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## **TRADE OVERVIEW**

After experiencing a 40 percent decline in 2009, U.S. new passenger vehicle exports rebounded sharply in 2010, increasing by 40 percent to \$45 billion. Imports of passenger vehicles were up by 42 percent to \$123 billion. However, this number actually continues a long-term trend of declining imports if 2009 is taken as an aberration. Imports in 2007 reached \$147 billion, and fell to \$133 billion in 2008. At \$78 billion, the overall motor vehicle trade deficit in 2010 was well above 2009's level of \$54 billion, and slightly less than 2008's level of \$79 billion. It is far lower than 2007's deficit of \$97 billion.

Imports continue to drop because foreign brands are increasing their U.S. manufacturing capacity. All the major foreign brands have opened, or plan to open facilities. U.S. consumers are increasing their purchases of "import brands" that are made in the United States.

### **Exports**

As global markets began to recover, U.S. vehicle exports also increased. In 2010, U.S. exports totaled \$45 billion, with exports of 2,233,230 vehicles. U.S. light vehicles were exported to almost 200 countries in 2010. The top five markets remained the same; however, there was a shift in the order. Canada remained the top export destination, with exports of \$17 billion, up 34 percent from 2009. Germany held on to the number two slot, with exports of \$3.6 billion, down 16.7 percent from 2009. Saudi Arabia became the number three export destination for U.S. light vehicles, with exports of \$2.95 billion, up 111 percent from 2009. Next in line came China, with exports of \$2.91 billion, up 286 percent from 2009. Finally, Mexico received \$2.8 billion in U.S. light vehicle exports, up 43 percent. Mexico fell from the number three position it had retained for several years prior to 2010.

Given the extremely low U.S. light vehicle export level of 2009, growth in many markets was at remarkably high levels in 2010. Some other major markets where the United States experienced high levels of export growth in 2010 would include: Korea, with exports of \$313 million (13,582 vehicles), up 170 percent; Chile, with exports of \$360 million (16,589 vehicles), up 150 percent; and Russia, with exports of \$106 million (3,429 vehicles), up 701 percent. While Saudi Arabia held the number three slot for top export destinations, other Middle East destinations followed relatively close behind, demonstrating the importance of the region to U.S. automotive trade. The United Arab Emirates came in at number six, with exports of \$1 billion, Kuwait was at number eight, with exports of \$707 million, and Qatar was the 12th leading destination, with exports of \$239 million.

### **Imports**

U.S. imports of passenger cars and light trucks increased in 2010 as the U.S. auto market began to recover. Imports were up 42 percent, totaling \$122.9 billion for the year. The United States still imports more vehicles by volume and value than any other country. This is largely explained by shipments from plants in Mexico and Canada. Our NAFTA partners accounted for 48 percent of U.S. light vehicle imports in 2010. This percentage has remained relatively

consistent for the past few years. Our top five sources for passenger vehicle imports -- Canada and Mexico, along with Germany, Japan, and Korea -- accounted for 93 percent of all U.S. light vehicle imports last year.

Germany was the primary source of U.S. light vehicle imports in 1965, while Canada was a distant third behind the UK. Canada rose to the top in 1970 because of the Detroit 3 investment in production facilities in Canada. In 1976, Japan, aided by the first oil shock in 1974, quickly rose to the top source for U.S. imports. Canada has since regained its top U.S. supplier status aided by Japanese investment in new Canadian production facilities. South Africa has recently risen well up in the ranks. As recently as 2002, motor vehicle imports from South Africa totaled \$267 million, with a volume of 11,511 vehicles. In 2010, South Africa was the number seven source for vehicle imports, with imports of 56,278 vehicles valued at \$1.5 billion.

The import statistics of our primary import suppliers were up in 2010. Imports from Canada were up 53 percent to \$35.8 billion while imports from Mexico increased by 47 percent to \$22.6 billion. Imports from Japan were up by 32 percent to \$31.8 billion (compared to \$41 billion in 2008) and imports from Korea increased by 15 percent to \$6.6 billion (compared to \$7.5 billion in 2008). Imports from Germany increased 55 percent, to \$17.4 billion in 2010 (compared to \$18.4 billion in 2008).

## **MAJOR MARKETS: REGIONAL AND INDIVIDUAL COUNTRIES**

### **Regional Groups (NAFTA, ASEAN, CEE)**

#### **NAFTA**

The North American Free Trade Agreement (NAFTA) includes the United States, Canada, and Mexico. Like the United States, the auto industry in Canada and Mexico faced a difficult 2009 but began a recovery in 2010 and continues to recover in early 2011. Their 2009 problems, especially in terms of production, were directly tied to their reliance on the United States as an export market, and the 2010 recovery was linked directly to the U.S. market as well.

As they did in the United States, General Motors (GM) and Chrysler sought financial support from the Canadian government in 2008/2009 in order to remain solvent. The Canadian process for granting the loans and the final terms of the loans was very similar to that in the United States.

The national Canadian government partnered with the Province of Ontario to loan GM \$10.8 billion, resulting in a 12 percent (approximately) ownership stake in the company. On April 2, 2010, GM completed the repayment of a separate interim loan of \$1.5 billion to Canada and Ontario, ahead of schedule. In GM's initial public stock offering, Canada sold 35 million shares of GM stock for a net value of \$1.15 billion, reducing its GM share to 9.34 percent. In January 2011, GM paid \$2.0 billion into the Canadian pension plan.

The national and provincial governments authorized loans to Chrysler up to \$3.7 billion. As of January 2011, Chrysler has borrowed \$2.9 billion of this total. In providing this loan to Chrysler, Canada agreed to take a two percent ownership in the company. Chrysler has not yet issued public stock or paid back any of its loan from Canada.

In 2010, Canadian light vehicle sales increased 6.2 percent compared to 2009, with sales increasing from 1.46 million to 1.55 million vehicles. Car sales declined by 5.9 percent and light truck sales increased by 12.1 percent. Production increases in Canada in 2010 totaled 2.07 million light vehicle (cars and light trucks), increasing from 1.49 million in 2009, or by 39 percent.

Mexico's overall passenger vehicle market expanded by 8.8 percent in 2010 compared to 2009, increasing from 752,552 to 818,785 vehicles. Production for 2010 when compared with 2009 also increased, from 1.56 million to 2.34 million, or by 50 percent.

Trade between the United States and its North American neighbors increased as a result of the upturns in all three markets. U.S. road motor vehicle (including commercial vehicles) exports to Canada expanded 38.4 percent in 2010 compared to 2009, rising from \$15.9 billion to \$22.0 billion. Passenger vehicle exports to Mexico increased at a slightly faster rate, expanding 39.5 percent from \$2.3 billion to \$3.3 billion.

U.S. imports of road motor vehicles from the NAFTA region followed a similar pattern. Imports from Canada increased 49.2 percent from 2009 to 2010, going up from \$24.6 billion to \$36.7 billion. Imports from Mexico increased 49.0 percent, from \$18.6 billion to \$27.6 billion during the same period.

### **The Association of Southeast Asian Nations (ASEAN)**

The ASEAN vehicle sales hit record highs in 2010 due to strongly performing economies. ASEAN is our fifth largest export market for all merchandise trade, behind Canada, Mexico, China and Japan. ASEAN has a combined GDP of over \$150 billion and a population of close to 600 million people, making it a key market for U.S. exports and investments. In 2009, total ASEAN merchandise trade was \$1.5 trillion. In 2010, U.S.-ASEAN trade was nearly \$163 billion (an 11.6 percent increase from 2009). According to *Just-Auto*, combined automotive sales in the ASEAN's six main markets, Thailand, Indonesia, Vietnam, Philippines, Singapore, and Malaysia, grew by 32 percent in 2010 to nearly 2.5 million units, up from 1.9 million in 2009. All of the major economies, with the exception of Singapore, recorded record highs.

Forecasts suggest combined vehicle sales in ASEAN's top six markets are expected to grow in 2011, but at a slower pace, not likely to exceed 2.6 million units. Some economies, however, will continue to fare better than others. Government policies such as scrappage schemes and fiscal stimulus policies are positively stimulating the market and affording some markets an advantage over others. The Thai auto market, for example, has responded favorably to tax incentives provided by the government for producers of "eco-cars."

According to *Business Monitor*, “the ASEAN region and the ASEAN Free Trade Agreement (AFTA) have been instrumental in providing a basis for trade and cooperation between not only the member states, but between divisions of the same company in different countries.” AFTA provides for regional tariff reductions, elimination of NTBs, harmonized customs nomenclature, intra-regional liberalization of trade in services, and regional IPR cooperation. ASEAN is seeking to build a European Union (EU)-like community by 2015 for all its members. Under the AFTA, all internal tariffs on manufactured products have been lowered to 0-5 percent. Thailand has been particularly successful in taking advantage of low tariff rates throughout the region. In fact, Thailand has become the world’s second largest market for the one-ton pickup truck behind the United States, making Thailand both a regional production and export hub.

The ASEAN Industrial Cooperation Scheme (AICO) has also had a major impact on automotive trade within the region. Under the AICO program, approved companies are eligible to benefit immediately from the AFTA 0-5 percent preferential tariff rate for trade in approved items. In the automotive sector this applies to completed vehicles, parts, half-finished goods, and materials. In order to qualify, products must have 40 percent ASEAN content and demonstrate resource sharing between participating companies. In addition, ASEAN members are required to abolish the localization arrangements in each country as well as the import tariff exemptions and local capital requirements.

The three largest automotive markets in ASEAN are Thailand, Indonesia, and Malaysia. The automotive industry in Thailand is one of the key sectors in the Thai economy. Despite a backdrop of political instability and a global recession, the Thai economy is estimated to have expanded by close to eight percent in 2010, aided by low interest rates. These interest rates helped drive domestic consumption and strong export growth. In 2010, Thailand produced approximately 1.5 million vehicles, and over half of these were exported (871,000). This compares with less than one million produced in 2009. Thailand’s passenger car sales rose by 50.7 percent to 346,750 units in 2010, while commercial vehicle sales were up by 42.3 percent to 453,617 units. Toyota’s sales increased to 325,750 units (an increase of 41.4 percent), for a market share of 40.7 percent. Thailand has become the premier production base for the rest of ASEAN, taking advantage of high import duties (80 percent on passenger cars) to keep imports low and 0-5 percent tariff rates for exports within ASEAN, thanks to the AFTA. Thailand also exports vehicle parts, primarily to the rest of Southeast Asia, and with the consolidation of the AICO scheme, this is only expected to grow.

Indonesia is also vying to become a major regional hub by possibly adopting World Forum for Harmonization of Vehicle Regulations (WP29) global technical regulations (GTRs). Indonesia believes it can benefit significantly from adoption of these GTRs, particularly in four key areas: tires, seat belts, automotive glass, and noise emission components. It is already attracting investment as a hub by auto companies such as Nissan and Toyota. Demand for motor vehicles in Indonesia has continued to be robust with an increase in new vehicle sales of 57.5 percent or 764,710 units, from 486,061 units in 2009. Despite one of the largest passenger car markets, with sales of 541,475 units in 2010 (a 50.7 percent increase over 2009), its commercial vehicle sales outperformed the industry average with 223,235 units sold in 2010 (a 79.8 percent increase). The Indonesian economy grew by an estimated six percent in 2010, with the domestic

economy accounting for the majority of that growth. However, the economy has also benefited from a large rebound in exports, with increased demand for commodities and energy. The vehicle industry is cautiously optimistic that these large numbers can be sustained, although there is concern over rising fuel costs for private motorists and higher vehicle taxation.

Malaysia retained the highest level of ASEAN passenger car sales for 2009 with 486,342 vehicles sold, mainly due to its domestic national car programs which focus on indigenous car sales and production. For example, Malaysia's closest rival in the region in terms of passenger car vehicles in operation is Indonesia, which only totaled 4.8 million in 2008, compared with 7.2 million for Malaysia. Malaysia has an indigenous vehicle industry, and, over the past three decades, has been dependent on strong protection provided by the government. Consequently, liberalization in the vehicle industry has been slow. In October 2009, the government released its new National Automotive Policy (NAP), which focuses on sustainability of the domestic industry, with more market opening for foreign brands. It is especially interested in streamlining its domestic industry to two national high volume car producers, Proton and Perodua. Malaysia has made progress in reducing import tariffs, admittedly after having secured a two-year deferral from ASEAN. Import tariffs on completely built-up (CBU) units were reduced from a band of 70–90 percent to 20 percent at the start of 2005. For completely knocked-down (CKD) kits, the import tariff was cut from 25 percent to zero. Import duties on CBUs were cut further, to just 5 percent, in March 2006.

### **Central and Eastern Europe (CEE)**

The CEE automotive market is an evolving region of diverse economies; some with indigenous automotive operations, and most with aspirations for attracting new or expanded automotive foreign direct investment. As many have recently joined the EU, they have also adopted EU economic policies affecting the auto industry, such as the Common External Tariffs and regulatory type approval, making intra-European trade more streamlined and consolidated. The top five CEE automotive markets in terms of sales and production are: the Czech Republic, Hungary, Poland, Romania, and Slovakia, and all five of these countries are members of the EU.

The CEE has a low rate of car ownership compared to Western Europe, and while this implies the potential for increased demand, with weak economic conditions and tight credit access in most CEE countries, consumers are likely to favor used cars for the foreseeable future. Moreover, David DiGirolamo, head of JATO Consult, states: "Central and Eastern Europe is not the new car market it once was. The lack of any formal incentive schemes, coupled with rising taxes and more stringent banking requirements, has reduced consumer demand across the region." In addition, the removal of Western European scrappage schemes will reduce the level of exports from the CEE to this region. Nonetheless, the International Organization of Motor Vehicle Manufacturers (OICA) reports that, while CEE produced nearly eight percent fewer vehicles in 2009 than in 2008, the region outperformed the rest of Europe. BMI predicts a steady seven percent growth in production over the next five years, to raise the region from approximately 3.0 million units to 4.22 million units.

The **Czech Republic** (CR) is emerging as one of the major markets in the region, and overtook Poland to be the regional leader in terms of production for 2010. BMI reports that 2010 production was up by 13 percent, based on strong export growth, which was also up by 16 percent from 2009. Specifically, 2010 production was nearly 1.02 million vehicles, up from sales in 2009 of 973,000 units, and 2010 sales were 184,000 units, up from sales in 2009 of 181,000 units. BMI forecasts vehicle (cars, light commercial vehicles, and heavy trucks and buses) production to continue to grow to 1.07 million in 2011, increasing to 1.34 million by 2015. Likewise, 2011 vehicle sales are forecast to be 191,000 units and nearly 230,000 by 2015. Volkswagen's Czech unit Skoda's Auto Chairman Winfried Vahland stated that the automaker plans to double revenue over the next five years and double sales within a decade. Skoda is the major producer, with most of its exports going to Russia, China, and India. Sales were also steady.

The Czech Republic has drawn significant other investment over the years. According to Just-Auto, Hyundai's plant in Nosovice, which opened in late 2008, will reach full capacity of 300,000 vehicles a year by next autumn, and plans to hire an additional 650 employees during 2011. The plant produced 200,135 vehicles in 2010, and 97 percent were exported. The plant currently employs 2,600 people and exports to 50 countries across Europe, North Africa and the Middle East. Considered as the mirror plant to Kia's Zilna plant in Slovakia (which opened in 2007, and is only 90 kilometers away) there will likely be product integration and model sharing, with Nosovice building some Kias and Zilna building some Hyundai's. Although the CR has introduced a VAT write-off for new vehicle sales, surrounding CEE countries offer a competitive low-cost edge. Domestic dealers are pricing new vehicles aggressively, to encourage customers to purchase these new vehicles rather than the used vehicles.

**Hungary's** automotive industry is also one of the key sectors in its economy. However, unlike its neighbors, Hungary has suffered six consecutive years of declining new car sales, due to the financial crisis of 2006, and tight government policies which affect consumer spending. There has also been a lack of investment in infrastructure programs, and Hungary has not yet adopted the euro. 2010 production was up slightly to 195,000 units from 2009 production of 183,000 units. However, sales dropped significantly from 71,000 units in 2009 to 53,000 in 2010. BMI forecasts vehicle (cars, light commercial vehicles, and heavy trucks and buses) production to be nearly 212,000 in 2011, increasing to 303,000 by 2015. Likewise, 2011 vehicle sales are forecast at 63,000 units and nearly 119,000 by 2015. Another glimmer of hope is that Audi has announced plans to invest almost \$941 million in its Hungarian operations during the next three years, as it expands its production plant in Győr. This may expand even further after 2013, with a reported second phase of investment in 2017-18, which could raise output to up to 339,264 vehicles annually. The current expansion will increase output to 125,000 vehicles a year from 2013, creating 1,800 new jobs. (Audi's plans for possible production in the United States have been deferred until after 2015.)

**Poland** has traditionally been the largest market in the region in terms of both automotive sales and production; however, the Czech Republic overtook Poland in 2010 to become the region's largest producer. Poland remains the region's largest market in terms of sales. Like other CEE markets, its automotive industry's strength is in its export-driven strategy. BMI reports that 2010



sales were approximately 408,000 units up from sales in 2009 of 372,000 units, and production was 901,000 units, up from 879,000 units in 2009. BMI forecasts vehicle production to be 927 million in 2011, increasing to 1.12 million by 2015. Likewise, 2011 vehicle sales are forecast to be 451,000 units and nearly 640,000 by 2015. Most sales in the Polish market are from imported models (mostly used), not domestic production, as these vehicles are typically exported to more lucrative markets. Therefore, it is not surprising that the Government of Poland (GOP) is juggling policies regarding used car imports to ensure that they are environmentally sound. Poland is also adopting policies to encourage the absorption of indigenous production and to insulate it from the reliance on exports. Since vehicle ownership level remains low (383 units per 1,000 people), a raise in wages should also boost demand. But with a tight economy, demand for older, used cars is also on the rise. The CEE markets are vulnerable to the flood of used cars challenging new market sales. In addition, output growth could slow with a forecasted stagnant EU market. With over 90 percent of its car production exported, Poland is overexposed to fluctuations in overseas markets. Export volume has risen steadily over the past few years; however, with the global recession, exports dropped during 2009, despite increases in local production capacity. For example, exports in 2009 were 1.09 million units, down from 1.46 million in 2008. Exports rose in 2010 to 1.2 million units and are expected to continue gradually recovering, with BMI forecasting 1.92 million units exported by 2014. Therefore, the indigenous market will either need to absorb this disparity or Poland will seek new export markets.

The GOP appears ready to encourage domestic sales. According to Just-Auto, GM said it will put its new Opel/Vauxhall small Cabriolet into production at its Polish plant in Gliwice. Some manufacturers, including auto parts manufacturers, are relocating within CEE, increasing competition for investments in the region. For example, in October 2009, Takata Petri, an auto parts manufacturer, announced that it is relocating its plant to Romania from Poland, based on closer proximity to demand. Nonetheless, substantial production will remain in Poland. In addition, Fiat Auto Poland broke its production record of 500,000 vehicles (by third quarter 2009) and it hit its target of 600,000 vehicles by year end, at its Tychy plant. Fiat is fully committed to remaining in this market.

**Romania's** automotive industry accounts for nearly six percent of its GDP. Car ownership levels are relatively low, and ongoing infrastructure projects are underway, so there is huge potential for growth. Nonetheless, in August 2010 the government announced an increase in VAT from 19 to 24 percent, which will no doubt have an effect on sales in the country during 2011. Consumer spending is expected to eventually rise by 2015, with vehicle sales increasing from a low in 2010 of approximately 147,000 units to a forecast in 2015 of 186,000. Production is forecast to grow significantly from 305,000 units in 2010 to 434,000 units by 2015, given the many investments underway, as labor costs remain relatively weak compared to other CEE markets. Dacia (Renault) and Ford are the major producers, and both are ramping up production. As a response to these investments, parts manufacturer investments are also on the rise, with reportedly 12 new companies to arrive in the next couple of years. Renault has invested one billion dollars to modernize Dacia's huge Pitesti plant. The low-cost Logan model, originally targeted as a low-cost car for emerging markets, is also a hit in France and Germany during these difficult economic times. In less than four years, one million Logans have been built. During

2007, Ford acquired the Romanian automaker Automobile Craiova, which operates the former Daewoo plant in the southwest of the country. (Ford had been absent as a producer in the CEE since it closed its CKD plant in Poland in the late 1990s, with most of its focus on a successful plant near St. Petersburg, Russia). Ford will start with a small car built solely in Craiova and expects up to 90 percent of vehicle production to be exported. This could be a version of the next generation Ka, which is being developed jointly with Fiat on the new 500 platform.

**Slovakia** is also emerging as one of the CEE's most significant automotive economies, with the sector accounting for approximately 16 percent of GDP. In addition, Slovakia entered the euro zone on January 1, 2009. Government incentives are still offered to foreign investors, and Slovakia retains one of the lowest-cost and highly skilled workforces in the CEE. Nonetheless, unemployment remains high in Slovakia (in the double digits), which has an effect on sales, and the economy is extremely reliant on foreign demand, as it is an export-based economy. According to BMI, in 2010, Slovakia produced approximately 489,000 vehicles, up from 461,000 in 2009. Sales were also up to 96,000 units, from 93,000 in 2009. Forecasts for 2015 are 719,000 units in production and 119,000 in sales. Kia's Zilna plant opened in 2007 and currently makes three versions of the Kia Cee'd compact. In September 2010, Kia broke its own production records by producing over 20,000 units in one month, or a 41 percent increase from the previous year. Even with labor costs low, both the Zilna and Nosovice (Czech Republic) plants are highly automated, including 100 percent automation in body shops, which run constantly. Kia committed another \$141 million to an engine plant to support its production. PSA Peugeot Citroen's small car plant in Trnava, Western Slovakia, opened toward the end of 2006, and is another beneficiary of the West European scrappage schemes in operation in markets such as Germany and the United Kingdom. In fact, PSA had to increase daily output at its Slovak plant in response to rising demand for small cars. Nonetheless, PSA does not anticipate a growth in exports, given the end of most of the scrappage schemes, so its production levels will remain steady. Volkswagen's plant in Bratislava currently builds the Audi Q7, the Volkswagen Touareg and the Porsche Cayenne. With the addition of VW's new small family car: Lupo (formerly "Up"), the plant has doubled capacity to 400,000 units, and increased direct employment by 1,500 people, and indirect employment by 7,000. The three and five door models of the Lupo will be launched globally during 2011.

Without a doubt, the CEE region will remain important for years to come, as the dynamics between the regions of Western Europe and the Commonwealth of Independent States places these countries in a strategic zone for automotive manufacturers. With the latest investments, it will be a region to watch.

### **Key Trading Partners (Japan, Korea)**

#### **Japan**

Japan was the second largest vehicle producing country in the world in 2010, behind only China. In 2010, Japan produced almost 9.6 million vehicles. China became the largest producer of vehicles in the world for the first time in 2009. For a number of years, Japan was the world's leading vehicle manufacturer, but a continued depressed Japanese economy and the movement of

production out of Japan to other countries, especially the United States, have caused its production to decline.

The United States has sustained large automotive trade imbalances with Japan since the early 1970's. This imbalance has had significant economic and political impacts, and has dominated our trade relationship with Japan over much of this period. U.S. automotive companies' sales of vehicles in Japan have not improved, while Japanese companies have continued to gain market share in the United States. A large portion of this gain can be accounted for by Japanese transplant operations in the United States, but Japanese companies continue to import almost one third of their vehicles from Japan. According to the three U.S.-based vehicle manufacturers, a variety of non-tariff barriers have traditionally impeded access to Japan's automobile market, and overall sales of North American made vehicles in Japan continue to decline.

In fact, the automotive trade deficit with Japan is the largest U.S. sectoral bilateral imbalance. It has grown from the \$30 billion dollar level in the early 1980's to a peak of \$56.8 billion in 2006. As the Japanese built assembly plants in the United States, the automotive deficit began to decline in both vehicles and parts. While decreasing to \$31.8 billion in 2009, due to the U.S. economic decline, it began rising again in 2010 to \$42.6 billion as the economy recovered. Meanwhile, overall sales of North American vehicles in Japan remain low despite an upturn in U.S. vehicle exports in 2007. Sales of Detroit 3 North American (data for U.S. only not available) produced motor vehicles in Japan decreased to approximately 9,000 vehicles in 2010.

In June 2009, Japan instituted an Environmentally-Friendly Vehicle Purchase Program that provided subsidies to consumers for the purchase of a new vehicle, with differing subsidy amounts available depending upon the class of the vehicle and whether a qualifying used vehicle was traded-in. The U.S. Government raised strong concerns with the Program because, as originally structured, U.S. automobiles imported into Japan using the Preferential Handling Procedure (PHP) certification process were unable to qualify. On January 19, 2010, Japan announced it would open its program to qualifying automobiles imported using the PHP process. While it was a welcome step, the actual number of U.S. models that qualified was greatly limited because Japan decided to use the U.S. Environmental Protection Agency (EPA) "city" mileage fuel economy rating, instead of the EPA "combined" mileage fuel economy rating, as a criterion for qualification. The program ended at the end of Japan's fiscal year (September 2010) and Japan did not extend it.

According to Ward's Automotive, since 1986, the Detroit 3 U.S. market share has declined from 73.5 percent to 45.0 percent in 2010. The Detroit 3 have lost share every year during this period except in 2010, when they increased their share by almost one percent. Japanese brands have increased their share from 20.9 percent in 1986 to 38.8 percent in 2010 and the share of Korean brands has increased from 1.0 percent to 7.7 percent during the same period. Germany is the primary source of other imported or transplant vehicles accounting for 7.6 percent in 2010.

The Japanese auto companies have increased their U.S. market share through both export from Japan and investment in U.S. manufacturing facilities. In 1986, import sales from Japan were 2,914,291 and sales from U.S. transplants were 467,621, for a total of 3,386,912 vehicles.

However, by 2010, U.S sales from North American transplants totaled 3,065,793 and import sales were 1,409,915 for a total of 4,475,708 units. Thus, while imported sales have declined by 1,509,376, or 52 percent, sales from transplants have increased by 2,598,172 units or 556 percent.

As of December 2009, the Japan Automobile Manufacturers Association (JAMA) reported that the cumulative Japanese investment by their members in the United States was \$33.3 billion. This total included vehicle manufacturing, automotive parts production, and research and development facilities. Japanese manufacturers produced 2.2 million cars in the United States in 2009 (the remaining 1.1 million Japanese nameplates were built in Canada or Mexico), down from 2.9 million units in 2008. In 2010, production rose to 2.7 million units.

## **Korea**

The South Korean automotive industry is world class, and exports from South Korea's automakers are exported to all of the major world markets, including the United States. In 2009 Hyundai (including Hyundai controlled Kia) was ranked by Automotive News as the 5th largest vehicle manufacturer in the world. Korea's automakers are heavily reliant on exports. In 2010 Korean manufacturers produced 4.3 million vehicles in Korea, and exported 65 percent to foreign markets.

The United States and South Korea have a long history of negotiations on automotive trade, having reached agreement on two Memoranda of Understanding to improve access to the Korean market – one in 1995 and one in 1998. These MOUs were negotiated because U.S. vehicle manufacturers were prevented from selling into the Korean market by a variety of measures.

Throughout 2006 the United States and Korea engaged in Free Trade Agreement (FTA) negotiations. The resulting agreement has not yet been ratified by either country's legislatures. In 2010, the Obama Administration engaged the Korean government to renegotiate the automotive terms of the agreement to provide improved market access for U.S. auto companies. The new text focuses on safety and environmental standards, regulatory transparency and tariff changes. The full text of the Agreement can be found on-line at:

[http://www.ustr.gov/Trade\\_Agreements/Bilateral/Republic\\_of\\_Korea\\_FTA/Final\\_Text/Section\\_Index.html](http://www.ustr.gov/Trade_Agreements/Bilateral/Republic_of_Korea_FTA/Final_Text/Section_Index.html)

In 1994, before the first MOU was signed, import sales in the Korean auto market totaled 3,810 vehicles (0.3 percent of the market), with Ford, Chrysler and General Motors accounting for slightly over half that total. By 1997, total import share had only climbed to 0.7 percent, with U.S. manufacturers accounting for approximately half (or 0.35 percent of the Korean market). Also during that time, the U.S. automotive trade deficit with Korea rose dramatically, up 30 percent to reach \$1.8 billion. As a result of unsatisfactory progress under the 1995 MOU, a second more comprehensive agreement was negotiated and put into place in 1998 (for more detailed information on the 1998 MOU see the report "World Motor Vehicle Import Requirements," also on the Office of Transportation and Machinery's Automotive Industry

Team's web page: [www.ita.doc.gov/auto](http://www.ita.doc.gov/auto)). While import sales in Korea have improved slowly, they are still low, representing slightly under seven percent of the total market in 2010 (above their peak of just over six percent in 2008).

The opening of Hyundai's first U.S. plant in 2005 had a strong impact on trade flows. The U.S. vehicle trade deficit with Korea had increased every year until peaking in 2004 at \$10 billion. After that, it declined to only \$5.6 billion in 2009. The deficit increased in 2010, climbing back up to \$6.2 billion. Given the fact that U.S. motor vehicle exports to Korea increased in 2010, this climb in the deficit is reflective of the dramatic increase in U.S. sales by Korean manufacturers. The Hyundai factory is operating near its capacity. Even with the addition of the Kia plant (opened in 2009), the two facilities are simply not producing enough vehicles to meet rising demand, leading to an increase in imports from Korea.

The U.S. auto parts deficit with Korea fell in 2009, dropping from \$3.5 billion in 2008 to only \$2.3 billion in 2009 as U.S. motor vehicle production fell. However, the auto parts deficit spiked back up in 2010, reaching \$4.4 billion – the highest level since 1989 (earliest records available). With imports of vehicles and auto parts from Korea rising, the overall automotive deficit increased, climbing to \$10.6 billion in 2010 – bringing it back in line with the automotive deficit of 2008 (\$10.56 billion).

The Korean manufacturers have enjoyed a sustained string of success in the U.S. passenger vehicle market. Every year since 1993 they have either maintained or increased their share of the U.S. market, rising from 0.8 percent, with sales of 109,000 vehicles in 1993, to 7.7 percent of the market with sales of 894,000 vehicles in 2010. In 2010, Hyundai and Kia increased their U.S. sales by 23.7 percent and 18.7 percent respectively, in a market that saw an increase of only 11.1 percent.

Korean automakers have a long history in the United States – one that, contrary to current trends, has not always been successful. The first Korean automaker to enter the United States was Hyundai in 1986. Kia followed much later in 1994 and Daewoo started sales in 1998 (only to leave the U.S. market in 2003 after declaring bankruptcy and to re-enter the U.S. market badged as Chevrolet and Suzuki products after GM purchased Daewoo assets and created a new company).

In 1986, Hyundai introduced the Excel, a small sedan, priced well below competitors' brands. Sales of the Excel reached 264,000 units by 1988. To build on the brand's growing popularity, in late 1988, Hyundai opened a plant in Canada, producing the Sonata (primarily for the Canadian market, with some exports to the United States). However, after only a few years, the Excel developed a reputation for poor quality, and sales plummeted. By 1992, Excel sales were down to only 42,000 and total Hyundai sales reached only 109,000 units. After only three years of production, the Hyundai Canada plant closed. It wasn't until the year 2000 that Hyundai sales began to approach the peak year of 1988, with sales rising past that peak in 2001.

After a long period of supplying the U.S. market entirely through exports, Hyundai invested over \$1 billion in its first U.S. manufacturing plant in Montgomery, Alabama. The plant started

producing vehicles in 2005, and last year Hyundai sourced 51 percent of its U.S. sales with U.S. produced vehicles. Hyundai produces the Sonata at the Montgomery plant. That plant is operating at or near capacity. As a result, Hyundai shifted production of the Santa Fe SUV to Kia's plant in West Point Georgia, which opened in late 2009 (for more information on the Hyundai and Kia plants, see the Hyundai/Kia section of the Road Ahead Part One).

### **“BRIC” Economies (Brazil, Russia, India and China)**

#### **Brazil**

Brazil is the largest auto market in South America, and has almost as many vehicles in operation as Canada. In 2010, Brazil surpassed Germany to become the fourth largest auto market in the world behind only China, the United States, and Japan. Sales in Brazil reached 3.5 million vehicles, over 10 percent higher than 2009. Vehicle production increased 14.3 percent, according to the Brazilian National Association of Motor Vehicle Manufacturers (Anfavea), to approximately 3.6 million units. According to Business Monitor International (BMI), Volkswagen was narrowly the leader of passenger car sales in 2009, with 25.1 percent of the market, followed by Fiat (25 percent), GM (20.3 percent), and Ford (9.8 percent). Almost nine out of ten new cars sold in the Brazilian market have flex-fuel engines, or engines that operate on a mixture of alcohol and gasoline, pure ethanol, or pure gasoline.

Given the rapid growth in the Brazilian market, many manufacturers are investing billions of dollars in the country. For example, in March 2010, Ford increased its original investment of \$2.2 billion in Brazil to \$2.4 billion. According to Ford CEO Mullaly, this is the most Ford has committed in terms of a five-year investment since it started operations there 92 years ago. Ford has also invested \$338.7 million, according to BMI, in its engine facility at Taubate to produce advanced Sigma series flex fuel engines at a capacity of 500,000 units a year. Brazil is Ford's third largest market.

2010 marked 85 years of operation in Brazil by GM, and the company hopes to sell up to 1 million vehicles in the country annually by 2014. To help meet that goal, in May 2010, GM announced its intention to invest \$386 million at the São Caetano do Sul plant, where a new Chevrolet model will be produced. Between 2008-2012, GM's total investment in Brazil will be \$2.8 billion, with the goal of increasing capacity and modernizing plants. During this timeframe, GM plans to invest \$771 million to enlarge its plant in Gravataí, \$1.1 billion to modernize its São Caetano do Sul plant, and \$441 million on the development and production of two new vehicles at the Sao Jose dos Campos plant.

In December 2010, Fiat announced plans to invest nearly \$1.77 billion toward building a new manufacturing plant in the state Pernambuco. Once completed, the plant will be capable of producing 200,000 units annually for sale primarily in Brazil, as well as other markets in Latin America. Fiat has also announced that it intends to invest nearly \$6 billion in Brazil by 2015. Fiat CEO Sergio Marchionne stated that it is the company's goal to raise sales to over 1 million vehicles annually in Brazil. Finally, it was also reported in 2010 that Fiat was considering Chrysler Jeep production.

In late 2009, VW made an announcement that it would be investing another \$3.5 billion in its plants through 2014, with a focus on product development, as well as an increase in output. It hopes to achieve one million sales in Brazil annually by 2014. Brazil is VW's third largest market after Germany and China.

Hyundai is investing \$750 million for a 150,000 unit facility. Construction began in April 2010 and the company hopes to start production in 2011. Once completed, the plant will have an initial annual production capacity of 100,000 units. According to BMI, Peugeot is planning to invest \$708 million in Brazil to develop new engines and raise production capacity to 220,000 units annually. Toyota also announced plans to invest \$600 million in a plant that it hopes will begin production in 2012.

### **Russia**

The Russian automotive market has seen remarkable improvement. With the return of cheap credit, a successful government scrappage program, and a rebound in world oil prices, the Russian automotive market has been recovering more quickly than expected following the 2009 global downturn. Vehicle sales were 1.9 million units, up 30 percent in 2010 compared to 2009, but still significantly below 2008 levels or 2.9 million units. In 2009, sales of new cars had decreased 49 percent to 1.47 million units. Some analysts predict Russia may reach three million units by 2014, allowing Russia to surpass Germany as Europe's largest auto market. By 2020, Russia could rise from its current 10<sup>th</sup> place position to become the world's 6<sup>th</sup> largest car market, selling 4 million units a year. Growth potential is huge as the Russian market is one of the least saturated in Europe with only 230 cars per 1,000 people compared with about 700 per 1,000 in Europe and 900 per 1,000 in the United States.

Russia was on track to become Europe's largest auto market in 2008. Factors contributing to Russia's automotive growth were increased crude oil revenue when the price of crude oil spiked in 2008 along with increased access to consumer credit, but access to credit dried up in the second half of 2008 as Russia felt the impact of the worldwide credit crunch. According to PriceWaterhouseCoopers, Russia's new car sales jumped 41 percent through June 2008, to 1.65 million units. If the market growth rate had remained at the same level in the second half of 2008, sales in Russia would have exceeded sales in Germany and might have reached between 3.6–3.8 million cars. The Russian economy had an injection of money from oil and gas industries trickling down to Russian consumers. But crude oil prices receded, the global recession slammed Russia's auto market, and credit dried up for Russian consumers. In the second half of 2008 sales of autos in Russia slowed dramatically, resulting in only 2.9 million cars sold for the year, and Russia remained behind Germany as Europe's second largest auto market.

The Russian Government put up a total of 21.5 billion rubles (\$700 million) in 2010 toward cash incentives for automobile purchases. The car-scrappage program began in March 2010, and offered 50,000 rubles (about \$1,750) to drivers turning in a domestic car that was 10 years old or older and buying a Russian-made domestic or foreign-brand car. The Russian Government

initially allocated 11.5 billion (rubles) for the program and expected that it would result in 200,000 car sales. In July 2010, car sales jumped by 50 percent compared to the same period in 2009. After its success, the government announced in mid-2010 that it would continue the program and would spend an additional 10 billion rubles in 2010 to stimulate automotive purchases. The scrappage program was extended into 2011.

The Russian Government also launched a program to provide loan subsidies to spur sales, increased tariffs on automotive imports to between 20-35 percent, and moved to strengthen the actual cash position of the auto makers. The Russian government put 2 billion rubles (\$56 million) toward subsidizing consumer car loans for buyers to purchase one of 30 foreign or domestic models made in Russia. The government also planned to spend another 12.5 billion rubles (\$347 million) through 2011 to buy up excess vehicle components and unsold commercial vehicles from domestic auto makers.

The Association of European Businesses (AEB) predicted the production of cars in Russia would total about 1.4 million units for 2010, while Business Monitor International forecasted 1.34 million cars for 2010. AEB also forecasted Russia's sales in 2011 to grow by 17 percent to 2.24 million units.

Foreign auto makers are investing in the Russian market and manufacturing vehicles within country. In the first half of 2010, 36 percent of the cars sold in Russia were imported and 33 percent were manufactured in Russia by foreign companies. U.S. auto exports to Russia are on the rise. In 2010, the United States exported nearly \$174 million worth of vehicles, up 247 percent over the \$50 million exported in 2009, but still short of the \$1.2 billion exported in 2008. The devaluation of the ruble and higher duties have made imports less attractive to consumers in Russia.

While the Russian Government increased tariffs to protect its automotive industry, Russia is working to accede to the World Trade Organization (WTO). The WTO is negotiating tariff rates and under the terms of Russia's WTO accession, tariffs on foreign autos would fall to 15 percent from the current 20-35 percent.

In 2010, the top brands of cars sold in the Russian market were AvtoVAZ (Lada) with 517,147 vehicles, Chevrolet with 116,233 vehicles, Kia with 104,235 vehicles, and Ford with 90,166 vehicles. In terms of groups, the GM group (Opel, Chevrolet, Cadillac, Hummer, and Saab) sold 159,376 vehicles and the VW group (Volkswagen cars, Volkswagen vans, Audi, Seat, and Skoda) sold 131,312 vehicles. The Ford Focus is the best-selling foreign car model in Russia with 67,041 vehicles sold in 2010 and General Motors' Chevrolet brand is the top foreign auto brand in Russia with 116,233 sold in 2010.

Ford was the first foreign auto manufacturer to start producing cars in Russia in 2002. Ford has a \$330 million plant near St. Petersburg which was the first wholly-owned auto production facility by a foreign company. Ford has 120 dealerships in 77 Russian cities and a parts center in Moscow. In February 2011, Ford announced a 50-50 venture with Moscow-based Sollers to assemble and distribute vehicles in Russia. Ford Sollers will manufacture Ford models at plants



near St. Petersburg and in the Republic of Tatarstan, east of Moscow. Sollers is Russia's second largest producer of passenger and light commercial vehicles. Ford plans to manufacture at least 300,000 cars in Russia a year, a criterion that needs to be met to qualify for Russian tax and tariff breaks.

GM owns a \$300 million factory in the St. Petersburg suburb of Shushary and has invested more than \$100 million in joint ventures with Russian companies Avtotor and AvtoVAZ. GM is in talks with Avtotor to form a joint venture to produce at least 300,000 cars a year in Russia. GM produces 60,000 units a year of the Chevrolet Cruze and Captiva models along with Opel's Astra and Antara in Russia. Avtotor has a capacity to produce up to 200,000 cars a year and currently assembles Chevrolet Lacetti, Chevrolet Aveo and a previous generation of Opel Astra. GM also announced that it would assemble 30,000 Chevrolet Aveo cars at GAZ's plant in Nizhny Novgorod to help boost its local presence. Sales of the Aveo will start in 2012.

### India

For years, automakers have realized the long-term potential of investing in India given the country's large population, relative low ownership rates of vehicles, and a growing middle class. The Indian automotive marketplace has grown substantially over the past decade and it is expected to continue this growth in the near future. Automakers also view India as an export center. Both of these points are demonstrated by the steady rise in Indian exports and sales. According to data provided by the Society of Indian Automobile Manufacturers (SIAM), in 2002-03, India exported 72,005 passenger vehicles. By 2009-10, this number had risen to 446,146. Domestic passenger vehicle sales have shown similar levels of growth in recent years. Passenger car sales reached almost 2 million units in 2009-10, more than double the level of sales in 2003-04 (902,096).

In 2006, India released the Automotive Mission Plan (AMP) which details development goals for the years 2006-2016, recognizes the importance of the automotive industry for all levels of society, and describes the government's role in supporting the automotive industry. The stated goal of the AMP is to double the automotive sector's contributions to India's gross domestic product (GDP) from 5 percent to 10 percent by 2016. However, today there are still a number of barriers that limit the development of the Indian automotive industry. Some of these limitations include high tariffs on automobiles, customs procedures that impede importation of automotive products, the high demand for two wheel vehicles, lack of adequate infrastructure that causes overcrowded roads and heavy congestion, and inflexible labor regulations.

The United States imported only five vehicles from India in 2008, three in 2009, and 16 in 2010. The United States exported only 225 vehicles to India in 2008, 177 in 2009, and 607 in 2010. U.S. manufacturers have instead invested directly in India as a potential market, and as an export hub for the Asian and African regions. Indian auto manufacturers are beginning to view the U.S. market in a similar way. India's Mahindra & Mahindra is hoping to eventually offer diesel pickups in the United States. The original goal was to introduce the truck in the United States in 2009. However, the target date has been delayed several times, and it is currently unknown, as of early 2011, when the Mahindra truck will hit the U.S. market. The Chairman of Tata has also

stated that they plan to introduce a U.S.-engineered version of the Tata Nano within the next several years.

Given the recent growth in exports and sales in India, U.S. manufacturers continue with plans to invest billions of dollars in the Indian market over the next several years. Ford is investing \$500 million to expand its Indian subsidiary. Ford began production at a new plant that has the capacity to produce 250,000 engines per year. While these engines will be used primarily for Indian vehicles, it is expected some engines will be shipped throughout the Asia-Pacific and Africa regions once output expands, possibly in 2011. GM's facility in Halol had its capacity raised from 60,000 units to 85,000 units in 2007. GM opened a second plant in India that began manufacturing in 2008, which has a capacity of 140,000 vehicles. This raises GM's capacity in India to 225,000 vehicles, according to *Automotive News*. Further, GM invested over \$200 million in a neighboring engine facility that had an initial production capacity of 160,000 units when it opened in 2010. According to *Business Monitor International*, these investments raise GM's investment in India to almost \$1 billion.

For 2010, GM saw its sales in India rise 59 percent compared to the previous year. GM sold 110,084 units in 2010, which is the first time it has sold over 100,000 units in the Indian market. These competitive sales figures are due in part to the success GM has achieved from sales of the Beat, Spark and Cruze. GM began sales of the Chevrolet Beat in 2010, which will eventually also be launched in over 150 other markets around the world. Ford also improved its sales in 2010 by tripling the number of units sold compared to 2009, to 83,887 units. Most of Ford's growth is due to the popularity of the Figo, which as of early 2011 had sold 68,000 units since its launch in March 2010. The Ford Figo was also voted Indian Car of the Year 2011. In 2011, Ford also plans to bring the Fiesta to India as part of its efforts to bring eight new global products to India by the middle of the decade.

According to the SIAM, for FY 2010 Maruti Suzuki controlled about half of the Indian passenger car market, followed by Hyundai, Tata, and Honda. The global financial crisis also impacted Indian auto sales in 2008 and 2009. However, tax breaks and other measures, like better access to financing, stimulated the Indian auto industry with strong sales in 2010. Based on SIAM data, this is demonstrated by the almost 31 percent growth in sales of passenger vehicles from 2009 to 2010.

The Indian market is dominated by small, low-cost vehicles (two wheelers such as scooters and motorcycles make up about 75 percent of the market share). The Tata Nano, also known as the "People's Car" due to its low price (\$2500), was released in 2009. There will be competition in the low-cost car segment from the alliance between Indian motorcycle-maker Bajaj Auto and Renault-Nissan. According to *Just-Auto*, they plan to build a plant in India with a capacity of 400,000 units a year to produce a car that they hope to sell between \$2500-3000. In addition, Volkswagen launched its first small car in India in early 2010, the Polo.

## China

In 2010, China continued to experience tremendous growth in vehicle sales, and remained the world's largest auto market for the second year in a row. Sales reached 18.06 million vehicles, an increase of 32.4 percent from 2009. China's government policies (which have included sales tax reductions, subsidies for rural residents, and incentives for trading in vehicles), along with economic growth that helped to increase demand from small and mid-size cities, have contributed to China's incredible auto sales growth over the past two years. Sales of passenger vehicles in 2010 were almost 13.8 million, an increase of 33.2 percent, and sales of commercial vehicles were 4.3 million, an increase of almost 30 percent. Total vehicle production increased 32.4 percent, reaching 18.26 million vehicles.

According to the China Association of Automobile Manufacturers (CAAM), the biggest selling domestic Chinese automakers in 2010 were: Shanghai Automotive Industry Corporation (SAIC), Dongfeng Motor Corporation, First Automobile Works (FAW), Chongqing Changan Auto, the Beijing Automotive Industry Holding Co., Ltd. (BAIC), Guangzhou Automobile Group (GAC), Chery Automobile, BYD Auto, Brilliance Auto and Jianghuai Automobile Co. (JAC). The leading international automakers in China were: General Motors, Volkswagen, Hyundai, Renault-Nissan, Toyota, Honda, Ford, PSA, Suzuki, and Mazda.

GM was the top global automaker in China in 2010 with sales of 2.35 million units, an increase of 28.8 percent. GM and its partners have a 13 percent market share in China. Sales of Shanghai GM (GM's joint venture with SAIC) increased 42 percent reaching 1.03 million units. Chevrolet sales increased 63.4 percent, reaching 543,709 vehicles; Buick sales were 550,010 vehicles, an increase of 23 percent; and, Cadillac had record sales of 17,366 vehicles. SAIC-GM-Wuling sold 1.2 million vehicles (an increase of 15.6 percent), and FAW-GM sold 88,224 trucks, its first full year in business. In China, GM has eleven joint ventures with SAIC and FAW, operates eleven assembly plants and four powertrain plants, and has more than 2,700 dealerships and sales outlets.

Throughout the year, GM and SAIC made a number of announcements to further collaborate and strengthen their relationship. In February, SAIC received regulatory approval to buy an additional 1 percent stake in Shanghai GM for approximately \$85 million. The acquisition increased SAIC's share of the joint venture to 51 percent. In August 2010, GM and SAIC signed a cooperation agreement to develop a new small-displacement gasoline engine family and an advanced transmission. The two also signed a memorandum of understanding in November to explore co-developing new energy vehicles and components, and to expand the role of their automotive engineering and design joint venture. Also in November, SAIC purchased a 0.97 percent stake in GM for almost \$500 million during GM's IPO. During Chinese President Hu Jintao's visit to the United States in January 2011, GM signed a two-year agreement with Shanghai GM to export vehicles totaling \$500 million and parts totaling \$400 million to China. GM is also partnering with SAIC to sell in India and other emerging markets. The joint venture is already exporting to Chile and Peru, and plans to begin selling in India in 2011. Additional markets are also being considered.

In addition to its activities with SAIC, GM made other China-related announcements in 2010. GM broke ground in July on the GM China Advanced Technical Center, which will develop advanced vehicle designs and technology solutions for GM in China and worldwide. In September, SAIC-GM-Wuling began selling the Wuling Hong Guang, China's first compact business vehicle. In late 2010, the joint venture also began production of a new brand, Baojun. The initial model, Baojun 630, is aimed at first-time buyers in China's second- and third-tier markets. In December, FAW-GM launched its third manufacturing facility, which will begin regular production of the venture's first pickup truck in 2011.

Sales in China by Ford and its local partners increased 40 percent to reach 582,467 units in 2010. The automaker, which has a 3 percent market share in China, is expanding production capacity, as well as increasing dealerships and introducing new models in China to further increase its sales. The automaker has also begun exporting its Canadian-built SUV, the Edge, to China, and is exploring exporting additional vehicles to China. Ford's three-way passenger vehicle joint venture in China, Changan Ford Mazda Automobile Co. (CFMA), sold 403,283 vehicles in 2010, an increase of 34 percent. The venture currently has two assembly plants in China, with a third plant under construction in Chongqing. In September 2010, Ford announced that the joint venture would begin building a new \$500 million engine plant in Chongqing in 2011. In early 2010, Ford and Mazda asked for regulatory approval to turn the joint venture into two separate 50-50 joint ventures with Changan.

Ford also owns a 30 percent stake of Chinese commercial vehicle manufacturer Jiangling Motors Co. (JMC), which sold 178,999 vehicles in 2010, an increase of 56 percent. JMC and Ford currently have two plants in China. In July 2010, Ford and JMC began construction of a new \$300 million assembly plant in Nanchang that will produce both Ford and JMC vehicles by the end of 2012.

In August, Ford completed the sale of its Volvo brand to China's Geely Holding Group for \$1.8 billion. Volvo announced in February 2011 that it would invest \$10-11 billion globally over the next five years, including building at least one manufacturing plant in China. Volvo is targeting annual sales of 200,000 in China by 2015.

Chrysler currently does not produce in China, but imports vehicles (such as the Jeep Compass and Jeep Wrangler). Beginning in early 2011, the all-new Jeep Grand Cherokee will be imported. Bloomberg News reported that Chrysler's sales in the Asia-Pacific region were 39,688 in 2010, including 23,428 sales in China. The automaker is considering exporting additional models from North America to China, including the new Chrysler 200 convertible and the new Fiat 500.

As some leading Chinese domestic automakers aim to sell their vehicles globally, they are trying to improve their competitiveness through acquisitions and foreign investments. For example, Geely's recent acquisition of Volvo, and Changan's announcement in early 2011 that it plans to build a research and development center in Plymouth, Michigan.

In recent years, many Chinese automakers have announced plans to sell in the U.S. market and have exhibited at the North American International Auto Show. However, many plans to sell in the United States have been derailed for one reason or another. Complying with both current and upcoming U.S. safety and emissions standards, meeting U.S. consumers' quality expectations, and overcoming financial- and distribution-related issues, have all been impediments to Chinese automakers' U.S. arrival. In addition, many have been focusing on China's high-growth auto market. BYD Auto, which has Warren Buffet's Berkshire Hathaway as an investor, has encountered delays, but will most likely become the first company to sell Chinese-made vehicles in the United States. The automaker announced plans in April 2010 to establish its North American headquarters in Los Angeles, California. In late 2010, it was announced that a fleet of BYD plug-in hybrid vehicles will be tested by the city of Los Angeles.

Going forward, the Chinese government would like to see a greater emphasis on the auto industry's development of new energy vehicles, in the hopes of saving energy, reducing its dependence on oil, reducing pollution, and eventually becoming a global leader in new energy vehicles in ten years. The target is to have 1 million new-energy vehicles in China by 2015. In August, China's State-owned Assets Supervision and Administration Commission (SASAC) announced an alliance of 16 state-owned companies (including automakers FAW, Dongfeng and Changan) to research, develop and produce electric and hybrid vehicles, as well as develop related standards. Initial funding for the alliance was almost \$200 million, with plans for alliance members to invest \$15 billion in the next couple of years.

With over 100 auto producers in China, and the top ten-selling domestic automakers accounting for the majority of sales, consolidation of domestic independent automakers is expected to continue. In addition, the Chinese government is considering policies that will require international automakers to establish independent brands with their Chinese joint venture partners. The new independent brands, which have lower-cost vehicle models, will most likely hurt the sales of the smaller, independent Chinese automakers and lead to further consolidation.

Although the past two years have seen vehicle sales in China increase 46 percent and 32.4 percent respectively, analysts have estimated lower growth rates (not above 15 percent) for 2011. The reduction in government incentives, a 2011 quota on new car registrations in Beijing, rising vehicle-related ownership costs, and possible inflation in 2011 are all reasons cited for the expected slow-down of vehicle sales for the year.

## **GOVERNMENT INCENTIVES FOR ADVANCED VEHICLE TECHNOLOGIES**

### **Government-Industry Partnerships (USCAR, PNGV, FreedomCar, USABC)**

The U.S. Government has provided ongoing research and development assistance to the U.S. automotive industry. It has provided most of this assistance through its partnership with the Detroit 3 via the United States Council for Automotive Research (USCAR). USCAR was formalized in 1992 as part of the federal government's Partnership for New Generation Vehicles (PNGV) program. The PNGV program later became the FreedomCar program. Under these programs the U.S. Government provided research assistance for hybrid drive, fuel cell and

battery electric technologies among others. Looking specifically at the PNGV program, according to the Government Accounting Office, the Federal government spent approximately \$250 million per year for PNGV related research. Industry participants estimate their contribution at \$800 million per year for PNGV related activities.

USCAR continues to oversee research in advanced combustion and emissions control, electrical and electronics, electrochemical energy storage, fuel cells, materials, and vehicle systems analysis. The U.S. Advanced Battery Consortium (USABC) is part of USCAR. USABC is supported by a cooperative agreement with the U.S. Department of Energy that provides up to 50 percent of the USABC budget. The Consortium's mission is to develop electrical energy storage for fuel cell, hybrid and electric vehicles.

### **Federal Incentives (2005-2008)**<sup>1</sup>

The Federal Government also provides incentives and requirements to produce advanced technology vehicles and inducements for their sale. The Energy Policy Act of 2005 provided a credit for taxpayers who purchased certain energy efficient vehicles, including qualified hybrid vehicles. The credit expired at the end of 2010 but was applied by manufacturer and began to phase out after 60,000 of the manufacturer's qualifying passenger automobiles and light trucks had been sold.

The Energy Independence and Security Act (EISA) of 2007 increased fuel economy standards, provided tax credits for increased production of biofuels for transportation, and provided incentives for electric vehicles. EISA included loan guarantees and grants for production facilities aimed at the manufacture of fuel efficient and electric drive vehicles or parts. It also contained loan guarantees for the construction of manufacturing facilities in the United States for advanced vehicle batteries, battery systems, components and related software. It further included \$25 billion in loans for re-equipping, expanding, or establishing a manufacturing facility in the United States to produce advanced technology vehicles or parts. Finally, it included a federal fleet purchase requirement for vehicles with higher fuel economy, including hybrid vehicles, neighborhood electric vehicles, electric vehicles, and plug-in hybrid vehicles if the vehicles are commercially available.

The America Competes Act of 2007 created the "Advanced Research Projects Agency-Energy (ARPA-E) at the Department of Energy. The new agency is aimed at providing cost share funding for long-term and high-risk energy technologies including advanced batteries, engine waste heat recovery and other technologies applicable to the automotive industry. No funds were set aside for it at the time of its creation.

The Energy Improvement and Extension Act of 2008 was part of the Emergency Economic Stabilization Act of 2008 (H.R.1424) signed into law in October 2008. Among other important changes, the Act provided a tax credit for the purchase plug-in vehicles until 2014. The base

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<sup>1</sup> Information on both Federal and state vehicle incentives can be found at DOE's Alternative Fuels & Advanced Vehicles Data Center: <http://www.afdc.energy.gov/afdc/laws/>

credit is \$2,500, plus \$417 for each kilowatt hour of traction battery capacity (battery capacity used to propel the vehicle) in excess of 4 kilowatt hours. The Act limited payments to \$7,500 for vehicles 10,000 pounds and under but payments were to rise to \$10,000 for vehicles weighing between 10,000 and 14,000 pounds. For vehicles weighing between 14,000 pounds and 26,000 pounds the credit was to be \$15,000. The credits were set to phase out after the first 250,000 total vehicles were produced.

The American Recovery and Reinvestment Act (ARRA) enacted in February 2009, added further advanced vehicle incentives including extending the tax credit for plug-in vehicles, more loan guarantees for advanced vehicle technology production capabilities, federal fleet purchasing requirements and \$2 billion in grants for U.S. manufacturers of advanced vehicle batteries, battery systems, components and related software. ARRA also capped the plug-in credit at \$7,500 and excluded vehicles over 14,000 pounds from receiving credits. It also changed the plug-in vehicle tax credit program by raising the limit from a program total of 250,000 vehicles to a maximum of 200,000 plug-in vehicles per manufacturer. The Act also provided \$400 million in funding for ARPA-E.

### **State Incentives/Mandates**

Many U.S. states have similar incentives and mandates. Minnesota passed a law in May 2005 that requires its gasoline to contain 20 percent ethanol by volume (E-20) or the maximum percentage allowed by EPA for all vehicles. The mandate takes effect if ethanol is not already 20 percent of all gasoline sold by December 31, 2012. Minnesota also offers grants for 75 percent of the cost or \$15,000 (whichever is lower) for the installation of E85 pumps in public access service stations. Georgia offers unrestricted access to High Occupancy Vehicle (HOV) lanes as well as an income tax credit of \$5,000 or 20 percent of a zero emission vehicle's purchase price (whichever is lower). The state also offers a tax credit of \$2,500 or 10 percent of the price (whichever is lower) to businesses who install electric car charging stations.

When it comes to mandates, California is the most extensive by far because its air quality problems led to an exception in the language establishing the U.S. Environmental Protection Agency (EPA). California's Air Resources Board (CARB) has the authority to set separate environmental regulations. Other states may choose to adopt these stricter standards or abide by those mandated by EPA. California offers a tax credit up to \$5,000 tax for qualified zero emission vehicles and unrestricted HOV access.

### **International Factors**

There are international drivers pushing advanced technologies as well. During the UN Climate Change talks in Copenhagen in December 2009, representatives of 14 of the world's largest cities pledged to make their cities more electric-vehicle-accessible. The "C40 Electric Vehicle Network" includes: Bogota, Buenos Aires, Chicago, Copenhagen, Delhi, Hong Kong, Houston, London, Los Angeles, Mexico City, Toronto, Sao Paulo, Seoul and Sydney. These cities plan to make it easier to obtain permits for charging stations, install public charging infrastructure,

coordinate incentives, and purchase the vehicles for municipal fleets in the 2010 through 2013 time period.

Likewise, Germany adopted a National Development Plan for Electric Mobility. The plan aims to prepare the market for the introduction of plug-in vehicles as well as support research and development for these vehicles. The plan aims for one million plug-in vehicles on German roads by 2020 and five million by 2030. Governments in France, Denmark, the United Kingdom, Ireland and Spain have similar plans. Unlike these other countries, Germany is not currently offering vehicle purchase incentives.

The Chinese government is working to encourage advanced vehicle production and vehicle efficiency. The plan has purchase incentives in five cities for plug-in electric vehicles of 60,000 Yuan or nearly \$9,000 per vehicle as well as 50,000 Yuan or roughly \$7,600 for plug-in hybrids. The cities are Shanghai, Shenzhen, Hangzhou, Hefei and Changchun. These subsidies are being matched by subsidies from some of the cities, such as Shenzhen, which is offering incentives of 30,000 Yuan on plug-in hybrids and 60,000 Yuan on electric vehicles. Applied with the national government incentives, the subsidies equal roughly \$18,000 for electric vehicles and \$11,000 for plug-in electrics.

In addition to the subsidy on plug-in vehicles, the Chinese government also has a 3,000 Yuan subsidy throughout the country for vehicles with engines 1.6-liters or smaller that consume 20 percent less fuel than current Chinese standards. This includes hybrid vehicles. The Chinese government had given priority to developing fuel cell vehicles in its last planning cycle, but it is now "giving priority to pure electric cars, and taking hybrid cars as complement" according to Zhang Jinhua, Vice-Secretary General of China's Society of Automotive Engineers. The Chinese leadership expect hybrid and fuel cell technology to be applied mainly to commercial vehicles.

### **CAFE/Energy & Environmental Issues**

In December 2007, the Energy Independence and Security Act (EISA) was signed into law, which includes provisions that will impact the future of the automotive industry. This legislation is designed to increase energy efficiency and the availability of renewable energy. Specifically, EISA increases Corporate Average Fuel Economy (CAFE) standards and establishes a new target of 35 miles per gallon (mpg) for the combination of cars and trucks by Model Year (MY) 2020. Manufacturers will be required to come within 92 percent of the standard for a given year or risk civil penalties being assessed for non-compliance. Manufacturers will also have the ability to earn credits for exceeding standards in one vehicle class that can be applied to increase the CAFE of a different vehicle class that is failing to comply with the standards.

In September 2004, California requested a waiver from the Environmental Protection Agency (EPA) to allow the state to set its own regulations to reduce greenhouse gases (GHG) by 30 percent by the 2016 model year, which can only be accomplished by meeting fuel economy levels more stringent than the new CAFE standard. The EPA initially denied this waiver request by arguing EISA provided a more effective national approach. However, in 2009, the EPA



granted California the waiver, and California subsequently stated that it would not set stricter emissions standards than the federal government establishes through 2016. As a result of the new assessment, EPA and NHTSA announced a joint standard in April 2010 to control emissions of greenhouse gases and for fuel economy, respectively. NHTSA established fuel economy standards that will reach 34.1 mpg for model year 2016. This will provide an average increase of 4.3 percent from the 27.3 mpg combined fuel economy level in MY 2011.

In addition, the EPA standards require manufacturers to achieve a combined average vehicle emission level of 250 grams of carbon dioxide per mile. EPA states these reductions will be the equivalent of taking 50 million cars and light trucks off the road by 2030. For the National Program as a whole (that is NHTSA's standards and EPA's standards), the agencies estimate that the lifetime benefits will total over \$240 billion.

For MY 2017-2025, NHTSA and EPA will again develop a National Program to further improve fuel economy and reduce greenhouse gas emissions. They will also continue to work with California in technical assessments of potential standards. In November 2010, NHTSA and EPA released a joint Supplemental Notice of Intent (NOI) for MY 2017-2025. The agencies announced that they expect to issue a proposed rulemaking by September 30, 2011, and a final rulemaking by July 31, 2012.

The White House has also stated it would like to implement an economy-wide cap-and-trade program to reduce GHG emissions 80 percent by 2050 and make the United States a leader on climate change, and Congress is also working on climate change legislation. According to the Alliance of Automobile Manufacturers, about 17 percent of man-made carbon dioxide emissions in the United States are accounted for by automobiles. Given this, the auto industry could be both greatly impacted by new policies and also play a leading role in reducing overall emissions across all sectors of the economy through new technologies. The Alliance, whose members include Chrysler, Ford, GM, Toyota and others, has stated in the past they support climate change legislation that will require equitable carbon dioxide reductions across all sectors of the economy that is economically feasible, is primarily market-based, and provides incentives for advanced technologies.

## **ALTERNATIVE FUEL RELATED TECHNOLOGIES**

### **Diesels**

Diesel engines are the dominant drivetrain technology in Europe. Diesel engines have done well in Europe due in part to looser emission regulations and significantly higher tax rates on gasoline. The U.S. Environmental Protection Agency (EPA) requires diesel automobiles to meet the same emissions standards as gasoline-fueled vehicles. While "clean diesels" meet these stringent standards, they continue to have higher emissions of a number of compounds deemed dangerous by EPA. And, the technologies required to allow the vehicles to meet emissions requirements add cost and generally lower their efficiency.

The added costs extend out in time to the point where the vehicle's increased efficiency allows consumers to recoup their initial higher outlay. Automakers have long claimed that consumers will only pay for technologies that deliver a 3 to 4 year return on the initial investment. Researchers have confirmed that buyers are risk averse and believe that this risk aversion combined with high petroleum fuel cost variability explains the overly short pay-back requirement. This suggests a significant market failure for many advanced vehicle technologies.

While diesel engines have long been marketed in larger vehicles such as pick-ups, they have generally not been offered in U.S. passenger cars. Several firms offered poorly engineered versions in the 1970s which helped sour U.S. consumers on the technology. In addition, higher prices per gallon of diesel fuel in the United States extend the payback time for these engines. Only about 42 percent of filling stations in the United States sell diesel fuel which possibly further limits their attractiveness to consumers. Nonetheless, German-based firms have been leading recent efforts to market diesel-fueled cars in the United States. VW/Audi, BMW, and Mercedes sold roughly 80,000 of the vehicles in 2010. And, other firms continue to evaluate selling diesel-fueled cars in the U.S. market. GM is rumored to be considering a diesel in its 2013 Chevy Cruze for the U.S. market.

### **Biofuels**

Infrastructure availability is an even larger barrier to the use of E85 (85 percent ethanol) fuel in the United States. E85 distribution infrastructure is increasing though it remains very limited with roughly 2,350 E85 filling stations nationwide. This distribution infrastructure is small compared to the diesel fuel infrastructure of roughly 48,000 and is tiny when compared with approximately 114,000 gas stations in the United States.

Flex-fuel vehicles help to address this limited infrastructure problem. Flex-fuel vehicles can be fueled with either gasoline or E85. As the flex-fuel vehicle fleet continues to expand, it lowers the chicken and egg problem which plagues many alternatives to petroleum. For alternative fueling stations to exist without subsidies, sufficient buyers of the fuel must be available; however, consumers will not buy the vehicles without the infrastructure in place to fuel their vehicles. Flex-fuel vehicles allow the vehicles to operate on the gasoline infrastructure and provide a viable market for the alternate fuel stations to start selling the fuel as their numbers increase. The added cost to make a vehicle flex-fuel capable is under \$200.

Though they are capable of burning various mixtures of ethanol fuel, flex-fuel vehicles are generally not optimized for burning ethanol and can return up to 30 percent fewer miles per gallon of fuel due to ethanol's lower energy content. However, advanced engine technologies such as direct injection and turbocharging are allowing engineers to get additional efficiency from ethanol by taking advantage of its higher octane and other properties. Doing so enables consumers to get greater mileage, thereby increasing its attractiveness as well as improving the environmental and security benefits.

The Detroit 3 remain committed to biofuels and are continuing to add flex-fuel vehicles capable of burning gasoline and ethanol. The firms are aiming to make 50 percent of their respective

lineups capable of burning E85 by 2012. While other firms offer some E85 capable vehicles, the majority of flex-fuel vehicles currently offered for sale in the United States are produced by the Detroit 3.

Another way to address the chicken and egg problem of fueling infrastructure is to produce fuels that current vehicles can burn and the current fueling infrastructure can handle without modification. Researchers are making advances in creating bio-based gasoline and diesel fuels that can be used in existing engines and simply mixed in with gasoline. There are similar results being achieved with the alcohol butanol which can also be used without modification in either gasoline vehicles or gasoline infrastructure.

To date, the primary way biofuels have been gaining market share in the United States is as a fuel additive. EPA regulates gasoline to help reduce vehicle emissions. The agency has allowed ethanol to be blended to 10 percent by volume (E10) in fuel grade gasoline. EPA has recently announced waivers which allow E15 fuel use in 2001 or later automobiles. While the decision can enable the sale of much greater volumes of ethanol, automakers and fuel providers have expressed concern with how the waivers will be implemented.

### **Compressed Natural Gas (CNG)**

With the recent gasoline price increases and the growing natural gas resource availability in the United States, there has been an effort to increase the use of natural gas as an alternative vehicle fuel in the U.S. market. A small start-up got a large leg-up from the Department of Energy in 2010 to build a compressed natural gas vehicle. The Vehicle Production Group LLC secured a roughly \$50 million loan for its six-passenger, wheelchair accessible vehicle called the MV-1. With expected annual production of 22,000 vehicles, the MV-1 will run on compressed natural gas.

Due to lower energy density, compressed natural gas vehicles tend to have lower range than gasoline-fueled vehicles; however, natural gas is less expensive per mile than gasoline and is much cleaner burning. Honda has been selling its natural gas fueled Civic GX for roughly 12 years and for the last eight years it has been rated as the "Greenest Vehicle of the Year" by the American Council for an Energy-Efficient Economy.

Unfortunately, the title hasn't resulted in large sales numbers, with the Civic GX sold primarily to fleet operators. This is important because with a total of 870 CNG filling locations, there are fewer compressed natural gas filling stations than E85 stations (2,350) and they are almost all behind corporate fences. Fiat is one of the leading sellers of dual-fuel vehicles in Europe. Dual-fuel vehicles are similar to flex-fuel vehicles in that they can run on either natural gas or gasoline. Like flex-fuel vehicles, these vehicles enable consumers to purchase the vehicles with less concern about infrastructure availability. Fiat and Chrysler are considering marketing some of Fiat's dual-fuel models in the United States.

## **Hybrids**

Sales of hybrid vehicles declined in 2010 to only 2.4 percent of total light vehicle sales. The tough economy coupled with lower fuel prices helped slow the uptake of these vehicles, Toyota continues to dominate hybrid sales with Prius sales alone capturing more than 50 percent of the 2010 total. In spite of a tougher sales environment, hybrids continue to grow as a percentage of Toyota Motor Corporation's total U.S. sales and ended at nearly 11 percent of the company's combined U.S. sales for the year. As a point of comparison, hybrids accounted for less than 2 percent of Ford's 2010 sales, yet it was again the second highest hybrid seller in the United States. Hybrids represented under 3 percent of Honda's total sales and it was the third highest U.S. hybrid vehicle seller again in 2010.

The year ended on a positive note for the subsector, with hybrid sales up 36 percent in December versus an increase of 31 percent in the overall light vehicle market. Nonetheless, lower priced offerings and added competition will be needed to help spur greater hybrid penetration. There is considerable evidence that this scenario will occur over the coming years. Several new models will debut in 2011. Korean-based Hyundai and Kia will each launch hybrid vehicles in 2011, and Chrysler will debut a hybrid version of its 2013 model year Chrysler 300 in 2012, followed by a hybrid minivan in 2013. Likewise, GM announced that it would make its low energy eAssist hybrid system standard equipment on its 2012 Buick LaCrosse, and optional on the 2012 Regal. Making the hybrid system part of the base drivetrain should lead to much higher volumes spreading out development costs. In a similar move, Toyota announced plans to create a lineup of Prius branded hybrid vehicles. It plans to introduce 5- and 7-seat wagons along with a compact version beginning this year. The company will have 11 hybrids for sale in 2012. The added hybrid models should work to increase competition, driving prices lower and further increasing sales.

## **Plug-In Electric Vehicles**

The big technology news for light vehicle propulsion in 2010 were the arrivals of GM's Volt and Nissan's Leaf. Early buyers began receiving delivery of vehicles at the end of the year with roughly 600 Volts and 150 Leafs delivered to U.S. consumers by year's end. The low numbers should give way to larger scale production as 2011 progresses.

Virtually every major manufacturer worldwide is also working to market a plug-in vehicle over the next 3 years. GM is focusing on its plug-in hybrid technology which offers a 40 mile range under battery electric power. After the charge on the battery is depleted, the vehicle operates in hybrid mode, running its engine for power and recovering energy during braking like other hybrid vehicles. Ford and Toyota are working on similar plug-in versions of their current hybrid vehicles and both are also looking at bringing fully electric vehicles (EVs) to market. Ford's electric Transit will debut in 2011 and its electric Focus will follow in 2012. The company showed off its C-Max Energi at the 2011 Detroit Auto Show. The crossover vehicle will be the automaker's first production plug-in hybrid and it will also go on sale in 2012.

The Nissan/Renault alliance is making major commitments toward the manufacture of highway capable electric vehicles. The alliance is making investments to enable it to produce 500,000 vehicles globally per year by 2012. This is much higher than the 50,000 to 60,000 Volt-style units GM has plans to produce by that point. Ford too is planning to sell limited quantities. Targeted electric Transit production will be roughly 10,000 per year while the plans for its Focus EV production are closer to GM's initial plans for the Volt. Toyota plans limited sales of its Rav4 EV and anticipates roughly 50,000 annual sales of its plug-in hybrid with a modest 14 mile electric range.

Other firms are also working to introduce plug-in vehicles. The Chinese firm BYD began Chinese market sales of its F3DM plug-in hybrid in December of 2008. In late 2010, the company began a pilot U.S. program for the plug-in electric vehicle with the Los Angeles Housing Authority. The company is working to meet U.S. homologation requirements for the vehicle which it expects to sell in limited numbers to corporate fleets. The vehicle's expected price tag is below \$29,000. With U.S. and state incentives dropping the price close to \$20,000, the relatively low purchase and operating costs should offer the possibility of significantly reduced transportation costs to fleet operators.

Despite the moderate initial production plans, compared to the rollout of hybrid vehicles, the rollout of plug-in vehicles is occurring at a much, much faster rate. It has been more than 15 years since the first hybrid was mass marketed and yet only a handful of companies produce hybrid models today. The number of plug-in models will reach a similar number in less than half the time span and, as mentioned earlier, virtually every major manufacturer worldwide will have at least one in production. It took Toyota over 12 years to sell 2 million hybrids. The Renault-Nissan alliance plans to be able to achieve that milestone for plug-in vehicle sales in less than half the time. The much higher level of competition also suggests much faster price declines than hybrids have achieved.

Unlike most other alternative fuel technologies, the principal concern for the introduction of EVs is consumer acceptance and not the availability of refueling infrastructure because roughly 50 percent of U.S. households have access to outdoor plugs. While this existing infrastructure is often times inadequate to support longer driving distances, it can support a large percentage of daily driving needs, and the investments needed to increase coverage are incremental in nature. This is a significant advantage.

<b>Infrastructure Type</b>	<b>Number of U.S. Outlets</b>
Gasoline*	114,144
Diesel**	47,940
E85	2,349
CNG	870
Electric (Public)	722
Electric (Private)***	52,740,051

Primary Source: U.S. Department of Energy, Alternative Fuels Data Center:

[http://www.afdc.energy.gov/afdc/fuels/stations\\_counts.html](http://www.afdc.energy.gov/afdc/fuels/stations_counts.html)[http://www.afdc.energy.gov/afdc/fuels/stations\\_counts.html](http://www.afdc.energy.gov/afdc/fuels/stations_counts.html)

\*2008 Statistics of U.S. Businesses (SUSB), U.S. Census Bureau:

<http://www.census.gov/econ/susb/index.html>

\*\*42 percent of gasoline station establishments.

\*\*\*50 percent of households, 2000 Census, Census Bureau Quickfacts:

<http://quickfacts.census.gov/qfd/states/00000.html>

### **Efficiency Technologies**

A technology shift may well not occur as consumers may not embrace new drivetrain technologies; however, vehicle producers must consider the potential impacts a technology shift will have on their investments. If consumers rapidly accept technologies such as the new plug-in vehicles or switch to diesels and production takes off quickly, some current drivetrain production investments may be retired long before automakers anticipated. There are a few technologies that face no investment risk along these lines. Improving vehicle aerodynamics is one of those technologies. Reducing vehicle wind resistance enables vehicles to travel at highway speeds at lower energy. GM's new 2012 LaCrosse will use flaps that close at higher speeds preventing the excess air from running through the engine compartment and under the vehicle. Doing so reduces drag and improves mileage. The increased speed enables sufficient airflow to cool effectively despite that smaller area.

Another strategy that works no matter the drivetrain is weight reduction. The lighter a vehicle, the less energy it takes to start it moving. Though some technologies can recapture some of the energy when braking, none are 100 percent efficient like weight reduction. Vehicle manufacturers are making considerable efforts to take weight out of vehicles because lighter vehicles put less stress on suspension, brakes, and steering. High-strength steels are being used in place of larger, heavier steels in vehicle structures. Aluminum and advanced composites are replacing other pieces, and considerable engineering is going into avoiding weight.

Many firms are also looking at making their cars smaller to reduce weight, particularly the Detroit 3. Chrysler's tie-up with Fiat will allow it to market several of Fiat's small cars in the United States. Likewise, most companies are shifting away from the idea that small cars are only entry level vehicles. Ford is earning higher margins in its sales of the Focus by adding content as its buyers have shown they are willing to pay for it.

Chrysler's tie-up with Fiat is also providing access to Fiat's fuel efficiency inducing technologies such as its "MultiAir" variable valve technology, which enables higher gas mileage and lower emissions. Ford continues working to market its similar "EcoBoost" engine technology. EcoBoost combines variable valve, turbo boost and direct fuel injection technologies that allow smaller engines to deliver the power of larger displacement engines while also delivering increased fuel efficiency. Ford plans to produce 1.5 million EcoBoost engines globally by 2013.

Vehicle manufacturers are also offering other technologies such as the dual clutch, CVT, and additional gear transmissions that allow engines to operate closer to their peak efficiency, thereby offering increased fuel economy. Chrysler minivans will get 9 speed transmissions in 2013. The companies are also adopting "Stop/Start" systems which turn off the engine when the

vehicle comes to a stop to save fuel. The vehicle restarts once the driver's foot leaves the brake pedal. Ford says that 98 percent of their vehicles will have six speed transmissions by 2012 and 20 percent will have Stop/Start by 2014.

Cylinder deactivation or variable displacement is a process of turning off the combustion in several cylinders of an engine under low-revving situations. This is another cost-effective innovation, allowing the driver to squeeze more efficiency out of the engine. Several automakers have developed their own versions of the system: Chrysler calls it "Multi-Displacement," GM calls it "Active Fuel Management," and Honda calls it "Variable Cylinder Management." According to Paul Lacy at IHS Global Insight, "cylinder deactivation will be used more widely in the future, particularly on V-6 and V-8 engines, while direct injection and turbocharging will be more common on four-cylinder engines."

Low-rolling resistance tires can boost fuel efficiency by as much as 2.5 mpg. Most of the gains in fuel efficiency are due to new tread compounds and tread designs. Some tests have shown these tires provide a five percent increase in fuel efficiency plus a shorter stopping time per vehicle (around 25 feet sooner than a baseline tire). Like virtually all of these technologies, low rolling resistance tires are more expensive at the outset, though they eventually provide enough of a return at the gas pump to compensate for the extra expense.

### **Hydrogen Fuel Cells**

A number of automakers continue to pursue the mass marketing of hydrogen fuel cell vehicles. GM, Honda, Toyota, Daimler, VW and Hyundai are among the firms with lease or pilot programs in progress around the globe designed to help refine their vehicles for eventual commercial sale. According to the U.S. Department of Energy's Hydrogen Program, targets for the commercial introduction of hydrogen fuel cell vehicles remain on track, with many automakers targeting 2015 market introductions. Several of these companies are currently expecting plug-in vehicles to be targeted toward the smaller vehicle spectrum while fuel cells would be aimed at larger models or those needing longer range.

Like a number of other alternative fuel technologies, limited fueling infrastructure will likely hold back early sales. At roughly 60 stations total in the United States, fueling infrastructure is easily the largest barrier to mass marketing hydrogen fuel cell vehicles in the United States. One way around this infrastructure deployment issue is to use fuel cells as range extenders on EVs. Volvo is testing the use of hydrogen fuel cells as range extenders for their C30 DRIVe EVs. Doing so would significantly cut the amount of hydrogen infrastructure needed, and allow the vehicles to take advantage of the range and refueling advantages of hydrogen fuel cells. Vehicle owners could make most local trips using electricity from the grid and use hydrogen only on longer trips. Hydrogen stations could be added slowly to city centers and along major traffic corridors allowing large enough usage to make them economical.

## **Rare Earths Elements**

Seventeen elements in the periodic table are known as Rare Earths Elements (REEs). REEs are being used in growing quantities in a number of products such as motors, electronics, and batteries. China's unofficial trade moratorium on REEs to Japan as part of a diplomatic dispute brought global attention to supplies of the material.

China currently supplies roughly 95 percent of global rare earths due to its low costs which are in part due to co-production of iron ore at its main mine. China has been lowering its REE exports via export quotas since 1996, with exports falling from about 65,000 metric tons to about 50,000 metric tons from 2005 to 2009. The export restrictions and China's apparent use of rare earths as a diplomatic weapon against Japan have made manufacturers and security analysts concerned about future supplies. Supply disruptions can be expected to harm the automotive industry since REEs are used in the production of autos and many auto components, including catalytic converters, window motors, alternators, and vehicle electronics.

Many people have voiced concern because rare earths are a particularly large presence in some advanced hybrid automobiles such as the Prius. Edmund's Green Car Advisor noted, "the Toyota Prius is one of the most rare-earth-intensive consumer products ever made, with each Prius containing about 2.2 pounds of neodymium and about 22 pounds of lanthanum. Other hybrids such as the Honda Insight and Ford Fusion require many of those elements."<sup>2</sup> Thus, concern has been raised that moving to some of these advanced vehicles will result in a switch from dependence on foreign oil to dependence on foreign REEs.

Though not rare as the name implies, REEs do tend to be dispersed and known minable concentrations are less common than for most ores. The United States and China have the largest percentage of known concentrated ores, but recoverable deposits exist in Australia, Brazil, India, Malaysia, South Africa, Sri Lanka, and Thailand. Further exploration is expected to uncover very large total resources relative to expected demand. Likewise, unlike with petroleum, the products are used only in the vehicle's production, not as an energy source, and the materials can be recovered and recycled at vehicle end-of-life.

Alternatives to rare earths exist for some advanced technologies. One example is the induction motor used by most firms bringing plug-in vehicles to market including GM in the Chevy Volt, Tesla Motors in its all-electric Roadster, BMW in its Mini E, and Nissan in its Leaf. Unlike permanent magnets used in hybrid motors which rely on large amounts of neodymium, induction motors use electromagnets. Since electromagnetic coils can be replaced with rare-earth permanent magnets at just 10 percent the size, induction motors are larger and heavier than ones that use rare-earth magnets. This size advantage has helped make permanent magnet motors the preferred option for Toyota and other hybrid vehicle makers. However, induction motors give

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<sup>2</sup> "With Hybrids and Electric Vehicles, U.S. Risks Switching Dependency From One Foreign Commodity - Crude Oil - To Another - the Rare Earths - Expert Warns," By Scott Doggett, Contributing Editor, Edmund's Green Car Advisor, <http://blogs.edmunds.com/greencaradvisor/2010/04/with-hybrids-and-electric-vehicles-us-risks-switching-dependency-from-one-foreign-commodity---crude-oil---to-another---the-rare-earths---expert-warns.html>



higher maximum power in more conditions. They are thus the likely choice for future plug-in vehicles.

Alternatives also exist for advanced batteries. The Prius and other early hybrids use NiHM batteries which usually require large amounts of lanthanum (most of the 22 pounds mentioned earlier) while advanced lithium batteries use little to no REEs. With most firms moving to lithium batteries for their plug-in and hybrid vehicles, lanthanum use will probably decline in these advanced vehicles over time. Ironically, similar concerns regarding security and dependency have been raised about lithium availability. Like rare earths though, it too is globally abundant, is found in concentrated form in a number of global locations, can be recycled, and is used in the vehicle's production and not as an energy source.

China's moratorium woke up industries outside of China to the threat posed to their production by over-reliance on Chinese REEs. Most are making concerted efforts to either limit their exposure or broaden their supply base. Mines are reopening or being developed and research is being conducted on how to reduce REE use even further over time. Since it takes two years to process REEs from ore, it will nonetheless remain a general concern for some time.

## **INNOVATION**

### **Changes in Corporate Strategy**

As the market becomes more competitive with new entrants, new technologies and greater financial constraints for consumers, manufacturers must increasingly fight for each sale and offer more value for the dollar. Auto manufacturers are adjusting to the economic realities by investing more money in the development of new technologies that will increase the appeal for consumers. They hope to attract buyers who want to stay connected in their vehicles as well as feel comfortable and safe. Manufacturers are also adding more technology as a standard feature in all their product lines as a way of offering technology to the masses. GM has demonstrated its commitment to focusing on and developing leading edge technology by naming a Global Chief Technology Officer (CTO) in February 2011.

Another change in corporate strategy is the emphasis on compatibility of manufacturing facilities worldwide. Companies such as Ford are introducing one platform for global markets by designing their models to be easily reproducible in other markets. Ford's global vice president of marketing Jim Foley believes that automakers are reacting to several factors: expensive fuel in the United States means Americans are looking for more fuel efficient vehicles like those found in other countries; consumers in countries like China are buying more U.S.-sized cars; and automakers feel the need to maximize their investment in this economy by selling new models in as many markets as possible. This transition to global platforms has already and will continue to shake up suppliers. Global platforms reduce engineering costs and give automakers flexibility to react to the market, and they also simplify manufacturing processes and improve quality by reducing variability. This will likely force further consolidation in the supplier industry. Moreover, suppliers must move quickly as manufacturers are already sourcing products for 2013-14, with GM reportedly being the most aggressive targeting its vehicle platforms to be

reduced from 18 today to 11 in 2014. In fact, according to Fred Thomas, Industry Director at Apriso, the tech and data revolution may assist the Detroit<sup>3</sup> by aligning corporate strategies with a more “pull” than “push” approach, applied by Henry Ford in the early days of the industry.

Automotive News’ reporter James Treece considers the three major challenges for auto engineers to be “how to limit a vehicle’s impact on the environment, how to keep occupants connected and informed, and how to reduce the chance of driver error in such mundane tasks as parking.” Diesel, electricity, compressed natural gas, biofuels and hydrogen cars are all being considered, with a view toward boosting fuel efficiency as well as limiting environmental impact. As new innovations flood the patent offices and markets, yesterday’s concepts are rapidly becoming today’s standard features.

### **Competition and Collaboration**

Although automakers rank at the top of lists on industry R&D investments, the process to achieve automotive innovation remains secretive, given fierce marketplace competition. Since company R&D is highly valuable intellectual property, engineers often work under top-secret security because the first company to market a technology can gain market share. For example, registered global patents and patent applications for alternative power innovations have more than doubled over the last few years. Many patents are also for vehicle security systems and vehicle navigation. Despite intense competition in innovative technologies, collaboration is occurring in developing electric vehicle batteries which will accelerate products to market and reduce costs by burden-sharing, so mass production can become a reality more quickly. International efforts by governments are also underway to streamline safety regulations for electric vehicles.<sup>3</sup> Collaboration is also occurring as manufacturers seek light-weighting solutions (e.g., switching from steel to aluminum) in order to achieve fuel economy requirements, and integrating more composite and recyclable plastic materials into their vehicles.

In terms of energy and autos, the smart grid and electric vehicles must develop in harmony. Collaboration means not only burden-sharing in terms of development, but also in advancing safety. According to Jason Forcier, President of North America for Robert Bosch LLC, “the industry – automakers and suppliers – legislators, regulators and consumer advocacy groups must work in unison to achieve technology neutral legislation and a common understanding among consumers of the benefits of these safety technologies.” Another example of collaboration can be seen in the recent release of guidelines by the Alliance of Automobile Manufacturers (AAM) addressing the development of telematics and in-vehicle technology, called Driver-Focused-Telematics (DF-T). (Nearly all auto manufacturers in the United States are represented by the AAM.)

### **Emerging Technologies and Top Gadgets**

According to an electric vehicle study by the Consumer Electronics Association, more than half of car buyers say that technology influences their vehicle purchase. Ford and other auto

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<sup>3</sup> [http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob\\_candidate.html](http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_candidate.html)

companies are trying to change consumers' perceptions of innovation by making it more readily available. Original equipment manufacturers are now leading technology sales over aftermarket parts manufacturers. Some of the new technologies being added to or becoming standard on vehicles are safety features like electronic stability control, blind-spot detection, and side/head airbags. The Ford Focus will include a voice command system and an Active Park Assist, an automated parallel-parking system. In addition, the Global Positioning System (GPS) and telematics packages that connect cars to home computers will become standard within the next few years. Even more opportunities are evolving in telematics as more manufacturers are developing electric vehicles. Energy management and navigation will become critical in terms of range and locations for recharging/battery swap stations, as well as topography for elevation, given how batteries use more power going uphill and recharge going down. Ford's SYNC infotainment system may have more competition once Blackberry commits to the auto market. RIM, the company that makes the Blackberry smartphone, has just purchased QNX, a software company. In November 2009, Mercedes-Benz USA and Hughes Telematics Inc. launched "mbrace" a new telematics offering that they say brings an unprecedented level of connectivity to customers. This will replace Tele Aid, the previous system of the last ten years.

Within the emerging technologies, there are both safety and fuel-efficient features. However, there are also some "cool" items that more and more people want to incorporate in their vehicles since the time spent getting back and forth to work, or travelling for work and/or pleasure typically requires more time in a vehicle. According to Popular Mechanic, the next four gen auto technologies to fall in the category of "must haves" are the Infiniti Eco Pedal, the Emergency Steer Assist, the Optima Sports Camber Tire, and the Continental Intelligent Tire System. However, the more mainstream gadgets of today such as lane departure warning systems; real time traffic information; in-car media storage devices; Bluetooth; self-parking; heated and/or cooled cup-holders; remote start; and, rear parking cameras will continue to be in high demand.

### **Leading Safety Technologies and Top Next Generation**

New technology geared to improve automotive safety can save lives. Traffic fatalities in 2010 fell to the lowest levels since 1949, and fatalities have also dropped 25 percent since 2005. According to Ward's Automotive Reports, the key factors in lowering the fatality rate are electronic stability control and new crash avoidance technologies being added to cars and trucks. Edmunds identifies technologies currently under development that can help keep the roads safer for drivers and pedestrians. In addition to the lane departure warning system and rearview camera, other top safety technologies include: tire-pressure monitoring; adaptive cruise control/collision mitigation; blind-spot detection/side assist/collision-warning; rollover prevention/mitigation; occupant-sensitive/dual-stage air bags; emergency brake assist/collision mitigation; adaptive headlights and/or night-vision assist; drowsiness detection; and, emergency response.

NHTSA has required that all U.S. passenger vehicles weighing 10,000 pounds or less be equipped with tire monitoring systems beginning with their 2008 models. Sensors at the wheel alert the driver if the pressure is too low by sounding an audible warning, a light on the instrument panel or both. Some models, such as Corvettes, use run-flat tires, which allow the

vehicle to continue to run at a relatively high rate of speed for 50 or more miles per hour. Adaptive cruise control/collision mitigation is a new technology that allows the cruise control to adjust the throttle and brakes to keep a safe distance from the vehicle in front if there are changes in traffic speed. If the system senses a potential collision it will typically brake hard and tighten the seat belts. This is available in Mercedes-Benz models.

Blind spot detection/side assist/collision warning is designed to alert the driver to cars and objects in blind spots during driving or parking. It usually responds when the turn signal is turned on and if it detects something in the way, it sends a signal (flashing light in mirror, vibration in seat or steering wheel, or an alarm will go off). Rollover prevention/mitigation is a system that senses and reacts to a potential rollover by applying the brakes and modulating the throttle to maintain control. They all have the same goal. Occupant-sensitive/dual stage airbags can sense different sizes and weights of occupants as well as seatbelt usage, abnormal seating position, rear facing child seats and vehicle speed. This is standard equipment on every Porsche. Emergency brake assist/collision mitigation technology recognizes when a driver makes a panic stop (changing quickly from gas to brake pad) and applies additional brake pressure to help shorten the stopping distance. This is different from an antilock braking system or electronic brake force distribution. Adaptive headlights and/or night-vision assist help the driver see farther down the road and to spot people, animals or trees in its path. The assist works in different forms such as infrared headlamps or thermal imaging cameras, and can provide coverage up to 1,000 feet away. The BMW night-vision system uses a high contrast image (far infra-red technology, or FIR), giving the driver up to five seconds of warning at a speed of 62 mph. Cadillac has also developed night vision technology that creates a black and white image of objects highlighted ahead, and displays them on a head-up display. It can be viewed by the driver's peripheral vision without obstructing the view of the road. Lastly, emergency response gives vehicles various ways to handle emergency situations. Daimler's enhanced Accident Response System (EARS) turns on interior lighting, unlocks doors and shuts off fuel when airbags deploy. Volkswagen also switches on the hazards and disconnects the battery terminal from the alternator. GM's OnStar and BMW's Assist both alert their response centers and make crash details available to emergency personnel.

Technologies such as stability-control systems, antilock brakes and better airbags are the primary reason U.S. highway fatalities have steadily declined for decades. Still, engineers around the world are working on ever better ideas for safety tech. According to Dan Carney of Popular Mechanics magazine, the five most promising are: skidding airbags; expandable door beams; inflating seatbelts; autonomous brakes; and, auto steering correction.

## **UAW**

According to the U.S. Bureau of Labor Statistics, less than eight percent of the nation's private work force was unionized at the end of 2009. When public employees are added to the figure, 12.5 percent of all workers belong to unions, about half the amount there were 25 years ago. According to a UAW filing with the Labor Department, the United Auto Workers (UAW) had 376,612 active members at the end of 2010, down from 1.5 million in 1979. Part of this decline was due to greater productivity that allowed auto companies to build more cars with fewer

people, but it also reflects reluctance on the part of blue-collar workers to vote for union representation, especially in the new auto transplants and U.S.-owned parts companies mostly located in the South. More than 50,000 UAW workers have accepted early retirement since 2007. Industry experts expect that union membership will stabilize or even increase somewhat as the auto parts and assembly industry begins hiring again due to the recovery of the U.S. market.

Many suppliers have negotiated or re-negotiated contracts with unions (primarily the UAW) in efforts to cut back on health care, pension, and other labor costs. UAW leaders realized that prospects of even maintaining current pay and benefit levels were dim because so many large suppliers are in Chapter 11 or have recently emerged from Chapter 11. Thus, suppliers were able to lower wages and cut back or eliminate other union negotiated benefits. For example, Delphi and Visteon negotiated changes with the UAW that lowered retirees' health care benefits and increased health care costs for working UAW members.

Late in 2007, GM, Ford, and Chrysler negotiated new contracts with the UAW, decreasing benefits for current and future employees and also lowering retiree benefits. On March 9, 2009, Ford UAW members approved additional changes to the 2007 contract. The changes included fewer holidays, eliminating the jobs bank, and most importantly, changes to the Voluntary Employees Beneficiary Association (VEBA). Similar changes were approved by GM and Chrysler UAW workers during bankruptcy proceedings. Also included in the new GM and Chrysler agreements were a no strike clause until 2015, one less holiday, and fewer job classifications.

In March 2009, Delphi eliminated health care for salaried retired workers, and the change was upheld by the court. In December 2009, a bankruptcy judge ruled Visteon had permission to eliminate health care benefits for most of its retirees. In addition, Visteon received permission to cut company-paid medical, prescription and life insurance coverage for 6,550 current and future employees, as well as their spouses and dependents. In July 2009, Dana, one of the largest U.S.-owned parts companies, entered into an agreement with the UAW and the United Steel Workers to set up a Voluntary Employees Beneficiary Association (VEBA); similar to those agreed upon with the Detroit 3 in 2007.

In June 2010, the UAW elected a new president to replace the retiring Ron Gettelfinger. Bob King, former head of UAW bargaining at Ford, will serve one term since he has to retire when he will have reached 65. Mr. King will head final negotiations in 2011 when all of the Detroit 3 contracts expire and also participate in any UAW contracts with the U.S. parts companies.

In March 2011, members of the UAW working for Dana approved a three year contract covering 2,500 workers in 13 plants. Under the terms of the new contract the workers will receive an increase in pay and participate in a profit-sharing plan. The Dana contract may have set a precedent for future contracts for UAW auto parts workers in other U.S. plants, reversing the trends of 2009-2010.

