sam sustainable asset management

WORLD RESOURCES INSTITUTE

CHANGING DRIVERS

The Impact of Climate Change on Competitiveness and Value Creation in the Automotive Industry

EXECUTIVE SUMMARY

Duncan Austin
Niki Rosinski
Amanda Sauer
Colin le Duc

This document is a summary of *Changing Drivers: The Impact of Climate Change on Competitiveness and Value Creation in the Automotive Industry,* produced by SAM Research and World Resources Institute. The full report is available for download at either www.sam-group.com/changingdrivers or http://capitalmarkets.wri.org

The purpose of the report is to help investors make better informed decisions regarding automotive company stocks in light of emerging "carbon constraints"—policy measures designed to mitigate climate change by limiting emissions of carbon dioxide (CO_2) and other greenhouse gases. The report explores how carbon constraints in global automotive markets may affect value creation in 10 leading automotive companies between now and 2015, a timeframe in which major technological and policy changes are possible. The Original Equipment Manufacturers (OEMs) assessed are BMW, DaimlerChrysler (DC), Ford, GM, Honda, Nissan, PSA, Renault, Toyota and VW—the world's largest independent automotive companies. The geographical scope of the assessment is the United States, European Union and Japanese markets, which together account for nearly 70 percent of current global sales.

The report is the result of collaboration between SAM Sustainable Asset Management (SAM)—a Zurich-based independent asset management company specializing in sustainability-driven investments—and the World Resources Institute (WRI)—an environmental research and policy organization based in Washington D.C. Drawing on the respective strengths and expertise of the two organizations, the report analyzes both the risks and opportunities of carbon constraints, and then estimates the combined implications for OEMs' future earnings. The report is explicitly forward-looking, focusing on the main factors affecting OEMs' exposure to carbon constraints, and drawing on the latest publicly available information about the 10 assessed OEMs.

sam sustainable asset management

WORLD RESOURCES INSTITUTE

MAIN FINDINGS

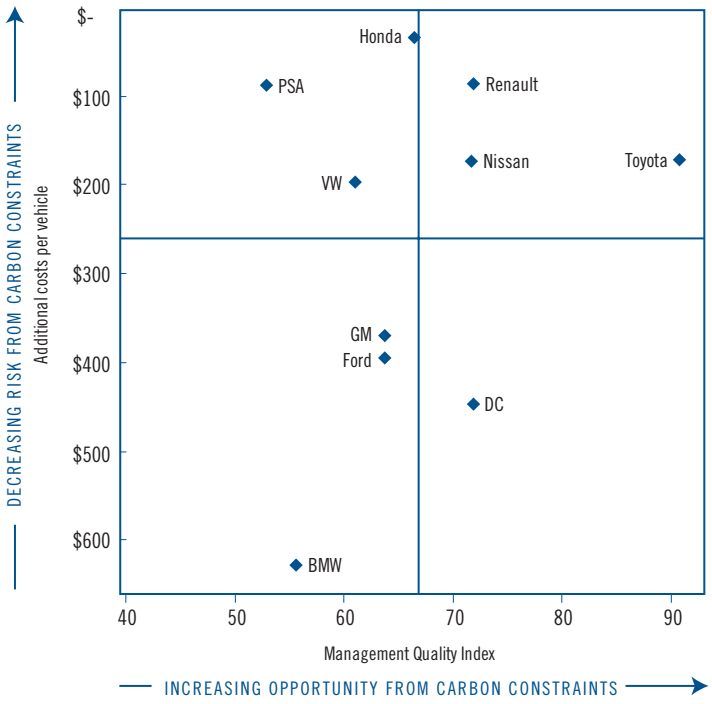
Emerging carbon constraints constitute a new and additional influence on competitiveness in the automotive industry.

- Carbon constraints are emerging in major automotive markets around the world. The European Union, Japan, Canada and Australia have adopted, or are close to adopting, regulations or commitments that will require significant reductions in vehicle-related carbon dioxide (CO_2) emissions over the coming decade. To date, the United States has made less of a commitment, though a 2002 California law seeks to regulate vehicle CO_2 emissions for the first time.
- Carbon constraints could directly affect some of the industry's traditional drivers for shareholder value creation, such as costs and innovative capacity. Consequently, carbon constraints could significantly alter the competitive balance in the industry.
- In particular, carbon constraints create both risks and opportunities for Original Equipment Manufacturers (OEMs). Risks include potential increases in manufacturing costs to meet carbon constraints and possible loss of market share to OEMs that produce less carbon-intensive vehicles. Opportunities lie in the potential to develop lower-carbon technologies ahead of rivals and so reap the benefits of technological leadership, brand differentiation and enhanced profits.
- OEMs are very differently positioned with regard to these risks and opportunities. To gauge the risks to OEMs, we performed a Value Exposure Assessment that estimates the costs OEMs will incur to meet carbon constraints. To measure opportunities, we performed a Management Quality Assessment that captures the relative potential of OEMs to yield a superior return on their investments in lower-carbon technologies, including diesel, hybrid and fuel cell technology. OEMs in the top right quadrant of Figure A have below average exposure to risks and above average management quality with regard to lower carbon technologies.

"Carbon intensity of profits" and management quality around lower-carbon technologies are two key determinants of an OEM's sensitivity to carbon constraints.

- The costs incurred in meeting new carbon constraints could vary by a factor of 25 across the industry, from an average cost per vehicle of $650 for BMW to less than $25 per vehicle for Honda. A key determinant of an OEM's value exposure is the degree to which its current profits are derived from high carbon-emitting vehicles (or its "carbon intensity of profits"). Because of different product mixes, the current carbon intensity of profits differs across the industry. OEMs with a high carbon intensity of profits rely disproportionately on high carbon-emitting vehicles to create shareholder value, and are therefore most at risk from carbon constraints.
- Management quality regarding carbon constraints also varies significantly. An OEM's ability to capitalize on carbon constraints will be determined by the quality of its management decisions regarding the development of key lower-carbon technologies. Success requires technological expertise and the management capabilities necessary to commercialize, market and mass produce these new technologies. Moreover, because there is uncertainty over which lower-carbon technologies will be

FIGURE A. QUANTIFICATION OF THE RISKS (Value Exposure) AND OPPORTUNITIES (Management Qality) OF CARBON CONSTRAINTS



Note: The lines indicate industry averages in each category.

adopted as market standards, OEMs must maintain innovative capacity across multiple technology pathways. Among the OEMs analyzed, Toyota emerges as a clear leader with a strong position in all three of the main engine technologies that promise to lower carbon emissions.

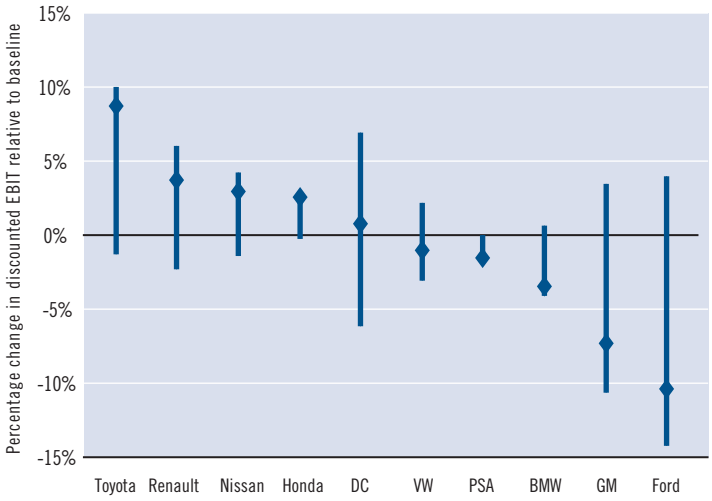
Carbon constraints could significantly affect OEMs' earnings and should be viewed as a material issue by investors.

- The challenge for investors is to determine how the risks and opportunities from carbon constraints will affect earnings, return on invested capital and ultimately, shareholder value. Consequently, we translate the results of the Value Exposure and Management Quality assessments into changes in forecasted EBIT (Earnings before Interest and Taxes) for the period 2003 through 2015.
- Converting our cost estimates and management quality scores into EBIT figures sets our results in the context of existing and projected business performance. The results shown in Figure B reflect the range of possible effects on estimated EBIT, in terms of percentage changes from business-as-usual EBIT forecasts. The upper limits reflect the results from the Management Quality Assessment alone, which captures the opportunity for OEMs, while the lower limits are results from the Value Exposure Assessment alone, which reflect risks. The points indicate the combined impact of both assessments on EBIT. Toyota appears best positioned, while Ford has the weakest result.

Relative sensitivity to carbon constraints also serves as an indicator of OEMs' positioning with regard to other market dynamics.

- While the findings refer primarily to carbon constraints, they also shed light on how OEMs may perform in response to other pressures that would lead consumers or regulators to value fuel

FIGURE 6. POTENTIAL IMPACT OF CARBON CONSTRAINTS FOR DISCOUNTED EBIT (2003–2015) BASED ON VALUE EXPOSURE AND MANAGEMENT QUALITY ASSESSMENTS



economy more highly (e.g., energy price rises or renewed energy security concerns). Indeed, consumer and policy responses to energy market shocks may play out considerably more rapidly than the steady progress in carbon regulations envisaged in the report, potentially making manufacturing adjustments more awkward. If so, the impacts on OEMs—whether positive or negative—may be more extreme than reported here.

- The findings may also offer insight into relative performance potential of OEMs in key emerging markets, where fuel economy may be valued for non-carbon reasons. In China, for example, low average income, minimal domestic oil reserves and densely crowded urban areas may steer consumers to smaller, more efficient vehicles that also perform well in carbon-constrained markets.

I. Climate Change and the Automotive Industry

Climate change is a relatively new issue for the automotive industry, and one that may have significant financial impacts for the sector. Climate change policies are already in place in several major automotive markets and appear likely to spread, forcing Original Equipment Manufacturers (OEMs) to lower the carbon emissions profile of new vehicles. At the same time, new technology options in various states of development offer the potential to meet new carbon constraints while increasing profitability. Carbon constraints thus create a combination of risk and opportunity for OEMs.

As part of international efforts to tackle climate change, several of the world's major automotive markets are adopting policies to reduce vehicle-related carbon dioxide (CO_2) emissions. With the bulk of automotive-related CO_2 emissions occurring during vehicle use, fuel economy and CO_2 emissions standards offer the best prospect for reducing vehicles' contribution to climate change. This type of "carbon constraint" is already emerging in the following markets.

- In the **European Union**, dialogue between regulators and the automotive industry trade association, ACEA (Association des Constructeurs Européens d'Automobiles), has led to a voluntary commitment by the industry to reduce CO_2 emissions from passenger cars by 25 percent relative to 1995 levels by 2008. This would lower emissions rates to 140 g CO_2 per km traveled, or approximately 39 miles per gallon (mpg). Depending on early progress, ACEA may extend the target to 120 g CO_2/km (or 46 mpg) by 2012.
- In **Japan**, new legislation requires fuel economy improvements in cars of 23 percent beyond 1995 levels by 2010. Specific targets vary with vehicle weight but extend to 125 g CO_2/km (44 mpg).
- In **Canada**, the government has proposed a target of improving vehicle fuel efficiency by 25 percent by 2010 as part of its Climate Change Plan.
- In **Australia**, the automotive industry has responded to the government's challenge to improve fuel economy by announcing a voluntary commitment to improve fuel economy by 18 percent by 2010.
- As an indicator of growing pressure in this area, over 60 percent of global vehicle sales in 2002 occurred in countries that have ratified the Kyoto Protocol.

To date, the **United States** has taken no comparable action to regulate vehicle emissions in response to the climate change challenge. Although the Corporate Average Fuel Economy (CAFE) standard for light trucks was moderately tightened in 2003 – to improve light truck fuel economy by 7 percent by 2007 – the fuel economy standard for cars remains fixed at the 27.5 mpg (201 g CO_2/km) level first set in 1990. Moreover, the US Congress has repeatedly rejected bills proposing higher fuel economy standards and has shown no willingness to take action on climate change. However, a 2002 California law seeks to regulate vehicle CO_2 emissions for the first time and several other states have expressed an interest in following California's lead.

New carbon constraints will push automotive OEMs to produce vehicles that emit fewer CO_2 emissions per km traveled. This presents OEMs with both risks and opportunities. Risks take the form of potential increases in manufacturing costs to meet carbon constraints and possible loss of market share to OEMs that produce more fuel-efficient vehicles. Opportunities lie in the potential to develop lower-carbon technologies ahead of competitors and so reap the benefits of technological leadership, brand differentiation and enhanced profits.

Investors and managers will have to consider these new risks and opportunities alongside existing industry fundamentals. For investors, carbon constraints could influence the return on investments in OEMs by affecting the industry's traditional value drivers. Carbon constraints could affect traditional drivers such as innovation, brand, and cost structure. Investors will have to be alert to the implications of these changing drivers over the next decade.

Managers should recognize that a successful business strategy in a carbon-constrained market will be one that can maintain or enhance profitability from sales of progressively less carbon-intensive (more fuel-efficient) vehicles. The management challenge for all OEMs is to incorporate carbon reduction plans into the business and ensure that they are aligned with traditional profitability goals. In turn, this requires that carbon concerns become central to mainstream business planning.

II. Lower-Carbon Technologies and Competitiveness in the Automotive Industry

A large number of lower-carbon technologies are emerging that may transform the industry. Further modifications to the conventional internal combustion engine (ICE) platform to improve carbon performance will be introduced, but diesel engines, hybrid electric vehicles and fuel cell vehicles are all set to challenge the traditional gasoline-ICE vehicle. However, there is much uncertainty regarding which technology(ies) will emerge as winner(s). OEMs face a considerable challenge not only in developing new technologies, but also in devising an innovation strategy that covers all possible outcomes.

In carbon-constrained markets, OEMs will have to produce vehicles that emit less carbon while continuing to create value for shareholders. To meet carbon constraints, OEMs can turn to a wide range of "lower-carbon technologies" some of which could transform the industry. Using the traditional gasoline-ICE platform as the baseline for today's new vehicles, we group into four main categories the main lower-carbon technologies that are expected to be developed between now and 2015:

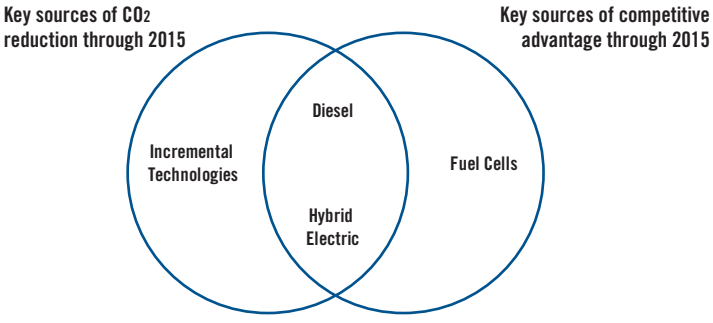
- "Incremental technologies" (including advanced gasoline-ICE technologies)
- Diesel (or compression-ignition) technology
- Hybrid technology
- Fuel cell technology

These technologies vary in terms of their carbon reduction potential and the degree to which they can penetrate the market by 2015. We find that "incremental technologies", diesel and hybrids will be the key technologies to deliver CO_2 reductions up to 2015. In addition, some lower-carbon technologies have the potential to alter the long-term competitive balance within the industry, as OEMs that are early movers on these technologies could develop important market niches, reap the benefits of brand differentiation and establish de facto standards that competitors will have to follow. The key technologies in this regard are diesel, hybrid, and fuel cell technology.

Hence, while incremental technologies may play a significant role in helping OEMs to meet carbon constraints, they offer little scope for OEMs to derive specific competitive advantage. In contrast, while fuel cells may deliver few actual carbon reductions through 2015, they represent a major and potentially disruptive advance in the automobile's evolution that could reward technology leaders with competitive advantage. Hybrid and diesel technologies lie somewhere in between these extremes, offering both the prospect of CO_2 reductions through 2015, and potential for brand differentiation and competitive advantage. (See Figure 1.)

Complicating the development of lower-carbon technologies is the uncertainty regarding which technology option(s) will become the market standard(s). Consequently, OEMs face not only the R&D challenge of producing lower-carbon technologies, but also the management challenge of devising an innovation strategy that is robust across multiple possible technology pathways. The latter in particular puts pressure on R&D budgets. To control expenditures, many OEMs are now engaged in research partnerships and alliances around lower-carbon technologies. If carbon constraints accelerate the demand for lower-carbon technologies, OEMs could win or lose depending on the expertise developed internally or through partnerships.

FIGURE 1. CONTRIBUTIONS OF LOWER CARBON TECHNOLOGIES TO CO_2 REDUCTIONS AND COMPETITIVE ADVANTAGE THROUGH 2015



III. The Current Carbon Profiles of Leading OEMs

In producing different vehicles for different markets, OEMs vary substantially in the carbon emissions associated with their product portfolios. Some OEMs rely heavily for sales and profits on vehicles that emit relatively high amounts of CO_2, while other OEMs derive the bulk of their profits from vehicles that are less carbon-intensive. By measuring the "carbon intensity" of current sales and profits, it is possible to assess each OEM's initial exposure to emerging carbon constraints. All else being equal, OEMs that earn a relatively large proportion of their profits from carbon-intensive segments will find carbon constraints more challenging. Of course, differing consumer preferences and regulatory attitudes to carbon constraints across major markets must also be taken into account.

OEMs are differently positioned to respond to the challenges of carbon constraints. This is because of differences regarding:

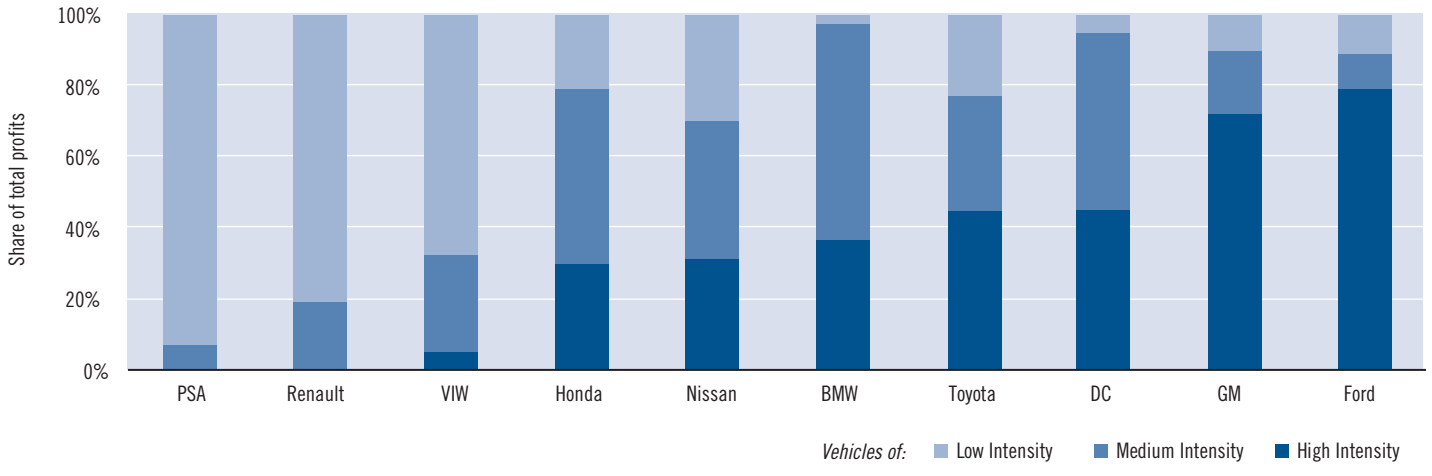
- segment mix (e.g., 49 percent of DaimlerChrysler's (DC's) 2002 sales in US, EU and Japanese markets were light trucks compared to only 3 percent for VW).
- carbon intensity of models (e.g., the average GM sports utility vehicle (SUV) emits 41 percent more carbon emissions per km traveled than the average Honda SUV).
- geographic distribution of sales (e.g., GM and Ford are dependent on sales in the United States while PSA and Renault primarily sell vehicles within the European Union).

The structure of each OEM's product portfolio largely determines its current "carbon intensity of profits." OEMs with a high carbon intensity of profits rely disproportionately on high carbon-emitting vehicles to generate profits and create shareholder value, and are therefore most at risk from carbon constraints. (See Figure 2.)

PSA and Renault are least dependent on more carbon-intensive vehicles to generate profits, while Ford and GM derive more than seventy percent of their profits from high carbon-emitting vehicles, because their profits are disproportionately attributable to light truck sales.

The carbon intensity of current profits only provides a snapshot of where OEMs find themselves today and says little about how OEMs can, and will, respond to carbon constraints. Consequently, we conducted two forward-looking assessments – a Value Exposure Assessment and a Management Quality Assessment - that take account of different possible development paths in different markets and the abilities for companies to respond to carbon constraints through innovation and strategic decision-making.

FIGURE 2. CARBON-INTENSITY OF OEM'S PROFITS, 2002



Notes:
High: Greater than 270 g CO_2/km (less than 20.5 mpg); Medium: 200 - 270 g CO_2/km (20.5 - 27.5 mpg); Low: Less than 200 g CO_2/km (greater than 27.5 mpg). Boundaries for high, medium and low categories were based on the current CAFE standards for cars and light trucks, rounded slightly for convenience.

IV. Value Exposure Assessment

The Value Exposure Assessment seeks to answer the following question:

- What costs do OEMs face in meeting higher fuel economy standards in 2015, given their initial sales levels and vehicle mix?

In all three main automotive markets covered in this report—the United States, European Union and Japan—governments have committed to higher fuel economy or CO_2 emission standards in the coming years. These standards will require OEMs to make potentially costly changes to vehicle specifications and sales mix. The costs incurred by each OEM will vary depending on its product portfolio and the current sales-weighted average fuel economy of its fleet, and on the costs of achieving CO_2 reductions for different vehicle types.

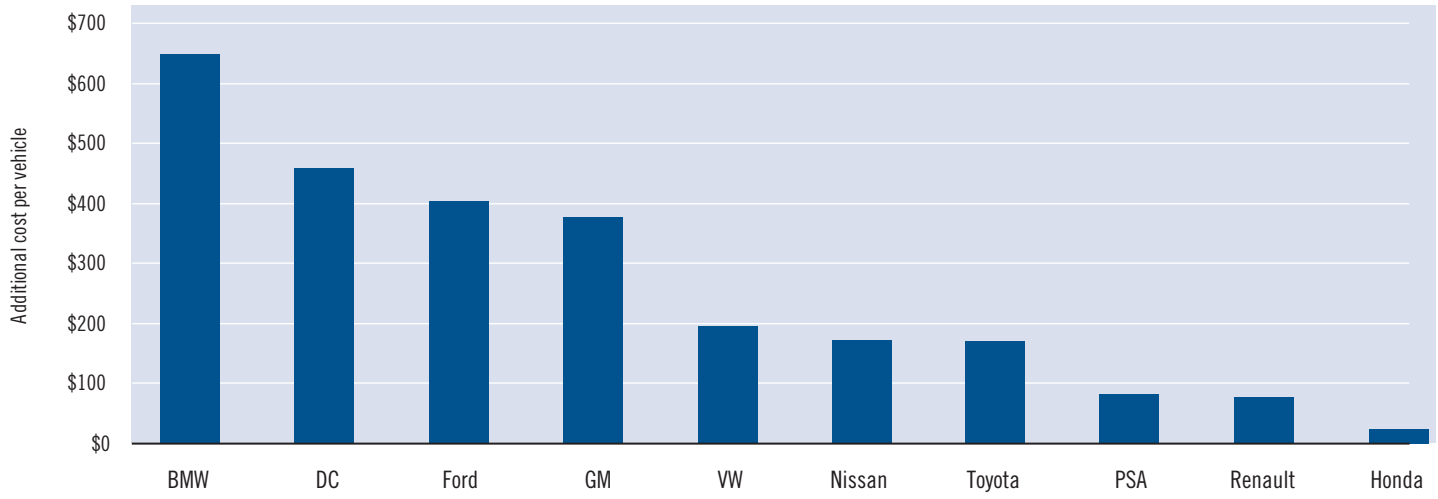
Using a risk assessment methodology developed by WRI, we estimated the cost that each OEM will incur to meet different possible carbon constraints between now and 2015. In our analytical model, each OEM is characterized by its 2002 sales and fuel economy levels and has access to three main categories of lower-carbon technologies—incremental technologies, diesel and hybrid technology. (Fuel cell technology is ignored in the Value Exposure Assessment because it is unlikely to contribute to actual CO_2 reductions before 2015.)

The model calculates the lowest-cost combination of technologies that an OEM must add to its existing vehicle fleet to ensure that it meets the specified new standards. Separate analyses are performed for the US, EU and Japanese markets and then aggregated to produce an overall cost estimate for each OEM. Because of uncertainties about the future regulatory environment, we assess sensitivity to different levels of carbon constraint that may emerge by 2015. In addition, we explore different market penetration rates for diesel and hybrid technologies, because of uncertainties regarding their technological development and acceptance by regulators and consumers.

Because OEMs' product mixes differ with respect to carbon-intensity levels, the costs incurred in meeting new standards will vary across the industry. We estimate that average OEM costs per vehicle could differ by a factor of 25, from $650 for BMW to less than $25 for Honda. (See Figure 3.)

While increased production costs are the direct manifestation of carbon constraints, OEMs could see returns on these costs in two ways. First, some OEMs will have to spend less than others to meet carbon constraints, and so should become more price-competitive in the marketplace and enjoy higher sales. Second, the fuel savings generated by most of the technologies referred to in this chapter outweigh the incremental manufacturing costs. If consumers were to value these fuel savings at the time of purchase, OEMs could recover their full costs. Moreover, consumers may perceive additional value from the certain lower-carbon technologies, independent of impacts on CO_2 emissions. For instance, diesel and hybrid technologies both offer non-carbon-related attributes that consumers may be willing to pay extra for.

FIGURE 3. ESTIMATED COSTS PER VEHICLE TO MEET CO_2 EMISSIONS STANDARDS BY 2015



V. Management Quality Assessment

The Management Quality Assessment seeks to answer the following question:

- Which OEMs have the strongest potential to capitalize on their investments in lower-carbon technologies and so benefit from carbon constraints?

We identify diesel, hybrid and fuel cell technology as key sources for future competitive advantage. The actual development of these technologies is only part of the challenge facing OEMs. OEMs also have to commercialize, market and mass produce these technologies if they are to reap the full rewards. Consequently, an OEM's ability to capitalize on carbon constraints depends on a wide range of management attributes regarding lower-carbon technologies, beyond just technological development capabilities.

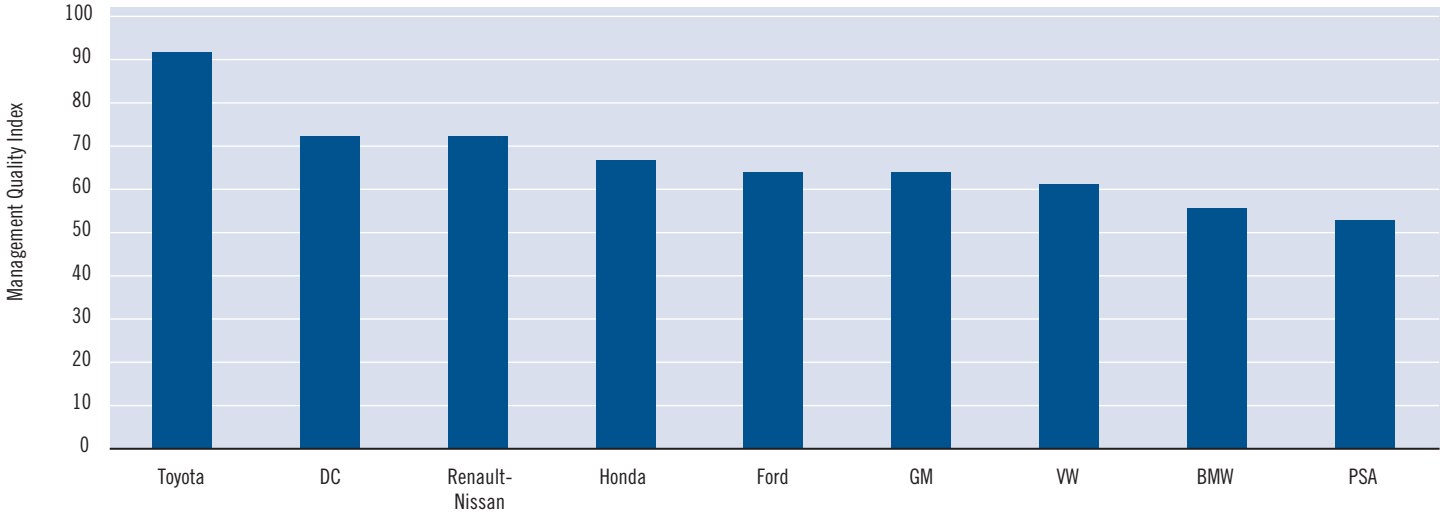
The analytical framework we used to assess lower carbon management quality is based on a management competence model developed by SAM Research. For the purpose of this report, SAM Research's standard competence model was adapted to focus on OEMs' ability to derive competitiveness through strategies to achieve lower carbon intensities (or "lower-carbon strategies").

By virtue of their market exposure, past management decisions and financial resources (among other factors), OEMs exhibit different levels of management quality with respect to lower-carbon technologies. The stronger an OEM's overall management capabilities in this area, the more likely it will be able to benefit from carbon constraints. While some OEMs have strong capabilities in one or two lower-carbon technologies, a few exhibit strength across all three technologies. Given uncertainties about the development of these technologies, and their acceptance by consumers and regulators in different markets, a strong management strategy across all three technologies may be advantageous.

The results reveal differential positioning among companies. (See Figure 4). Toyota, DC and Renault-Nissan have the strongest overall management quality scores across all lower-carbon technologies. At the other end of the scale, PSA and BMW display the weakest management positioning regarding lower-carbon technologies.

Besides overall strength, an OEM's current strategy with regard to carbon constraints may be more or less robust (or balanced) across alternative technology pathways. Based partly on prevailing regulatory regimes in their most important markets, OEMs have developed different preferences for lower-carbon technologies. While most European OEMs display a strategic bias toward diesel, US-based OEMs focus on fuel cell technology. Toyota and Honda show most bias toward hybrid technology. Renault-Nissan stands out among OEMs as having one of the more balanced lower-carbon strategies, reflecting the alliance's strategic fit and competitive potential.

FIGURE 4. MANAGEMENT QUALITY ASSESSMENT: ALL LOWER-CARBON TECHNOLOGIES



Note: Management quality score for BMW reflects its activities regarding the hydrogen-powered internal combustion engine. Renault and Nissan receive the same management quality assessment scores to reflect the expected level of integration and strategic coordination between the two OEMs over the next decade.

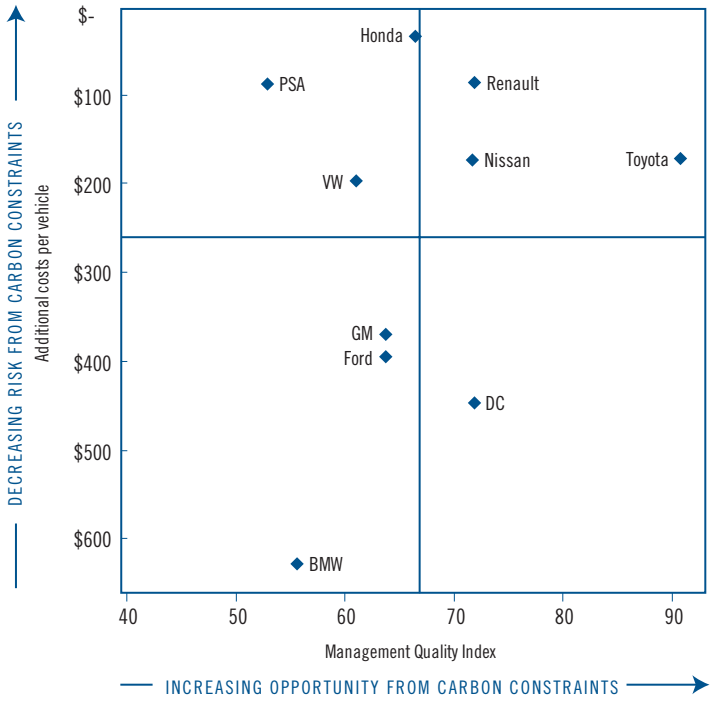
VI. Aggregate Results and Implications for Valuation

The combined results of the Value Exposure and Management Quality assessments are illustrated in Figure 5. Risks are presented in terms of average additional cost per vehicle in 2015 (lower costs are better). The upside strategy opportunities are expressed as a qualitative score between 0 and 100 (higher scores are better). OEMs in the top right quadrant can be considered "lower carbon leaders" with below average exposure to risks and above average management quality with regard to lower carbon technologies.

Several findings are of note:

- OEMs vary considerably with respect to both value exposure and management quality around carbon constraints. This indicates that carbon constraints have the ability to influence competitive balance within the industry.
- Honda is the OEM that has the lowest value exposure. It faces the least immediate risk from carbon constraints as the current high fuel efficiency of its vehicles implies only minimal costs to meet new standards. Toyota emerges as the clear leader on carbon-related management quality with a strong position in all three technologies that will be key for long-term competitiveness.
- Renault and Nissan are also strongly positioned with better than average management quality scores and lower than average expected costs from carbon constraints.
- PSA and VW are two other OEMs that have lower than average value exposure, while DC has above average management quality with regard to carbon constraints.
- BMW stands out as having the greatest value exposure, though this may be somewhat misleading. BMW is the smallest of the 10 OEMs reviewed and produces exclusively premium (and high cost) vehicles. Consequently, BMW should have a greater ability to pass on those costs to consumers than do other OEMs.
- PSA has the weakest management strategy regarding carbon constraints, which may limit its ability to exploit opportunities even though it faces low expected costs.
- Ford and GM both have above average value exposure and below average management quality regarding climate risks. Their value exposure is driven principally by the relatively low fuel efficiency of their current vehicle mix. While much of this is due to their leadership in the carbon-intensive segments of the US market, which may not face immediate constraints, their current bias towards heavy vehicles coupled with below average positioning on hybrid and diesel technology may limit their near-term competitiveness in non-US markets.

FIGURE 5. QUANTIFICATION OF THE RISKS (Value Exposure) AND OPPORTUNITIES (Management Qality) OF CARBON CONSTRAINTS



Note: The lines indicate industry averages in each category.

A key challenge for analysts is to determine the implications of these findings for shareholder value creation. Consequently, we translate the results of the Value Exposure and Management Quality assessments into changes in forecasted EBIT (Earnings before Interest and Taxes) for the period 2003 through 2015. EBIT is a foundation for valuation estimates in this sector and so changes in an OEM's EBIT offer useful insight into possible changes for overall Return on Invested Capital (ROIC) and thus shareholder value.

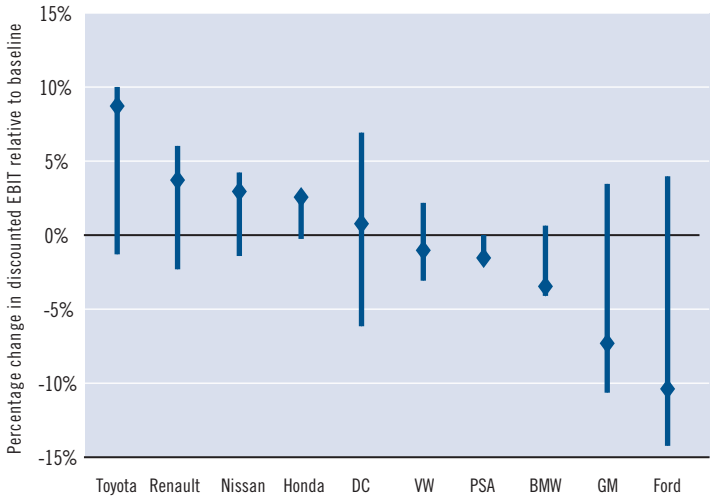
Converting our cost estimates and management quality scores into EBIT figures sets our results in the context of existing and projected business performance. Though this adds confounding factors to our initial results (e.g., differences in existing EBIT margins across OEMs), it nonetheless represents the basic challenge facing investors: to understand the additive effect that carbon constraints may have on each OEM's financial position.

The combined results presented in Figure 6 show the range of possible effects on estimated EBIT, in terms of percentage changes from business-as-usual EBIT forecasts. The upper limits reflect the results from the Management Quality Assessment alone, which captures the opportunity for OEMs, while the lower limits are results from the Value Exposure Assessment alone, which reflect risks. The points indicate the combined impact of both assessments on EBIT.

Translating value exposure and management quality scores into a single EBIT measure (shown as points in Figure 6) again reveals wide variety in values across OEMs—from a possible increase in discounted EBIT of 8 percent to a decrease of 10 percent. Toyota appears best positioned, while Ford has the weakest result.

Further information on the methodologies used and the results for OEMs can be found in the full report available for download at either www.sam-group.com/changingdrivers or http://capitalmarkets.wri.org.

FIGURE 6. POTENTIAL IMPACT OF CARBON CONSTRAINTS FOR DISCOUNTED EBIT (2003–2015) BASED ON VALUE EXPOSURE AND MANAGEMENT QUALITY ASSESSMENTS



ACKNOWLEDGMENTS

We would like to thank the many individuals who helped in the production of this report. We are grateful to a number of financial analysts who reviewed the report or provided helpful comments including: in the United States, Steve Girsky and Maryann Keller; in Europe, Kamran Baig, Thomas Besson, Christian Breitsprecher, Clive Wiggins, Henrik Lier and Lars Ziehn; and in Japan, Kunihiko Shiohara and Tatsuo Yoshida. We also received helpful comments and advice from Feng An, KG Duleep, David Friedman, David Greene, Jason Mark, Martina Otto and Robert Repetto. We particularly thank Justin Adams for his fresh perspectives and feedback.

The SAM authors would like to thank their colleagues Alois Flatz, Thilo Goodall, Davide Rima and Markus Moor for their helpful contributions.

The WRI authors are grateful for the generous input of their colleagues Phil Angell, Andrew Aulisi, Liz Cook, Navroz Dubash, Suzy Greenhalgh, David Jhirad, Nancy Kete, Chris Lagan, Bill LaRocque, and Lee Schipper. We also thank Moeko Saito and Anand Rao for their research assistance. We are also grateful to the SC Johnson Foundation, the Oak Foundation and the Surdna Foundation for their generous financial support. Finally, we thank Hyacinth Billings, Kristina Bonner, Karen Holmes, Donna Lomangino and Maggie Powell for their help with the editing and production of the report.

While recognizing the contributions of those mentioned above, the authors bear sole responsibility for the opinions expressed in this report.

ABOUT THE AUTHORS

Duncan Austin is Senior Economist in the Sustainable Enterprise Program at World Resources Institute.

Niki Rosinski is Senior Sustainability Analyst for Energy & Mobility at SAM Research Inc.

Amanda Sauer is an Associate in the Sustainable Enterprise Program at World Resources Institute.

Colin Le Duc is Head of Research Operations at SAM Research Inc.

SAM Sustainable Asset Management is an independent asset management company headquartered in Zurich, Switzerland. Established in 1995, SAM was among the first asset managers to specialize in the field of sustainability-driven investments. SAM manages institutional and private mandates in line with sustainability criteria. And together with Dow Jones & Company, SAM launched the world's first index to track the performance of sustainability-driven companies worldwide.

SAM Sustainable Asset Management
Seefeldstrasse 215
8008 Zurich
Switzerland
WWW.SAM-GROUP.COM

World Resources Institute is an independent nonprofit organization with a staff of more than 100 scientists, economists, policy experts, business analysts, statistical analysts, mapmakers, and communicators working to protect the Earth and improve people's lives.

World Resources Institute
10 G Street, NE
Washington, DC 20002 USA
WWW.WRI.ORG