

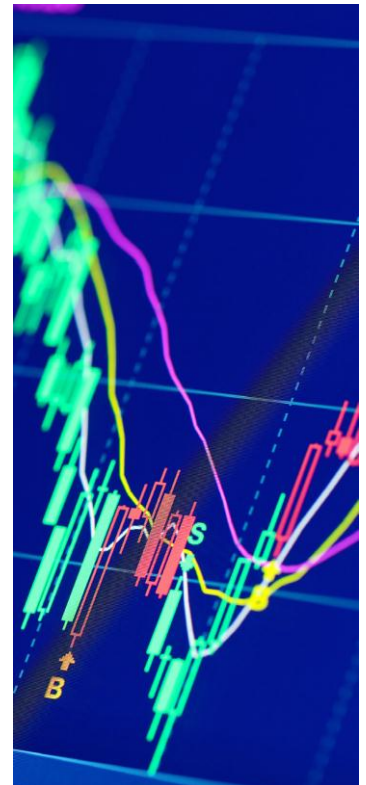
Globally Low Oil Price, Regionally Different Auto Industry Impacts



A Price Rout

Over the last few years, the world had become accustomed and perhaps too comfortable with \$100 per barrel oil. Today, however, the price of oil is recalibrating to the new realities of supply and demand brought about by the surge in production and weaker growth in the world economy. What does the price collapse and subsequent rebalancing mean for the auto industry whose products constitute the single biggest market for oil products?

- Prior to the price rout, IHS expected world light vehicle sales to rise by 760 million units between 2014 and 2021. Now we anticipate a gain of another 5 to 7 million vehicles.
- The impacts will vary widely among markets. The greatest influence will be in the United States, where motorists are most exposed to swings in the price of oil owing to the relatively low level of taxation. The result will be a shift towards larger, more thirsty vehicles. High levels of taxation or subsidies insulate motorists in many other countries from the changes in oil prices.
- Alternative fuel and electric vehicles will be more challenged in the marketplace.
- Costs for some energy-derived inputs such as plastics will decline, giving a minor boost to automaker and parts supplier margins.
- In the U.S. market, the “return on investment” for higher fuel efficiency will be drawn out far beyond buyers’ frame of reference, possibly forcing reconsideration, or at least a renewed battle, over more stringent fuel efficiency regulations.
- Sustained lower than had been expected oil prices will make it harder to reconcile increasingly stringent low fuel consumption/CO₂ regulations in the major markets as consumer demand would be spurred for larger, higher fuel consumption vehicles.
- At the same time, the overall market boost provided by the lower cost oil will obscure some underlying challenging market developments in resource-based economies

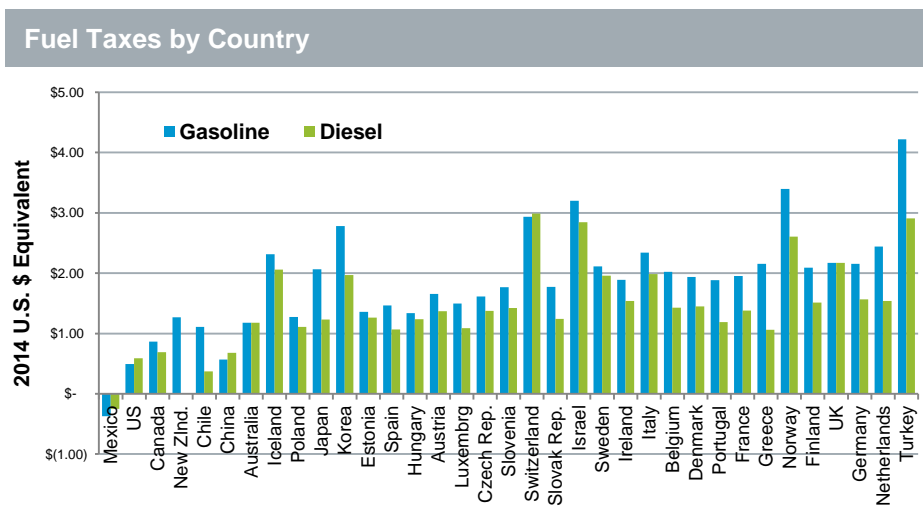


Impacted Factor	High Oil Price	Low Oil Price
CO ₂ /fuel consumption compliance	In line with market demand	Contrary to market demand
Preferred vehicles	Smaller	Larger
Energy-based inputs	Higher in cost	Lower in cost
Alternative Fuel Economics	Potentially attractive	Relatively unattractive

U.S. Feeling the Effects More Than Others

A change in oil price will certainly be reflected at the fuel pump, but the scale of the reflection will vary depending on the gas tax or subsidy in each market. The impact on pump price will be proportionally less for those markets having higher taxes on fuel. Moreover, each government may opt to alter its taxes or subsidies at any time. Mexico, for example, may take advantage of lower prices to reduce its subsidy, while others may offset the fuel cost decline and raise taxes to replenish national coffers.

The current state of relative taxation and fuel use point to the fact that the U.S. is not only the largest market but also the one where the impact will be greatest. The relatively high power of oil price to affect the pump price of fuel in the U.S., combined with the high share of total ownership costs contributed by fuel costs (due to high annual vehicle miles travelled), make the U.S. market one of the most oil-price sensitive markets in the world.



Other major markets are less sensitive to oil price. In high fuel-tax markets the percent change in fuel pump price is less than in the U.S. For example, a \$20 drop in crude oil price will reduce Norwegian pump prices by about 15%, whereas the price impact in the U.S. would be about 35%. In addition, compared to the U.S. average, passenger vehicles in other markets use less fuel due to their smaller size and lower annual distances travelled. While European consumers have noticed the change at the pump, their purchase behaviour in terms of vehicles is not expected to change significantly. In

China, fuel prices are set by the government, with adjustments as frequently as every two weeks.

Historically the Chinese benchmark price follows the price of crude oil. Observed prices reinforce this practice with current Chinese pump prices in the range of those last seen in 2009 before the government began imposing fuel tax increases to encourage conservation. Despite the higher fuel prices in these markets, the net result is that the contribution of fuel price to total overall ownership costs is less than in the U.S., rendering these markets less sensitive to crude oil price fluctuations.

The major markets of Japan, Europe, U.S., China and others¹ have requirements to meet certain levels of performance with respect to fuel consumption/CO₂. There are also government requirements and/or incentives for certain alternative powertrains ranging from California’s mandate to offer zero emission vehicles to Japan’s recent incentive for Full Hybrids that attenuate or override market forces and fuel price considerations to some extent.

Factors Influencing the Impact of Low Fuel Prices on Market and OEM Response

Market	Fuel Cost as a % of Total Ownership Cost	Pump Price Impact of Oil Price	2014 Share of Alternative Powertrains	Directional Impact on Alternative Powertrains	Factors Attenuating Regional Response
U.S.	~25%*	High	4.5%	↑	Need to achieve sales-weighted CAFE & CO ₂ performance
Europe	~15%**	Low	2.6%	↔	Need to achieve sales-weighted CO ₂ performance
China	~15%***	Medium	1.1%	↔	Policy-driven market, consumer has little choice. Government subsidies for alternative powertrains overrides impact of fuel price
Japan	~15%***	Low	24%	↓	Increased government incentives for full hybrids but cost/benefit of mild hybrids compared to conventional vehicles is high

* American Automobile Association
 ** Automobile Association of Ireland
 ***IHS estimate

The net upside impact will be a potential increase in margins for automakers in the U.S. market. Some lower input costs combined with a small increase in capacity utilization and a slight shift towards larger, traditionally more profitable vehicles suggests margins could improve, although these could be offset to some extent by the need to deploy more alternative powertrains (stop-start, hybrid and electric and natural gas) to achieve regulatory fuel efficiency/CO₂ requirements.

¹ About three fourths of all the world’s cars are sold in markets with some level of fuel efficiency requirement

Impacts on Light Vehicle Market

Low oil prices will affect more than the total global industry volume and share of small and large vehicles. Their influence will manifest itself in significantly different ways from one market to the next. Powertrain and other vehicle technologies will shift as automakers strive to maintain compliance with regulatory standards regardless of changing preferences upon the part of buyers.

Light Vehicle Sales

Coming out of the 2009 recession, the light vehicle market² had a strong growth outlook with IHS Automotive forecasting over 760 million cumulative world sales in the years between 2014 and 2021. This would amount to a 33% increase over the previous eight year period. Lower oil prices will further raise the sales number. At this point, it is difficult to quantify the additional sales increase resulting from lower oil prices. However, IHS Automotive estimates that cumulative global sales could rise another 5-7 million units over the forecast period. Not surprisingly, the largest beneficiaries will likely be the U.S. market where the lower fuel prices will augment consumer confidence as well as household balance sheets, and developing markets such as India and ASEAN where lower ownership costs will bring new buyers. However, low oil prices are also leading to reductions in government fuel subsidies and to shifts in tax policies in many countries. Consumers in those nations will not have the full benefit of cost savings.

The impact of lower oil price – ignoring GDP effects – will have little impact on vehicle sales in middle-eastern oil producing countries. Fuel is already priced quite low (it is heavily subsidized in many of these countries) so there will be little impact on the consumer's cost of ownership. For non-oil countries, we would expect a very modest positive impact due to lower ownership costs. In these markets, however, sales volumes are already relatively low so there will not be much unit volume gain. The incremental increase from low oil alone (no GDP impact) is estimated to add 100K-150K units through 2020, or about 2% of the Global increase.

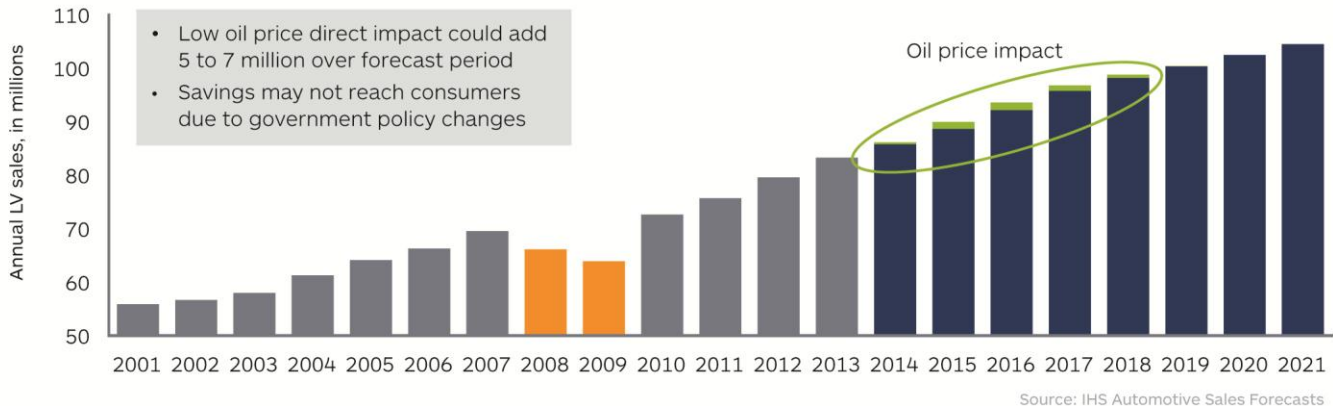
The automotive industry will need to adjust to a shift towards larger vehicles in the U.S. and Canadian markets. Lower fuel costs make higher priced/larger sized vehicles more affordable to own, and the value of fuel economy less important. Discussions with automakers in the U.S. to date indicate that production plans for larger light trucks – mostly SUVs and pickups - have been increased at the expense of smaller vehicles in the B- and C-segments³. By contrast, outside the U.S., automakers expect little to no change due to the greater insulation of pump prices from oil costs due to taxes and/or subsidies. As discussed earlier, the impact in these markets is further attenuated by government incentives and the need to meet regulations.

² Light Vehicles are cars and trucks, including utility vehicles, vans and pickups, with a gross vehicle weight rating of 6 tons or less

³ B- and C-segment vehicles are those in the lower second- and third-tier vehicle market segments. Specifications of these vary somewhat, but they have overall (bumper to bumper) lengths in the range of 3700 to 4200 mm and 4000 to 4600 mm respectively.

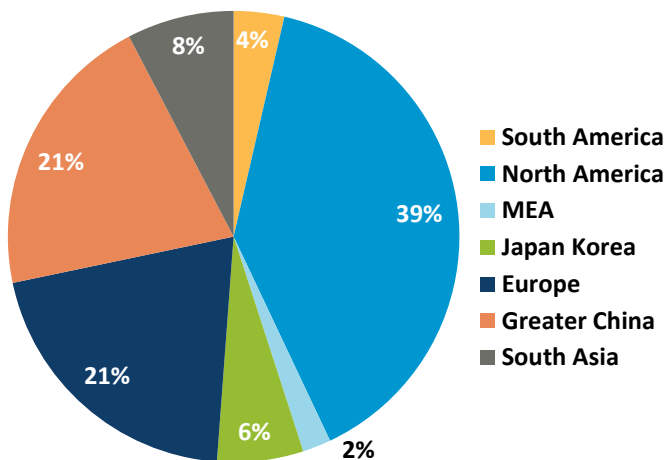
World Light Vehicle Sales Forecast

Outlook optimistic from US/Europe recovery and China market growth



Region Share Of "Low Oil" Incremental Volume Gain

North America will likely see the largest impact on market sales through 2020



Powertrain Technologies

The impact on powertrain technologies will mirror the market response. In Japan, China and Europe, the initial expectation is that there will be little change in these markets.

Automakers in all the major markets have their feet held to the regulatory fire, and they will need to offer increasingly fuel efficient fleets regardless of fuel price and market preferences.

In the U.S. market there will be a greater need to improve the average fuel efficiency of the new vehicle fleet due to the expected up-segment market shift. While the unexpected decline in fuel price has been too fast, and is expected to be too short, for any major change in investment strategy and technology roll out schedule, IHS expects an increase in the

market share for technologies already in the pipeline ranging from downsized and boosted engines as well as stop-start and higher levels of electrification. These changes will affect short term plans in locations around the globe, and at first glance the responses may seem counterintuitive. For example, anticipating changes in export market demand, at least one automaker in Japan has cut back planned production levels for some of its smaller, most efficient models. At the same time, U.S. production plans for the hybrid share of a larger sedan have been raised. IHS expects that this seemingly anomalous tactic is meant to offset the losses in new vehicle fleet fuel economy as the market moves from B- and C-segment vehicles to larger and higher fuel consumption alternatives.

Such responses are necessary because while fuel prices are generally expected to return to higher levels by the time the 2025 requirements must be met, a shortfall in meeting the standards in the interim years will cost an auto manufacturer important credits that they may be counting on for 2025. As a result, IHS expects greater penetration of alternative (mostly stop start and hybrid) powertrains as well as downsized and boosted gasoline engines in the next several years.

Diesel demand is not expected to be impacted by low oil prices. In Europe, both Diesel and gasoline prices are falling by roughly the same amounts; their relative attractiveness is basically unchanged. In the U.S., Diesel prices are also declining, but remain higher than those for gasoline. Diesel will remain attractive to those segments that need the benefits of high torque and long cruising range. In China, policy directs diesel fuel to commercial use, while the consumer favors gasoline. In Japan, the diesel demand is anchored by tax policy and is already priced much lower than gasoline. The expected crude oil price changes won't significantly alter the economics of diesel in Japan.

The industry has a long lead time from product conception to the showroom floor, generally 3 – 5 years for many manufactures. Thus, planning decisions for new vehicles may need immediate re-evaluation. Yet the current expectation is that oil prices will climb back to early 2014 levels within that time frame, leaving the industry with little time (or need) to respond. Overall sustained low oil prices would require adjustments to longer-term product plans.

“Return on Investment” Gets Drawn Out?

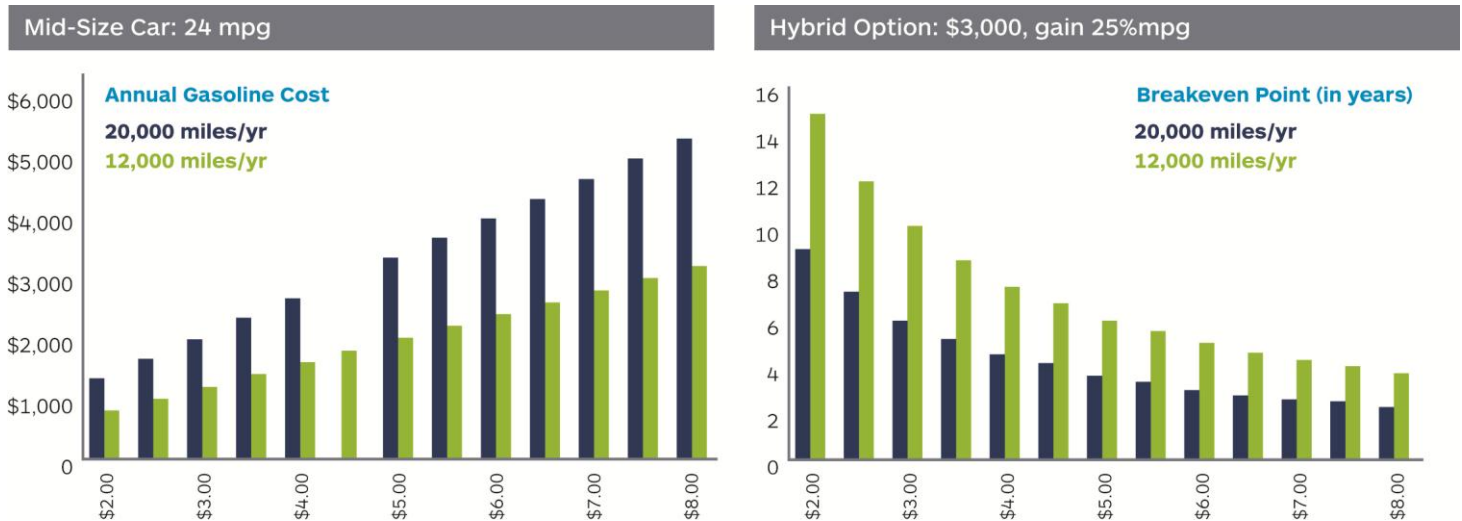
In recent years, many countries have implemented policies to direct consumers toward more fuel efficient vehicles in order to address pollution concerns and reduce dependence on imported oil. Manufacturers, assuming stronger demand for improved fuel efficiency as a result of these policies, have invested heavily in engine and transmission technologies, aerodynamic improvements and reduced rolling resistance and other product options, some offered at a price premium, that improve fuel economy and lower carbon emissions. The expectation has been that consumers will likewise invest in these technologies because the higher fuel economy will result in lower operating costs. However, lower gasoline prices change the return on investment calculation for consumers dramatically, and with oil prices now falling, demand for these technologies will likely fall as well. Lower fuel prices raise the consumers' payback period – the time needed to earn back the investment in the fuel saving technology – and most “rational” consumers are likely to determine the added cost is not worth it.

Indeed, over the past 40 years, IHS researchers have explored the acceptable payback period for new technologies offering greater fuel efficiency. In interview after interview, vehicle manufacturers have stated that the consumer readily accepts a simple payback within 18 months. This does not compare favorably with discounted cash flow calculations used in the most recent U.S. fuel economy legislation⁴ which indicates that the technologies required to achieve the 2025 fuel efficiency levels (including those that yield off-cycle credits) will be approximately 38-40 months at \$3.87 per gallon gasoline – approximately twice the level historically experienced by OEMs! Lower gasoline prices serve only to increase the payback challenge even further.

An IHS calculation suggests that a \$3000 on-cost for a hybrid technology yielding a 25% increase in the fuel economy of a mid-sized car could take 9 to 12 years to pay back if gasoline remains in the range of \$2.00 per gallon! Lower fuel prices make it even harder to meet not only the current but the more stringent post 2020 regulations in European, U.S. and other markets taking leadership roles in the area of sustainability.

⁴ U.S. Environmental Protection Agency, National Highway Traffic Safety ration, 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, report RIN 2060-AQ54; RIN 2127-AK79, page 40

Example Impact on Simple Payback for a Hybrid Option on a Mid-sized Car in the U.S. Market



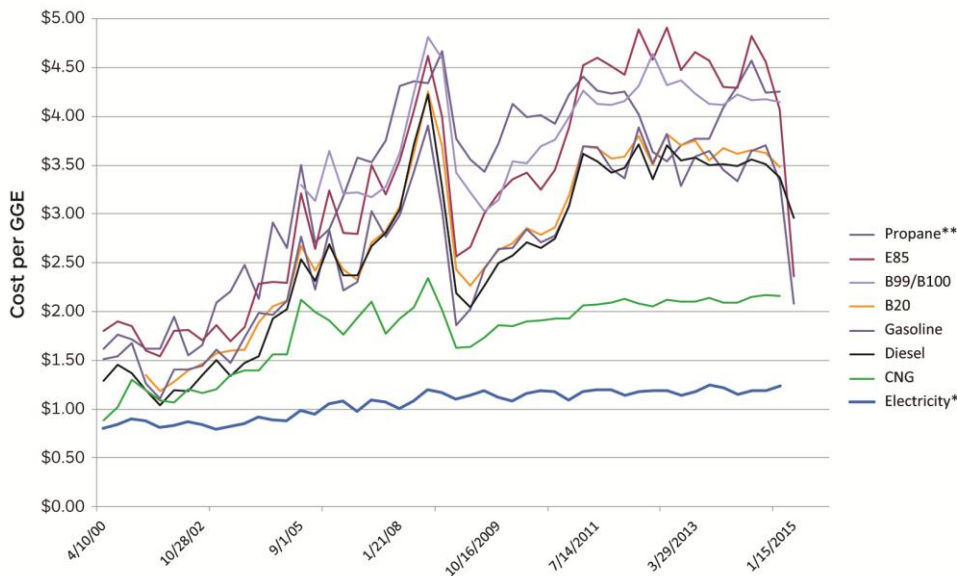
Source: IHS Automotive

Challenges for Alternative Fuels

In the absence of massive subsidies, the drop in oil price pushes most alternative fuels off the table, economically. Except for CNG, the “pump” price of popular alternative fuels has almost always been higher than that of gasoline in the U.S. market on a gasoline gallon-equivalent basis. Convenience factors, discounts for bulk purchases and local regulations have often made these fuels attractive for certain commercial fleet operators when location or use specific circumstances over rode the differences in market price.

Now, however, the equivalent price of all of these fuels is in the range of 75% more expensive than gasoline on an equivalent energy basis. In fact, as of this writing, gasoline is in the range of the trend price of CNG. Only E85 seems to be tracking the price of gasoline due to a coincidental and serendipitous overabundance of corn driving down the price of ethanol. Even the attractiveness of electricity is likely to be impacted. As the fuel cost per mile of a gasoline vehicle approaches that of an electric, the payback period for the electric vehicle will be extended. Fleets that would have welcomed the low total cost of ownership of pure electric vehicles when gasoline costs were several times higher than electricity may think twice with liquid fuel prices approaching electricity on an operating equivalence basis. Clearly, the new oil pricing is going to make further market penetration of alternative fuels into the U.S. and other low fuel-taxation markets quite challenging.

U.S. Average Retail Fuel Prices



*Electricity prices are reduced by a factor of 3.4 because electric motors are approximately 3.4 times as efficient as intern combustion engines

www.afdc.energy.gov/data/

Source: U.S. energy Information Agency through 10/1/14. 1/15/15 data added from AAA Fuel gage

Implications for the Regulatory Review

The drop in fuel prices is an additional disruption to anyone planning the next generation of vehicles and powertrains. It came at a very challenging time as Europe is expecting CO₂ standards for 2025 to be set in the range of 75 to 80 g CO₂/km soon, and the current rules for U.S. CAFE regulations are firm only through 2021, with those for 2022 to 2025 under review. The time period during which oil prices remain low and the resultant market response are bound to have a significant impact on the final outcome of these regulations.

In the U.S., a “mid-term review” is required before the proposed 2022 to 2025 regulations can be considered final and binding. This review will take place in earnest and must be completed prior to April 1, 2018. The review will evaluate the stringency of the 2022 to 2025 standards and the industry’s ability to meet them. “The evaluation will be based on (1) a holistic assessment of all of the factors considered by the agencies in setting standards, including those set forth in this final rule and other relevant factors, and (2) the expected impact of those factors on the manufacturers’ ability to comply, without placing decisive weight on any particular factor or projection.”⁵

One of the key factors that must be evaluated in the mid-term review will be the market response to the fuel efficient vehicles and technologies offered by the industry. If the relatively low fuel prices of the current period cause sustained and significantly greater shifts towards higher fuel consumption vehicles, the review could determine that the standards as they exist are too stringent. Reaching this conclusion will be politically difficult. “Green” voters will likely not forgive politicians who allow a relaxation of the standards to go unopposed, whereas labor unions and others who advocate the economic and strategic importance of a financially healthy auto industry will not want the proposed standards to stand. The likely solution will be a combination of market incentives, more off-cycle credits and multipliers for the sales of selected advanced technology vehicles similar to the Flex-Fuel credits that are just now being phased out.

⁵ Ibid page 95

In Europe, the likelihood of the 2025 standards being set at 75 to 80 gram levels are a bit less uncertain than in the U.S. The overall market response is expected to be less dramatic, but perhaps more importantly, the impact comes at a time when some politicians are signalling that they will discourage the use of diesels, as in Paris and London, for pollution reasons. Perhaps all of France would be next, where about 60% of the light vehicles built are diesel. While fuel prices are expected to be recovering by 2020 or so, the European automakers are far more concerned about the impact of regulations and aligning their powertrain strategies to meet the 2025 challenge.

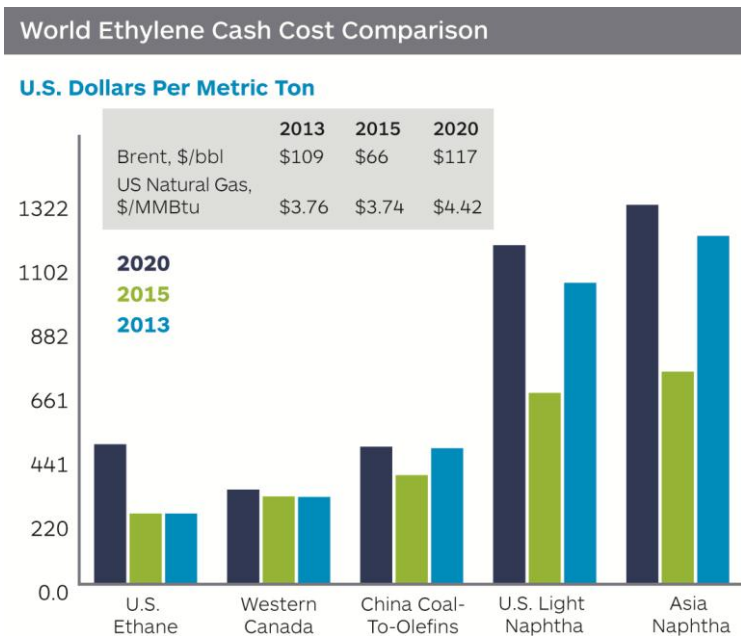
Regardless of the regulatory outcome, the timing of the current price decline inserts an additional level of uncertainty into the planning cycle of the auto industry. Entering 2015, the auto industry is just 10-years or one platform cycle away from the most stringent fuel efficiency/climate change standards yet conceived. To plan for a profitable auto making or component supply business in this era is perhaps one of the greatest business challenges of the day.

Chemical Costs

From the paint used on the exterior to the plastics under hood and interiors, from friction-reducing lubricants to the synthetic rubber in tires, the global auto industry is a major consumer of chemicals or their derivatives. Energy-based hydrocarbons are essential raw materials for virtually all chemicals. The near- and medium-term effects of lower oil prices on global chemical producers and their customers are significant and can be expected to reduce costs for oil-based input materials which represent about 16% of the mass of a typical new car.⁶

Offsetting the lower commodity prices, stronger economic growth will stimulate demand for plastics in general. Furthermore, the reduction in coal and natural gas prices relative to crude caused many firms to invest in new facilities that use methane rather than petroleum as a feedstock.

Some firms will be cost-disadvantaged in the short term as a result, because natural gas will not experience the same downward movement as oil, and will have increased more by 2020 than will oil compared to 2013 (17% for natural gas vs 7% for oil). The net impact of today's low oil prices on the basic building blocks for many downstream chemicals and plastics will largely disappear by 2020.



⁶ American Chemical Council

Risks to the forecast

Sustained Low Cost of Oil

As discussed earlier, the relatively low oil prices are expected to last only a few years. In that situation, benefits are more or less immediate, and will have no long term influence on product plans or investments beyond those that can be made on an opportunistic basis. But what if general expectations are wrong and prices remain low for a sustained time as they did after the 1986 price collapse?

If this scenario holds true, selling new fuel efficient technologies will be much harder, at least on an ROI basis without significant cost reduction or decontenting.⁷ Meeting regulations that are not synchronized with market demand will significantly challenge auto- and policy-makers alike.

Impact in Resource-based Economies

The low price of oil may be masking the effects of other phenomena that would, in more ordinary times, send out a red flag. Low oil prices are boosting the global market volumes and thereby somewhat offsetting other forces that would, in a more stable oil price environment, push some markets downward.

Conventional wisdom would suggest that the lower oil price will stimulate virtually all markets. The exception would be markets such as Russia and Venezuela whose economies are dependent on income from oil. In these markets, IHS had already downgraded the sales forecast significantly as oil prices began to decline. At current levels, the impact is incrementally more severe, and serves to further damp the upward boost on the global industry volumes.

Further inhibition of the global market comes from coincidental impact of resource-based economies. Chile, for example, is highly dependent on income from copper. Driven by slowdowns in what were significant growth markets such as China, the mine price of Chilean copper has recently declined substantially. Employment, wages and consumer confidence are dropping alongside the price of copper, and the auto sales forecast is down as well. While the industry can rejoice in the slight overall uptick expected in the market, those who husband the fortunes of the industry need to be mindful of other underlying factors, currently masked by low oil price, which suggest a cautious outlook for investment and growth.

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⁷ Removing some features from a vehicle to offset the added cost of new technologies to comply with regulations

