technology or technologies will emerge as global winners. Based partly on prevailing regulatory regimes in their most important markets, multinational auto makers have developed different preferences for lower carbon technologies: most European auto makers display a strategic bias towards diesel, as diesel cars make up more than 40% of European car sales; US based auto makers tend to focus on fuel cell technology; Toyota and Honda show most bias towards hybrid technology.

Another potentially important area for the future direction of the auto industry is materials development. According to Amory Lovins, head of the Rocky Mountain Institute in the United States, only 13% of the fuel energy of a modern car even reaches the wheels. The rest is either dissipated as heat and noise in the engine and drive-train or lost to idling and accessories such as air conditioners¹⁷. Lovins argues that use of lightweight materials in car manufacture would greatly improve vehicle fuel efficiency without compromising passenger safety. Lightweight steel or advanced composite materials, such as fibreglass or carbon fibres can nearly double the efficiency of today's hybrid cars and light trucks¹⁸. Moreover, Lovins suggests that ultralight cars could greatly accelerate the transition to hydrogen fuel cell cars, because a greater fuel economy would require smaller fuel cells, which would be easier to manufacture affordably and would not require new vehicle storage technologies.

Only 13% of the fuel energy of a modern car even reaches the wheels

Recent years have seen several initiatives in steel technology and manufacturing processes in support of greater fuel efficiency. For example, the Ultra Light Steel Auto Body ("ULSAB") and ULSAB Advanced Vehicle Concepts programmes, sponsored by a consortium of global steel manufacturers, including Pohang Iron & Steel Co ("POSCO") of Korea and several Japanese steel makers, explored advances in lightweight design for automobiles. POSCO, one of the world's leading steel makers, has devoted significant R&D budget to advanced automotive products and could be a valuable partner to the Korean auto industry in this area in the future.

Auto companies face a considerable challenge not only in developing new technologies, but also in devising an innovation strategy and maintaining capacity across multiple technology pathways. The latter, especially, puts pressure on R&D budgets. For auto makers in ex-Japan Asia, a long term technology strategy is most likely to mean re-examining their JVs and alliances and trying to ensure that they have access to the range of most likely technologies under development.

The introduction of vehicles using new technology also presents a significant management challenge, especially for smaller auto makers, as this is likely to increase manufacturing costs significantly, at least until economies of scale in their production are built up. These costs, together with the need to pay technology royalties to JV and alliance partners, could significantly damage local companies' profitability in the short to medium term.

Governments in Asia are promoting the development of new technology with a mixture of incentives and penalties. The Chinese government, for example, is expected to issue a new set of technical standards in 2005 for the development of hybrids. The Korean government has also supported the development of hybrid vehicles and has taken part in a number of pilot programmes, which has assisted Hyundai's progress in that area.

Many new auto technologies rely on access to alternative fuels or fuels of a much higher quality than that widely available

For investors in the auto sector in Asia, it is essential to bear in mind that many of these new technologies are based on alternative fuels or existing fuels of a much higher quality than that widely available. The practical challenges involved in nationwide production, storage and delivery of, say, hydrogen for fuel cell technology or ethanol for biodiesel technology will be considerable, as will the investment in infrastructure and technology required to make it happen.

Given the involvement of government in both the auto and energy sectors, it is very likely that government will play an active role in co-ordinating between the sectors and attempting to ensure that capacity in fuel production and delivery keeps pace with commercialisation of new technology vehicles. Most countries already have national programmes to support new technologies and alternative fuels, such as India's National Hydrogen Energy Board and the Philippines' proposed National Fuel Ethanol Programme. The challenge for investors in analysing these developments is to reach an assessment of where the value of the resources provided by governments will outweigh the potential delays and competitive market distortions created by government dominance, and to identify the groupings of auto makers, fuel suppliers and regulators that may deliver real future value.

As technology and local conditions continue to push the auto industry in Asia in different directions, long term investors should also consider the possibility that the sector will not follow the precise model established in the developed countries. As the industry migrates to low cost centres like India and China, it is possible that it could fragment into separate areas of specialisation, as opposed to the traditional vertical integration of Western car companies. Currently, most Asian auto companies are assembly operations, dependent on foreign JVs for technology. Given capital constraints and practical difficulties of developing in-house technology, it might be a reasonable strategy for less sophisticated companies to continue to focus on assembly and to buy in technology from those companies in the region who are able to deliver it. For example, India is already establishing regional expertise in auto engineering design, which is lodged within independent companies that have no capacity to manufacture cars themselves. Meanwhile, the more sophisticated supply chain companies being built up in the region are likely in the future to possess superior technology to that of many of the auto assemblers.

Another key area of activity within the industry in developed markets is that of auto financing. While many of the major global companies have announced plans to build up this part of their offering in Asia, it is again possible that local companies may not follow their model. Auto financing is a potentially attractive business for the banking sector, which, at national level and with a regulated financial services environment, may well be able to maintain control of it and deny entry to the local auto companies.

Given a scenario of fragmentation and specialisation within the industry in Asia, strategic alliances, rather than vertical integration, could be the dynamic force driving strategic competition for the auto makers.

In the longer term, therefore, new technology has the potential to alter the auto industry in Asia along multiple dimensions. Critically, investors in the sector need to be aware that this change may not necessarily be for the benefit of the auto makers. The size of the future markets in India and China, in particular, mean that a local technological breakthrough, if successfully commercialised, might lead to dominance of that market segment in the region by Indian or Chinese auto companies. Equally, however, a potential disaggregation of the regional auto industry, and a restructuring by specialisation, could have negative implications for the auto makers, in that the margin advantages may go to the key suppliers with new technology, while the auto companies remain low value-added volume assemblers for the long term.

In the longer term, therefore, new technology has the potential to alter the auto industry in Asia along multiple dimensions

INVESTOR QUESTIONS FOR COMPANIES

Management

- Does management have a specific strategy on climate change issues (auto emissions, fuel efficiency) and related regulatory risk?
- Does management have specific interaction with government on these issues?
- Does management have specific interaction with JV partners on these issues?

Fleet mix

- What is the breakdown of light, medium and heavy vehicles?
- What is the breakdown of commercial and passenger vehicles?
- What percentage of the fleet is SUVs? Is this percentage expected to change in future?
- Does the fleet mix include any hybrid vehicles? Is this percentage expected to change in future?
- Does the fleet mix include any alternative fuelled vehicles e.g. CNG? Is this percentage expected to change in future?
- Which segments of the fleet are manufactured by the company itself and which by its JVs with foreign auto makers?

Compliance with domestic standards

- What percentage of the fleet currently complies with domestic fuel efficiency and auto emissions standards?
- What percentage of the fleet currently complies with published standards to be introduced in the near future?
- What percentage of the fleet currently complies with equivalent Euro IV or Euro V standards?
- What investment is required to ensure that all vehicles comply with current standards?
- When will this investment take place?
- What investment is required to ensure that all vehicles comply with published future standards?
- When will this investment take place?

- What investment is required to ensure that all vehicles comply with Euro IV or Euro V standards?
- When will this investment take place?
- How will the company fund these capital expenditures?

Exports

- What percentage of the fleet is manufactured for export?
- Do the export model vehicles currently meet all the auto emissions and fuel efficiency standards in the markets in which they are planned to be sold?
- What investment is required to ensure that all vehicles comply with standards in the markets in which they are planned to be sold?

Fuel efficient technology

- Has the company developed its own technology to manufacture fuel-efficient models?
- If not, where does it source such technology?
- Do the company's JVs with foreign auto makers have access to fuel efficiency technology from those companies? Does the company itself have access to this technology?
- Does the company have long-term agreements with technology providers?
- Are agreements with technology providers exclusive to the company?

R&D

- Does the company have a strategy for the development of alternative fuelled vehicles?
 - hybrid and electric technology
 - fuel cell technology
 - diesel (or compression ignition) technology
 - gas-based alternative fuels e.g. CNG
- Is the company carrying out research into the use of lightweight materials, such as advanced steel or composite materials, in order to improve vehicle fuel efficiency?
- How much does the company spend on R&D?
- Does the company control its own R&D or is this activity lodged exclusively in its JVs?

- Is the company taking part in any government-sponsored research programmes or pilot schemes of new auto technologies?
- What other R&D initiatives is the company undertaking?

Fuel supply

- Is the company involved in any dialogue or agreements with fuel supply companies on provision of cleaner or alternative fuels?

RESOURCES

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- China Motor Corp www.5230.com.tw/eng_version
- Denway Motors www.irasia.com/listco/hk/denway/index.htm
- Geely Auto www.geelyauto.com.hk
- Hyundai Motor worldwide.hyundai-motor.com/index.html
- Hyundai sustainability report [worldwide.hyundai-motor.com/dataPDF/sustainability/Sustainability\(ENG\).PDF](http://worldwide.hyundai-motor.com/dataPDF/sustainability/Sustainability(ENG).PDF)
- Kia www.kiamotors.com
- Mahindra & Mahindra www.mahindra.com
- Maruti Udyog www.marutiudyog.com/index.asp
- Proton www.proton.com
- Tata Motors www.tata.com/tata_motors

Useful web-based resources

- The Auto Channel www.theautochannel.com
- Clean Air Net www.cleanairnet.org/caiasia
- Climate Biz www.climatebiz.com
- Green Car Congress www.greencarcongress.com
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- 10 Innovest Strategic Value Advisors, April 2004. *"Automotive Industry Global Report"*
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The Association for Sustainable & Responsible Investment in Asia

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ASrIA is a not for profit, membership association dedicated to promoting corporate responsibility and sustainable investment practice in the Asia Pacific region. ASrIA's members include investment institutions managing over US\$4 trillion in assets, however membership is open to any organisation which has an interest in sustainable investment.

ASrIA has taken a leadership role in promoting sustainable investment in Asia since our founding in 2001. ASrIA has run conferences, seminars and workshops, and published wide-ranging research on SRI issues. ASrIA has also created a very wide network of organizations and individuals interested in the broad range of policy issues and investment strategies which are essential to the implementation of SRI in Asia. ASrIA's website, www.asria.org, is the primary resource for SRI in Asia, attracting over 4,000 page views per day and over 5,000 subscribers to our regular e-bulletin.

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