DRIVING SUSTAINABLE ECONOMIES

Emission impossible

Which car makers are driving into trouble?

March 2016

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Contents

CDP's sector research for investors provides the best and most tailored environmental data in the market. CDP's team of analysts, voted no. 1 climate change research provider in 2015 by institutional investors, takes an in-depth look at high emitting industries one-by-one, starting with the automotive industry, electric utilities, diversified chemicals and metals & mining. Forthcoming industries include oil & gas, cement and steel industries.

The full report is available to CDP investor signatories and includes detailed analysis, methodology and recommended areas of engagement for investors to raise with company management teams. In addition, a separate engagement booklet providing further detail on company specific engagement ideas is available to CDP signatories on request.

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Linking emissions-related metrics to earnings for global automakers

- We update our Super-League Table for automakers which ranks companies based on a number of emissions-related metrics which in aggregate could have a material impact on company performance.
- There are four clear leaders: Nissan, Renault, BMW and Toyota.
- There are four clear laggards: Suzuki, Tata Motors, Hyundai and FCA.

Overview

In this report, we update our Super-League Table (SLT) for the global automobile original equipment manufacturers (OEMs), including expanding the scope of our analysis and enhancing the methodology for some metrics. We initiated coverage of the auto OEMs in February 2015 as part of a series of investor-focused reports related to high carbon-emitting sectors. Other industries under our coverage include: European electric utilities (May 2015), global chemical companies (August 2015) and global diversified miners (November 2015). Each report features the CDP Super-League Table which ranks companies in an industry grouping on a number of mostly emissions-related metrics relevant to that industry. When taken in aggregate, we believe these metrics could have a material impact on company earnings and therefore investment decisions.

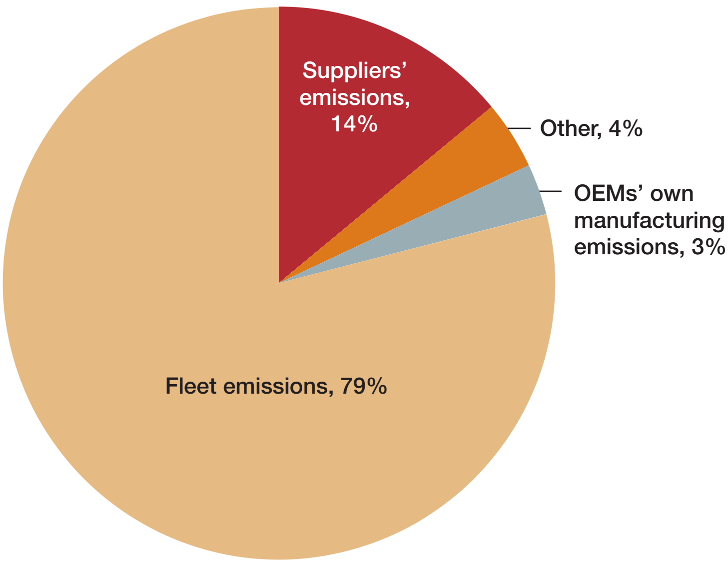
In this report, we present a Super-League Table that ranks 15 of the top 16 auto OEMs globally (excluding China, by market capitalization); together they represent 90%[1] of the global auto market by sales volume. These are the 15 auto OEMs that responded to CDP's 2015 climate change questionnaire. Kia (ranked 14th by market cap, with 4% global auto market share) did not respond to the questionnaire so is not included in our analysis.

Scope of report: key areas

There are four key areas in our SLT assessment:

- **Fleet emissions:** fleet emissions account for approximately 80% of total emissions for the auto industry[2]. Most major global auto markets are regulated on fleet emissions and there are significant penalties for non-compliance. We assess the OEMs' performance against fleet emissions standards in the EU, US, China and Japan, which in aggregate account for nearly 70% of global passenger vehicle demand.
- **Advanced vehicles:** battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs) and fuel cell vehicles (FCVs) will increasingly contribute to the OEMs' reduction in fleet emissions. We assess how well OEMs are capturing growth opportunities in this area.
- **Manufacturing emissions:** about 17% of the industry's emissions come from the manufacturing stage. We assess the OEMs' performance on upstream (supplier) emissions along with their own manufacturing emissions and adopt this as a proxy for operational efficiency.
- **Carbon regulation supportiveness:** using InfluenceMap's[3] proprietary analysis, we assess each OEM's actions in supporting or opposing climate legislation. We believe that supportive firms are most likely to benefit from progressive climate legislation.

Auto industry emissions split by categories



Note: Based on OEMs' responses to CDP's climate change questionnaire in 2015.

Source: CDP

1. Based on Bloomberg and company data, and assuming 100% of joint ventures sales in China are assigned to the non-Chinese OEM partners.
2. Based on the OEMs in this study.
3. A UK-based not-for-profit organization whose remit is to map, analyze and score the extent to which corporations are influencing climate policy and legislation (www.influencemap.org).

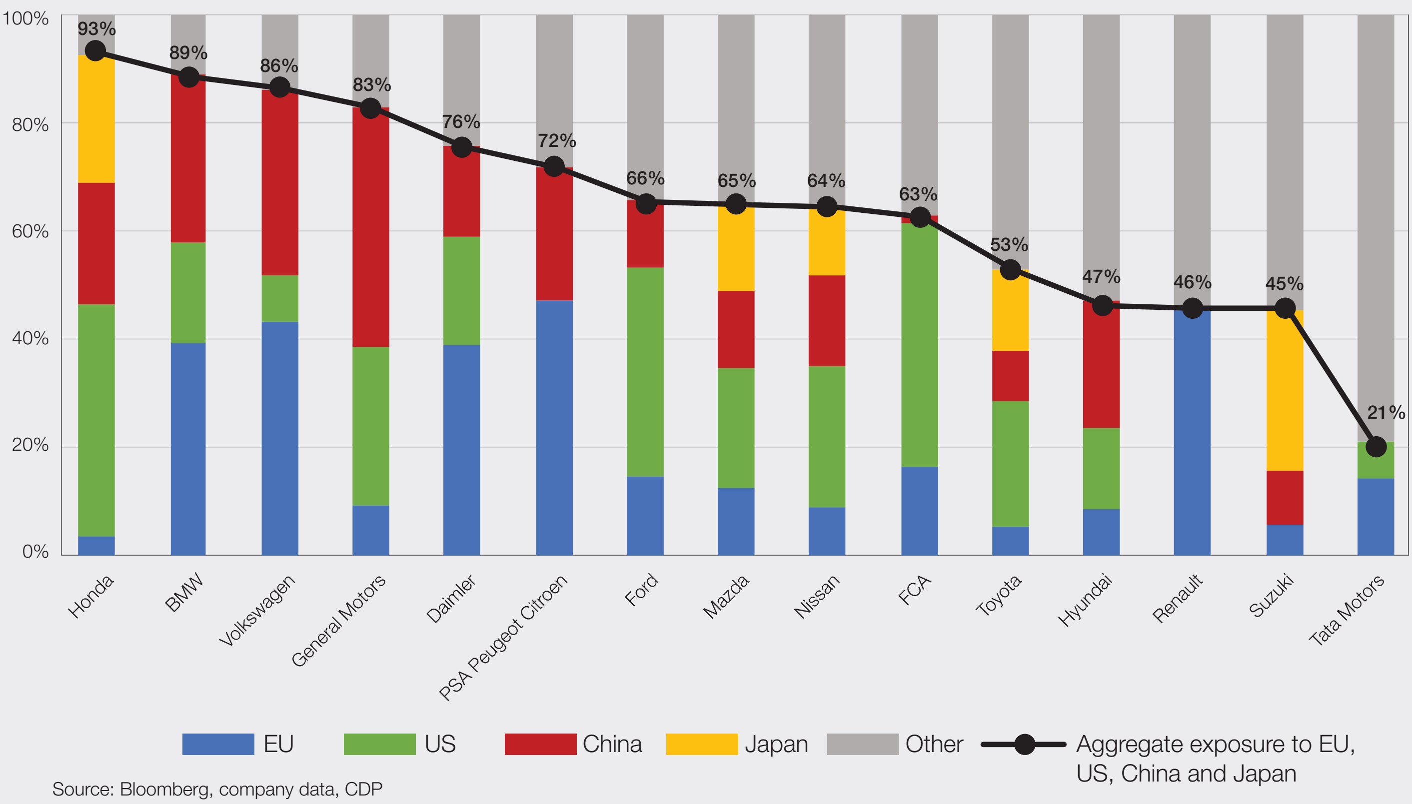
Condensed summary of the Super-League Table for global OEMs

2016 SLT rank	2015 SLT rank	OEM	Country	Market cap 2015 (USDbn)	Global market share (2014)	Overall SLT Score	Fleet emissions grade	Advanced vehicles grade	Manufacturing emissions grade	Carbon regulation supportiveness grade	CDP performance band (i)
1	1	Nissan	Japan	45.0	7%	4.42	C	A	D	A	A
2	3	Renault	France	27.5	3%	4.87	B	A	B	A	A-
3	8	BMW	Germany	70.0	3%	5.34	B	B	A	B	A
4	2	Toyota	Japan	222.0	11%	5.76	A	B	B	B	B
5	5	Daimler	Germany	95.2	3%	7.05	A	C	A	E	A-
6	7	Honda	Japan	59.3	4%	7.30	C	D	D	A	A-
7	10	Ford	US	59.3	8%	7.38	C	B	D	D	B
8	9	PSA Peugeot Citroen	France	14.0	4%	7.41	C	D	C	B	A-
9	4	Mazda	Japan	11.9	2%	7.94	A	E	A	D	B
10	12	General Motors	US	54.6	13%	8.39	E	B	D	B	A-
11	6	Volkswagen	Germany	97.1	13%	8.70	E	A	A	C	N/A
12	11	FCA	Italy	19.0	6%	9.29	D	D	A	E	A
13	13	Hyundai	South Korea	30.5	6%	9.63	D	C	C	E	C
14	14	Tata Motors	India	22.1	1%	10.27	C	E	E	C	C
15	N/A	Suzuki	Japan	18.1	4%	11.14	D	E	E	C	C
				Total	89%						
					Weights for each area		**40%**	**30%**	**15%**	**10%**	**5%**
					Adjusted weighting for VW		**42%**	**32%**	**16%**	**11%**	

(i) This is the CDP annual performance band (A to E) awarded to companies that respond to CDP Climate Change Questionnaire. The distribution of A to E grades is awarded relative to 2,233 companies that respond to CDP. As Volkswagen withdrew its response to CDP after its emissions scandal, it is not ranked and graded in this area.

Source: CDP

Vehicle sales split by geography in 2014



Source: Bloomberg, company data, CDP

Key findings

We note three key themes arising from our research:

- Around 80% of the global passenger vehicle market has some form of regulation on fleet emissions, and the regulation is tightening. However, we believe that the regulation needs to become even tighter, even quicker if global warming is to be limited to a 2-degree rise. We believe that regulators addressing the significant divergence between lab-tested results and real-driving emissions will go some way to dealing with this, although more still needs to be done. In our view, some OEMs are overly relying on generous credits which are available as regulators transition towards tighter standards.

- Investment in advanced vehicle technologies, such as BEVs and PHEVs, needs to be accelerated, especially as there could be a reversal in demand for diesel vehicles. In light of increasing pressure to deal with urban air pollution, and compounded by Volkswagen's NOx emissions scandal, major European cities are considering measures to discourage diesel vehicles, e.g. Paris has proposed a ban on diesel vehicles by 2020. A reduced exposure to diesel vehicles can have a negative impact on CO_2 emissions, as diesel vehicles typically emit less on a like-for-like basis, which is accentuated for larger vehicles. We favor those OEMs that are increasing their focus on advanced vehicles so that they are more flexible and better prepared for policy changes that discourage diesel vehicles. Some OEMs are lagging seriously behind in this area.

- Half the OEMs were found to be mildly supportive of low carbon regulation and the other half mildly obstructive. There were no real extremes of stance, as with other industries. In addition, the auto industry appears to have no regional trends, possibly due to the global nature of auto sales (unlike other industries where regulation is based on location of manufacturing facilities, the auto industry is regulated according to emissions of vehicles sold).

Leaders and laggards

Our SLT identifies those companies that consistently outperform across all key areas and those that consistently underperform:

- Kia is the only one of the top 16 auto OEMs globally that did not respond to CDP's climate change questionnaire in 2015 and therefore is not included in our analysis. Investors should ask Kia why it is not providing sufficient transparency on its carbon emissions and business strategy to deal with rapidly changing legislation.

- There are four clear leaders, Nissan, Renault, BMW and Toyota (with SLT scores ranging from 4.42 to 5.76), followed by a close middle section, fifth place Daimler to ninth place Mazda (with SLT scores ranging from 7.05 to 7.94), and then there are four clear laggards (Suzuki, Tata Motors, Hyundai and FCA, with SLT scores ranging from 11.14 to 9.29).

- Nissan retains last year's top position with an overall SLT score of 4.42, notably ahead of second place (SLT score 4.87). It maintains its leadership in advanced vehicles (where it receives an A-grade) as its LEAF is the best-selling battery electric vehicle globally.

- Renault is ranked second, improving slightly from last year's third position due to its progress in advanced vehicles and manufacturing emissions. Its battery electric vehicle Zoe receives the best score in our technical review of advanced vehicles. Together with its partner in the Renault-Nissan Alliance, it receives an A-grade in carbon regulation supportiveness as it appears to be supportive of progressive low-carbon regulations.

- BMW is ranked third. It improves significantly from last year's eighth rank mainly due to its support for positive climate regulations and its aggressive development pipeline of plug-in electric vehicles (PHEV). As such, it achieves a B-grade in our new carbon regulation supportiveness key area and its advanced vehicles grade is upgraded to a B-grade (from a C-grade in 2015). It is also a clear leader in managing its upstream emissions, achieving an A-grade in the manufacturing emissions key area.

- Toyota is ranked fourth, slightly down from second place last year. It scores well again for fleet emissions across all markets except for China (although we believe it is still on track to meet its China 2015 target). Toyota is the most active OEM in developing hydrogen fuel cell vehicle (FCV), although at the cost of shifting away from BEV technology. As such, Toyota receives a B-grade for advanced vehicles, down from an A-grade last year. On a positive note, it achieves a B-grade for manufacturing emissions, notably higher than the D-grade achieved last year.

- Daimler keeps its fifth place. It has an improvement in both fleet emissions (A-grade in 2016, versus B-grade in 2015) and advanced vehicles (C-grade in 2016, versus D-grade in 2015), but has a disappointing performance in carbon regulation supportiveness, where it received an E-grade. Daimler is a clear laggard in this key area due to its continued opposition to the fleet emissions regulations in the EU and US.

- Honda is ranked sixth, slightly up from last year's seventh place. It receives an A-grade in our new carbon regulation supportiveness key area, but a D-grade for advanced vehicles, down from a B-grade last year - it discontinued both of its advanced vehicles (FIT, a BEV, and Accord PiH, a PHEV) in 2015, although we also acknowledge it has a development pipeline of AVs.

- Suzuki is a clear last place. It is a new entrance to the SLT as 2015 was the first year that it responded to CDP's climate change questionnaire. Its overall SLT rank is mainly dragged down by its poor performance in advanced vehicles and manufacturing emissions. It is one of only two OEMs that do not have market-ready advanced vehicle offerings.

- Tata Motors is ranked second from bottom, a slight improvement from last year's bottom rank. It receives a C-grade in fleet emissions and E-grades in both advanced vehicles and manufacturing emissions. It is one of only two OEMs that do not have market-ready advanced vehicle offerings in the markets we analyze, and also has poor management of supplier emissions.

- Hyundai is ranked third from bottom. It receives a D-grade for fleet emissions, performing badly across all key markets. It received an E-grade for carbon regulation supportiveness as it appears to be obstructive towards low carbon regulation. Its performance in advanced vehicles is mixed: it has an insignificant sales history of advanced vehicles but it is one of the few OEMs that are actively developing FCV technology with models available in the market.

- FCA is ranked twelfth with a consistently bad performance in fleet emissions, where it receives a D-grade. We believe it is at risk of missing targets for EU 2021, US 2016 (for passenger vehicles) and China 2015 (for imported vehicles). It receives a D-grade for advanced vehicles, down from a B-grade last year due to a lack of focus on advanced vehicles – its only sales are from a 'compliance vehicle' in the US (in order to gain access to the Californian vehicle market).

- Volkswagen is ranked in eleventh, compared to sixth place last year. It receives an E-grade for fleet emissions, down from a C-grade last year, due to its emissions scandal. On the positive side, it achieves an A-grade for advanced vehicles (up from C-grade in 2015) and an A-grade for manufacturing emissions (same as 2015). It launched five new models of advanced vehicles last year, contributing to a three-fold increase in advanced vehicles sales volume globally, and has the most aggressive manufacturing emissions reduction target, at an annual reduction rate of 3.5%.

- Mazda is ranked ninth, down from fourth place. It has a mixed performance across the key metrics. It receives an A-grade in the overall fleet emissions, but an E-grade in advanced vehicles – and suffers as we now assign a higher weighting to advanced vehicles key area (30% in 2016 compared to 25% in 2015). In addition, it receives a D-grade for carbon regulation supportiveness, which is the lowest grade amongst the Japanese OEMs.

Penalties

- General Motors and Ford are at notable risk of penalties in both the EU and US; these penalties could potentially equate to a combined US$1.8 billion (114% of EBIT) and US$1.2 billion (27% of EBIT) respectively.

- In addition, we estimate that FCA is at risk of a penalty in both the EU and US totaling US$ 573 million (or 17% of EBIT).

- BMW, Hyundai, Daimler and Honda are all at risk of a penalty in either the EU or US.

- The potential penalties facing OEMs at risk of missing their targets are CDP estimates. They are based on the assumption that generous credits will not always be available to OEMs, as we believe global regulations need to become tighter in order to align with science-based targets to limit global warming to a 2-degree rise. The penalties are for illustrative purposes only.

Linking our findings to investment choices

We recognize that investment decisions are based on a multitude of different factors and that some of these can be misaligned with emissions-reduction efforts.

Our SLT rankings are not intended as definitive winners and losers for investment purposes, but rather as a proxy for business-readiness in an industry likely to be significantly impacted by the more stringent carbon regulation needed to meet long-term climate objectives.

We would flag that companies towards the bottom of our SLT are possibly higher risk-investments from a sustainability perspective than those towards the top.

Methodology

We score each OEM based on a number of different metrics which are first ranked and then weighted within each of the four key areas (see below for individual weightings) to produce a weighted rank for each key area with an accompanying grade (A to E). We calculate the overall SLT score by apportioning the weighted ranks for each key area according to their respective weights.

Each of the key areas has a separate chapter within this report with accompanying information on the precise methodology for how we rank and grade each metric.

In addition to the four key areas, we also include CDP's climate score for 2015 in the SLT. It scores 2,233 companies that respond to CDP's investor-backed climate change questionnaire based on their climate change readiness. A high overall score is a sign of completeness of the response to the questionnaire and implies a well-run business and forward-looking management team that is transparent about how climate change affects its business.

Following Volkswagen's emissions scandal, there is some doubt concerning the credibility of its CO_2 emissions data submitted to regulators; thus we assign Volkswagen the joint-lowest rank (and an E-grade) in the EU, US and China fleet emissions analyses (it does not have exposure to Japan). This gives it an E-grade for fleet emissions and negatively impacts its rank in the SLT. Volkswagen is ranked eleventh place overall; however, would be ranked fifth if we used emissions data submitted by Volkswagen to the respective regulators.

For further study

Areas of further interest to analyze include:

- Quantifying the cost per OEM of complying with the fleet emissions targets in each region. Cost may include R&D spend on both increasing the efficiency of internal combustion energy (ICE) vehicles and advanced vehicles (includes BEV, PEV and FCV), and the purchase of credits (provided there is a vehicle credit trading market with transparency on the price of credits).
- An extension of our study to include light commercial vehicles, as well as trucks (and heavier vehicles) where relevant.
- An expansion of the fleet emissions study to other countries and regions including South Korea, India and Latin America.

Summary of key areas, associated metrics and relative weightings within the Super-League Table

Key area in SLT	Link to company earnings	Metrics	Key area weighting in SLT	Metric weighting within each key area
Fleet emissions	Significant financial penalties for non-compliance.	i) EU fleet emissions ii) US fleet emissions iii) China fleet emissions iv) Japan fleet emissions	40%	Varies based on OEMs' sales exposure to each market
Advanced vehicles	Potentially explosive market growth opportunity, in particular in China. Early movers will benefit, laggards may miss out.	i) Technical review ii) Sales review iii) Other considerations	30%	40% 50% 10%
Manufacturing emissions (i)	Manufacturing emissions reduction is a proxy for increased manufacturing efficiency. Efficient manufacturing can enhance financial performance.	i) Manufacturing emissions performance ii) Suppliers' emissions reporting and engagement iii) Emissions reduction targets iv) Emissions data transparency	15%	40% 20% 20% 20%
Carbon regulation supportiveness	Use of lobbying and political engagement influence to support or oppose progressive climate policies for a low-carbon future.	i) InfluenceMap score	10%	100%
CDP performance band	Proxy for management quality.	i) CDP annual performance score	5%	100%

i) The four items shown here within manufacturing emissions are the four areas covering seven metrics.

Source: CDP

4. Volkswagen's internal investigation revealed "irregularities" in CO_2 emissions levels and it set aside EUR 2bn in contingency funds on the issue (in addition to the EUR 6.7bn set aside for the NOx emissions scandal).

Fleet emissions summary

- Most major car markets are tightening regulations on fleet emissions, with significant penalties for non-compliance.
- Mazda, Toyota and Daimler are leaders in fleet emissions performance.
- The bottom three OEMs are Hyundai, FCA and General Motors.

Overview

This chapter summarizes the results of the detailed analysis of fleet emissions from the following chapters:

- EU fleet emissions
- US fleet emissions
- China fleet emissions
- Japan fleet emissions

In each of these chapters, we assess whether OEMs are on track to meet their respective passenger vehicle fleet emissions[5] targets in each market, along with an estimation of the potential financial penalties in the EU and US if the OEM is off track to do so. We award ranks and grades to OEMs, which we aggregate on a weighted basis in this key area to give the overall fleet emissions scores, ranks and grades.

Highlights

- Mazda is the leader for overall fleet emissions. It is ranked consistently highly across all key markets.
- Toyota is ranked second. It scores well in all markets except China (although we believe it is on track to meet its China 2015 target).
- Daimler is ranked third, thanks to its top position in the EU.
- Renault drops from last year's top rank to fourth. It is still on track to meet its EU 2015 and 2021 targets, but with a lower margin for error than other OEMs.
- As with last year's result, General Motors and FCA are the bottom two performers.

The EU

- All OEMs are on track to meet their 2015 targets.
- We find that five OEMs are at risk of missing their 2021 targets. They are Honda, General Motors, FCA, Hyundai and Ford. Among them, any potential penalties would be the most material for General Motors in both absolute and relative terms.

The US

- The four Japanese OEMs – Nissan, Mazda, Honda and Toyota – are the only OEMs that are on track to meet their 2016 passenger vehicle targets.
- The remaining six OEMs are at risk of missing their 2016 targets for passenger vehicles, with FCA being the worst performer.
- The credit system which allows OEMs to transfer credits between passenger vehicles and trucks, carry credits forward for five years, as well as trade between OEMs, seems to be very generous in helping OEMs meet their fleet targets.

China

- All OEMs in our study sell cars in China both through forming joint ventures (JVs) with Chinese OEMs and exporting directly to China[6]. The JVs account for 65% share of the Chinese market[7].
- All OEMs' JVs are on track to meet their targets for 2015.
- Five OEMs' exported vehicles are at risk of missing their 2015 targets (although this represents only 5% of the Chinese market share); any potential penalty would be the most material for FCA and Suzuki.

Japan

- Only Japanese OEMs are considered in this chapter, as non-Japanese OEMs' sales represent only 6% of the Japanese market.
- All five Japanese OEMs seem to be able to meet their 2015 targets.
- When comparing OEMs' performance in 2015 against their 2020 targets (for illustrative purpose), three OEMs – Honda, Mazda and Toyota – have already reached the required targets.

5. Both the EU and US regulations measure fleet carbon emissions, whereas the Chinese regulation measures fleet fuel efficiency and Japan the fleet fuel economy. As these three measurements are all directly related, we use the term fleet emissions when referring to them collectively.
6. Renault's JV in China officially opened its plant and started production in 2016 so our analysis of its performance is solely based on exports.
7. Assuming 100% of JV sales are assigned to the non-Chinese OEMs

Fleet emissions summary

OEM	% sales exposure to EU, US, China and Japan	EU fleet emissions grade	US fleet emissions grade	China fleet emissions grade	Japan fleet emissions grade	Overall fleet emissions score	Overall fleet emissions rank	Overall fleet emissions grade	2015 Overall fleet emissions rank	2015 Overall fleet emissions grade
Mazda	70%	C	A	A	B	4.0	1	A	2	A
Toyota	53%	A	A	D	A	4.5	2	A	3	A
Daimler	88%	A	D	B	N/A	4.6	3	A	5	B
Renault	55%	B	N/A	C	N/A	5.1	4	B	1	A
BMW	83%	C	C	A	N/A	5.3	5	B	11	D
Honda	93%	E	A	C	B	6.0	6	C	6	B
Nissan	75%	A	B	C	E	6.2	7	C	4	B
PSA Peugeot Citroen	85%	A	N/A	E	N/A	6.3	8	C	9	C
Ford	78%	D	C	B	N/A	6.9	9	C	10	D
Tata Motors	37%	D	N/A	B	N/A	7.5	10	C	7	C
Suzuki	39%	D	N/A	C	D	9.6	11	D	N/A	N/A
Hyundai	47%	E	C	D	N/A	10.0	12	D	12	D
FCA	73%	D	E	C	N/A	10.4	13	D	14	E
General Motors	83%	E	E	E	N/A	11.6	14	E	13	E
Volkswagen	86%	E	E	E	N/A	13.4	15	E	8	C

Note: in calculating the overall fleet emissions score in this table, we use the weighted scores for each market. We display grades in this summary for simplicity only.
Source: CDP

Percentage of normalized exposure to the four key markets

OEM	EU	US	China	Japan
Mazda	21%	29%	23%	27%
Toyota	12%	32%	24%	32%
Daimler	52%	23%	25%	0%
Renault	97%	0%	3%	0%
BMW	45%	21%	34%	0%
Honda	5%	33%	32%	31%
Nissan	15%	31%	34%	19%
PSA Peugeot Citroen	64%	0%	36%	0%
Ford	31%	42%	26%	0%
Tata Motors	51%	4%	45%	0%
Suzuki	14%	1%	25%	60%
Hyundai	20%	24%	56%	0%
FCA	40%	45%	14%	0%
General Motors	16%	27%	57%	0%
Volkswagen	43%	7%	50%	0%

Source:International Council on Clean Transport, US Environmental Protection Agency, the Ministry of Industry and Information Technology of China, Japan Automobile Manufacturer Association and CDP

Summary of potential penalties in the EU and US

OEM	EU 2021		US 2016		Combined	
	Total penalty (USDm)	% EBIT (i)	Total penalty (USDm)	% EBIT (i)	Total penalty (USDm)	% EBIT (i)
General Motors	697	46%	1,053	69%	1,750	114%
Ford	272	6%	889	20%	1,161	27%
FCA	279	8%	293	9%	573	17%
Hyundai	158	3%	237	4%	394	6%
BMW			412	4%	412	4%
Honda	232	4%			232	4%
Daimler			246	2%	246	2%

(i) 2014 company results

Source: CDP

Regulations by region

The table below provides a summary of the fleet emissions regulations for passenger vehicles across the EU, US, China and Japan. For completeness, we include South Korea because it is Hyundai's domestic market (though it accounts for only 14% of its total sales volume). Currently there is no such regulation in place in India.

The five schemes use different measures but they are essentially regulating the same thing: fleet carbon emissions. Currently, each regulation has its own testing method, i.e. NEDC for EU (which China follows), US combined cycles for US (which South Korea follows) and JC08 for Japan. Since each of them allows different driving cycles, testing conditions and procedures, converting targets solely based on the respective measurement units does not allow a fair and direct comparison. In the table below, we converted them to gCO_2/km measured in the NEDC test method. Regulatory agencies and industry players across the world have been discussing implementing a standardized testing procedure, the Worldwide Harmonized Light Vehicles Test Procedures (WLTP). However, so far only the European regulator has confirmed the implementation of WLTP in September 2017.

Summary of fleet emissions regulations for passenger vehicles across the EU, US, China, Japan and South Korea

Country or region	% global market	Standard type	Test method	Structure	Target year	Fleet target (measure)	Fleet target normalized to NEDC (gCO_2/km)	Penalties
EU	21%	CO_2 emissions	NEDC	Weight-based fleet average	2015 2021 2025 (proposed)	130 gCO_2/km 95 gCO_2/km 68-78 gCO_2/km (indicative)	130 95 N/A	On a per vehicle basis: €5 for the first g/km, €15 for the second g/km,€25 for the third g/km,€95 for each subsequent g/km. From 2019, the penalty will be €95 from the first gram onwards.
US	11%	GHG emissions	US combined	Footprint-based fleet average	2016 2025	225 gCO_2/mi 143 gCO_2/mi	145 87	Section 205 of the Clean Air Act specifies a penalty of up to US$37,500 per vehicle for a violation.
China	32%	Fuel consumption	NEDC	Weight-class based per vehicle and fleet average	2015 2020	6.9 L/100km 5 L/100km	161 117	Naming and shaming, potential ban on expansion plans and producing new models.
Japan	6%	Fuel economy	JC 08	Weight-class based per vehicle and fleet average	2015 2020	16.8 km/L 20.3 km/L	143 122	Naming and shaming and a fine up to one million yen (around US$ 8,800) per OEM per reporting year; there is no clear penalty regime and penalties are considered as 'minimal'.
South Korea	2%	Fuel economy	US combined	Weight-based fleet average	2015 2020 (proposed)	17 km/L or 140 gCO_2/km 24.3 km/L or 97 gCO_2/km	145 96	Naming and shaming; no financial penalty.

Source: International Council on Clean Transport , OICA, CDP

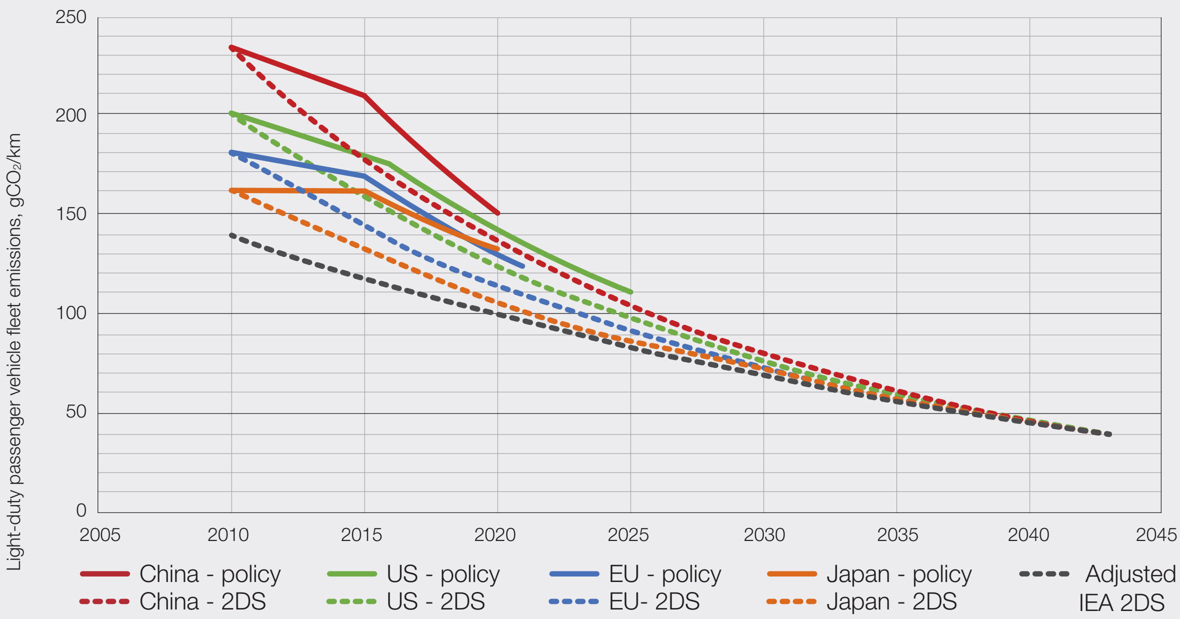
2DS compatibility of current fleet emission policies

As noted in the Japan fleet emissions chapter, we find that the 2015 performance of three OEMs (out of five analyzed) have already outperformed their 2020 targets. This finding led us to inspect the stringency of each key market's passenger vehicle fleet emissions targets, especially in light of the outcomes from COP21 in Paris.

We compare the passenger vehicle fleet emission targets (i.e. policy pathway) across the four markets in our study with the International Energy Agency's 2 degrees scenario (2DS) pathway for light-duty passenger vehicles. We find the following:

- Passenger vehicle fleet emission targets across the four markets are currently not aligned with the 2DS pathway required for light-duty passenger vehicles.
- Current Japanese targets are the least aligned with this pathway. The targeted fleet emissions are about 20% higher than the 2DS level required in 2020. The gap between both pathways continues to increase over time.
- The Chinese target seems to be the most stringent across all markets as it converges at a higher pace towards the 2DS trajectory.
- We note that current regulation across these markets include a range of flexible mechanisms (e.g. credits gained from selling low-emitting vehicls, credits transferred between passenger vehicles and trucks within an OEM, credits traded between OEMs, etc.) that implicitly reduce the stringency of these targets; thus, the level of absolute emissions reductions would be lower.

Comparison of adopted passenger vehicles' fleet emission targets with the respective IEA 2DS pathway



Methodology

- We collect data on the carbon intensity pathway for light-duty passenger transport from the IEA 2DS scenario, and data on passenger vehicles' fleet emission targets for EU, US, China and Japan in their original units and test cycles.
- We collect the actual fleet emissions in 2010, for each market, and use it as our base year.
- We use a compounded annual growth rate between each target period to calculate each policy pathway.
- We convert each pathway to grams of CO_2 per kilometer. We note that we do not convert any test cycles.
- We scale up each pathway with a "real-world" conversion factor related to each test cycle, as follows: NEDC (i.e. for EU and China): +30%, US combined (i.e. for US): +25% and JC08 (i.e. for Japan): +15%.
- The IEA 2DS pathway is based on a global carbon budget, thus it is important to reflect "real-world" emissions in policy pathways.
- Given that the IEA 2DS trajectory is in grams of CO_2 per passenger-kilometer, we multiply it by a passenger occupancy factor over the years. This results in the same units as each regional pathway. We assume a global average factor of 1.57 passengers per vehicle.
- As the IEA 2DS pathway takes into account both old and new vehicles, we shift the pathway to the left by 7 years – assumed to be the average vehicle lifetime. This compensates for the fact that policy pathways are based on new vehicle registrations.
- Following a convergence approach, we calculate the compounded annual growth rate between 2010 and the target year (2050 - 7 = 2043) necessary for each market to achieve the IEA 2DS target. We then calculate the 2DS pathway for each market.

Methodology and limitations

We outline the detailed methodology for our assessment across markets in their respective chapters. Here we summarize how the overall fleet emissions scores and grades are determined.

- We obtain the overall (weighted) ranks from the chapters for each key markets.

- We collect sales data (for 2014) for each OEM in the four key markets from the International Council on Clean Transport, US Environmental Protection Agency, the Ministry of Industry and Information Technology of China, and Japan Automobile Manufacturer Association.

- We calculate the normalized sales exposure for each OEM to these four markets, and multiply it by the respective overall (weighted) rank for each market.

- This gives us the overall fleet emissions scores, based on which the overall fleet emissions grade is awarded.

- Our view of whether an OEM is on track to meet its targets is based on forecast fleet emissions from 2014 up to the target year. Forecasting is subjective in nature and the results are inherently uncertain. We believe we have been fair in our forecasts; however, they are limited by the information available to us and are based solely on historic emissions and do not take in account, for example, planned increases in R&D spend, model renewal cycles or changes to average fleet mass.

- Our degree of confidence is highest in the EU, where we had fleet emissions data for each OEM for the last fourteen years. In contrast, we only have four years' data for US.

- We have only four years' data for Japan (2012-2015) so we don't forecast it up to the target year 2020; instead we compare OEMs' performance in 2015 against their targets in 2015.

- We only have two years' data for China, thus we are unable to assess trends in fleet emissions data there. Instead, we compare the data for 2013 against a 2013 hurdle that the Chinese government sets for each OEM (and the same for 2014) to assess whether they are on track to meet their respective 2015 targets.

- The potential penalties facing OEMs at risk of missing their targets are CDP estimates. They are based on the assumption that generous credits will not always be available to OEMs, as we believe global regulations need to become tighter in order to align with science-based targets to limit global warming to a 2-degree rise. The penalties are for illustrative purposes only.

EU fleet emissions

- In our view, seven OEMs are at risk of missing their 2021 targets. Among them, any potential penalties would be the most material for General Motors.
- Toyota is ranked first and maintains its A-grade as last year.
- Nissan, a close second, improves significantly compared to last year due to a surge in efficient vehicles in its fleet.

Overview

All 15 OEMs in our study are exposed to the EU auto market, together representing a market share of 93%. In this chapter, we assess whether they are on track to meet the EU fleet emissions targets for both 2015 and 2021. The EU fleet-wide targets are 130 gCO_2/km for 2015 and 95 gCO_2/km for 2021. An indicative range of 68-78 gCO_2/km is being discussed for the 2025 target. These targets are adjusted to give a specific target for each OEM according to its fleet average weight.

The 2015 target implies a total reduction of EU fleet-wide emissions of 15% over the seven year period from 2008, whereas the 2021 target is significantly more difficult to achieve – it requires a 27% reduction over the six year period from 2015. Although most OEMs met their 2015 targets in 2013 (so they effectively have eight years to reduce emissions to the required 2021 level), the low-hanging fruit was generally picked in the early years and so we consider that meeting the 2021 targets is challenging for some OEMs.

For each OEM that we consider to be off track to meet its 2021 target, we estimate the potential financial penalty based on the penalty regime, and a forecast of sales over the period of 2015-21 by assuming a 1% annual decline from 2014 sales volumes[8]. OEMs failing to meet their targets will face the following penalties:

- From 2012-2018: €5 for the first gram of exceedance, €15 for the second gram of exceedance, €25 for the third gram of exceedance, €95 for each subsequent gram of exceedance (per vehicle sold).
- From 2019, the penalty will be €95 per every gram of exceedance (per vehicle sold).

We differentiate OEMs in EU fleet emissions using three key metrics:

- **Metric 1) 2015 performance:** we rank OEMs based on the percentage that their projected fleet emissions in 2015 are over or under their respective targets.
- **Metric 2) 2021 performance:** same as above but for the year 2021.
- **Metric 3) Cumulative outperformance:** in addition to assessing whether OEMs meet/beat their targets in the target years, we compare OEMs' historical emissions over 2012-2014 against their interim targets (we start from 2012 as this is the first year when the regulation was phased in). Evaluating historical emissions is crucial from a carbon budget perspective.

Highlights

- All OEMs are on track to meet their 2015 targets.
- Toyota is ranked first and maintains its A-grade as last year. Both its historical emissions performance (2012-2014) and projected performance in target years (2015 and 2021) are beating its targets with high margins.
- Nissan is ranked second and improved impressively compared to last year. We note that it has a significant drop in fleet emissions of 12.8% in 2014, partly due to the surge in vehicles qualified for super-credits[9], and also due to the increase of efficient vehicles in its fleet. In 2014, vehicles with less than 110 gCO_2/km accounted for 43% of its sales in the EU.
- Tata Motors sees the biggest drop in its EU fleet emissions rank. Last year we underestimated Tata Motors' fleet emissions due to insufficient data. This year we have fourteen years' data of Tata Motors – the same for all OEMs – hence we are able to make a more accurate estimation.
- General Motors, ranked fourth in the EU by market share, is at risk of missing its target for 2021. We estimate this could lead to a penalty of US$697million (or 46% of 2014 EBIT).
- We also estimate that FCA, Ford, Honda and Hyundai are at risk of missing their 2021 targets, resulting in penalties equivalent to between 3% and 8% of their 2014 EBIT.

8. Based on a three-year average over 2012-2014.
9. Vehicles with emissions less than 50 gCO_2/km.

EU fleet emissions summary

OEM	% EU market share in 2014	2015 performance rank	2021 performance rank	Cumulative outperformance rank	Overall weighted rank	EU fleet emissions rank	EU fleet emissions grade	2015 report rank	2015 report grade
Toyota	4%	1	3	2	2.4	1	A	2	A
Nissan	4%	3	1	7	2.6	2	A	13	E
PSA Peugeot Citroen	11%	2	4	1	3.0	3	A	4	B
Daimler	5%	5	2	5	3.2	4	A	3	A
Renault	10%	4	6	3	5.0	5	B	1	A
BMW	6%	8	8	4	7.2	6	C	7	C
Mazda	1%	11	5	12	7.6	7	C	5	B
Ford	7%	7	11	9	9.8	8	D	9	D
FCA	6%	6	13	8	10.6	9	D	12	E
Suzuki	1%	13	10	10	10.6	10	D	N/A	N/A
Tata Motors	1%	14	9	14	11.0	11	D	6	B
Hyundai	2%	10	12	13	11.8	12	D	11	D
General Motors	7%	12	14	11	13.0	13	E	14	E
Honda	1%	15	15	15	15.0	14	E	10	D
Volkswagen	25%						E	8	C
Total	**93%**								
	Weighting:	**20%**	**60%**	**20%**					

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: European Environment Agency, International Council on Clean Transport, CDP

Metric 1) 2015 performance

OEM	% EU market share in 2014	2014 actual performance (gCO_2/km)	% change in fleet emissions pa (forecast)	2015 projected performance (gCO_2/km)	2015 target (gCO_2/km)	Beat or Miss target?	% beat/ (miss) target	2015 performance rank
Toyota	4%	111	-5.0%	105	127	BEAT	17%	1
PSA Peugeot Citroen	11%	110	-4.6%	105	125	BEAT	16%	2
Nissan	4%	116	-6.7%	108	129	BEAT	16%	3
Renault	10%	113	-4.5%	108	124	BEAT	13%	4
Daimler	5%	131	-6.0%	123	139	BEAT	12%	5
FCA	6%	116	-2.7%	113	123	BEAT	9%	6
Ford	7%	121	-3.1%	117	128	BEAT	9%	7
BMW	6%	133	-4.0%	128	140	BEAT	9%	8
Hyundai	2%	128	-3.3%	124	133	BEAT	7%	10
Mazda	1%	128	-5.6%	121	129	BEAT	6%	11
General Motors	7%	129	-3.0%	125	132	BEAT	5%	12
Suzuki	1%	123	-4.4%	118	123	BEAT	4%	13
Tata Motors	1%	181	-4.8%	172	178	BEAT	3%	14
Honda	1%	133	-1.9%	130	132	BEAT	1%	15
Volkswagen	25%							
Total	**93%**							

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: European Environment Agency, International Council on Clean Transport, CDP

Metric 1) 2015 performance:

- All OEMs are on track to meet their 2015 targets. Indeed, many of them achieved their targets ahead of time: eleven OEMs in 2013 and thirteen in 2014.
- Toyota, PSA Peugeot Citroen and Nissan are top-ranked. They beat their targets by 17%, 16% and 16% respectively.

Metric 2) 2021 performance:

- Five OEMs are at risk of missing their 2021 targets: Ford, Hyundai, FCA, General Motors and Honda.
- We forecast that General Motors and FCA are the most at risk, missing their targets by 9% and 6% respectively (with no super-credits being considered). This could lead to penalties of US$ 697 million and US$ 279 million respectively, equating to 46% of EBIT for General Motors and 8% for FCA.
- We estimate that Honda will miss its 2021 target the most, by 20%.
- Honda and General Motors are the most challenged to meet their 2021 targets, as they would need to increase their percentage fleet emissions reduction per annum by 250 bps, 120 bps and 120 bps respectively relative to our percentage fleet emissions reduction forecasts.

Metric 3) Cumulative outperformance:

- PSA Peugeot Citroen is ranked first, in line with its good performance in 2015 and 2021, according to our estimation.
- Although Nissan is ranked third and first in 2015 and 2021 performance, it has an emissions deficit over 2012-2014.

Metric 2) 2021 performance

OEM	% EU market share in 2014	2014 actual performance (gCO_2/km)	% change in fleet emissions pa (forecast)	2021 projected performance (gCO_2/km)	2021 target (gCO_2/km)	Beat or Miss target?	% beat/ (miss) target	2021 performance rank
Nissan	4%	116	-6.7%	71	94	BEAT	24%	1
Daimler	5%	131	-6.0%	85	102	BEAT	17%	2
Toyota	4%	111	-5.0%	78	93	BEAT	17%	3
PSA Peugeot Citroen	11%	110	-4.6%	79	92	BEAT	14%	4
Mazda	1%	128	-5.6%	86	95	BEAT	10%	5
Renault	10%	113	-4.5%	82	91	BEAT	9%	6
BMW	6%	133	-4.0%	100	102	BEAT	2%	8
Tata Motors	1%	181	-4.8%	128	131	BEAT	2%	9
Suzuki	1%	123	-4.4%	90	90	BEAT	0%	10
Ford	7%	121	-3.1%	97	94	MISS	-4%	11
Hyundai	2%	128	-3.3%	101	97	MISS	-5%	12
FCA	6%	116	-2.7%	95	90	MISS	-6%	13
General Motors	7%	129	-3.0%	105	96	MISS	-9%	14
Honda	1%	133	-1.9%	116	97	MISS	-20%	15
Volkswagen	25%							
Total	**93%**							

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: European Environment Agency, International Council on Clean Transport, CDP

Estimated penalties for OEMS that are off track to meet their 2021 targets

OEM	% change in fleet emissions pa (forecast)	% change in fleet emissions pa required to meet 2021 target	Additional % reduction in fleet emissions pa required to meet 2021 target	% miss 2021 target	Penalty per unit (EUR)	Forecast volume sales in 2021 in EU (i)	Total penalty (EURm)	Total penalty (USDm)	% EBIT (2014)
General Motors	-3.0%	-4.1%	-1.2%	-9%	760	835,665	635	697	46%
FCA	-2.7%	-3.5%	-0.8%	-6%	475	535,659	254	279	8%
Ford	-3.1%	-3.6%	-0.5%	-4%	285	868,986	248	272	6%
Honda	-1.9%	-4.5%	-2.5%	-20%	1,805	116,887	211	232	4%
Hyundai	-3.3%	-3.9%	-0.6%	-5%	380	377,676	144	158	3%

(i) Sales are forecast by assuming a decline of 1% pa from 2014 (based on an average over 20120-2014).

Source: European Environment Agency, International Council on Clean Transport, CDP

Metric 3) Cumulative outperformance

OEM	% EU market share in 2014	Cumulative surplus/ (deficit) per vehicle over 2012-2014 (gCO_2/km)	Rank
PSA Peugeot Citroen	11%	8.8	1
Toyota	4%	8.3	2
Renault	10%	5.1	3
BMW	6%	5.0	4
Daimler	5%	3.4	5
Nissan	4%	-0.4	7
FCA	6%	-0.8	8
Ford	7%	-3.6	9
Suzuki	1%	-3.8	10
General Motors	7%	-3.8	11
Mazda	1%	-3.8	12
Hyundai	2%	-4.5	13
Tata Motors	1%	-4.8	14
Honda	1%	-8.8	15
Volkswagen	25%		
Total	**93%**		

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: European Environment Agency, International Council on Clean Transport, CDP

Impact of super-credits on OEMs' fleet emissions

We acknowledge that the regulation provides incentives to OEMs to produce low-emitting vehicles, i.e. less than 50 gCO_2/km. These vehicles are counted as more than one vehicle in the OEMs' sales-weighted fleet emissions. Based on data from European Environment Agency, we calculate OEMs' performance including and excluding super-credits and find the followings:

- All OEMs of our study meet their 2014 interim targets even without credits.
- Super-credits only have impact on seven OEMs, but at a very low level, affecting only 0.1% to 3% of OEMs' fleet emissions.
- Even if one may argue that the sales of low-emitting vehicles will increase, the impact of super-credits will not necessarily increase as the weighting factor given to low-emitting vehicles decreases, i.e. it is counted as 2.5 and 1.5 vehicles in 2014 and 2015 respectively, and will be phased out in 2016. Similarly, it will be counted as 2, 1.67 and 1.33 vehicles in 2020, 2021 and 2022 respectively, and will be phased out in 2023.
- Since there is no material impact from super-credits, we do not take it into account in our projection of OEMs' performance.

Impact of super-credits on OEMs' fleet emissions performance in 2014

OEM	2014 target (gCO_2/km)	2014 performance, without super-credits	2014 performance, with super-credits	% beat/(miss) target, without super-credits	% beat/(miss) target, with super-credits	Reliance on super-credits
Nissan	129	115	111	11%	14%	3%
BMW	140	132	130	6%	7%	1%
Renault	124	113	112	8%	10%	1%
Daimler	139	131	131	6%	6%	1%
Toyota	127	113	112	11%	12%	0.3%
General Motors	132	131	130	1%	1%	0.1%
PSA Peugeot Citroen	125	110	110	12%	12%	0%
Hyundai	133	137	137	-3%	-3%	0%
Ford	128	122	122	5%	5%	0%
FCA	123	122	122	1%	1%	0%
Tata Motors	161	178	178	-11%	-11%	0%
Mazda	131	128	128	2%	2%	0%
Honda	132	134	134	-1%	-1%	0%
Suzuki	119	124	124	-4%	-4%	0%

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: European Environment Agency, CDP

Methodology and limitations

The overall EU fleet emissions rank and grades are determined as follows:

- We combine the weighted ranks of the three metrics using the following weightings: metric 1) 20%, metric 2) 60% and metric 3) 20%. This determines the overall weighted rank for EU fleet emissions. We assign less weight to the 2015 performance as all OEMs are on track to meet their 2015 targets.
- The EU fleet emissions grade is awarded according to the overall weighted rank.

We apply the following methodologies to determine the weighted rank for each metric:

Metric 1) 2015 performance

- We collect OEMs' fleet average emissions, fleet average weight and sales data over the period of 2001-2014 from the International Council on Clean Transport (ICCT) and crosscheck it with European Environment Agency (EEA)'s data over the period of 2010-2014. EEA published such dataset only from 2010 onwards.
- We calculate each OEM's specific targets for 2015 and 2021 by applying the formulae used by the regulator, and based on each OEM's fleet average mass in 2014. We recognize each OEM's fleet average mass in 2015 and 2021 could be different from that of 2014 but we believe this assumption is fair as the average fleet weight over the past decade has remained steady, with an average annual increase of 0.2%. For OEMs that qualify for special emissions targets due to niche derogations (i.e. having an annual sales between 10,000 and 300,000 vehicles), we collect their special targets from the EEA.
- We recognize that each brand may form a pool with other brands in order to share a target (calculated on the basis of the fleet of the pool) and we notice that the Peugeot and Citroen are in separate pools. However, to enable a fair comparison with the peer group, we have sales-weighted the two separate pools.
- We forecast OEMs' fleet emissions performance over the period 2015-2021 by adopting a constant percentage reduction rate calculated based on a line of best fit. We calculate each OEM's annual reduction percentage since 2002 and adopt the percentage reduction that equals the intercept of the line of best fit with 2014.
- We rank OEMs based on the percentage that their projected fleet emissions are over or under their respective targets.

Metric 2) 2021 performance

- We apply the same methodology as metric 1 for 2021 performance.
- To estimate the potential penalties for OEMs that are at risk of missing their 2021 targets: we round down the gCO_2/km missed to the nearest gram, multiply it by €95 (penalty for every gram of exceedance and each vehicle) and the forecast of sales over the period of 2015-21 by assuming a 1% decline from 2014 sales volumes (based on a three-year average over 2012-2014). We then convert the penalty from Euros to US Dollars using the YTD 2016 exchange rate.
- To put the penalty into perspective, we show it as a percentage of the corresponding OEM's EBIT in 2014. We collect data on OEMs' EBIT in 2014 from annual reports, and convert them to US Dollars using YTD 2016 exchange rate.

Metric 3) Cumulative outperformance

- We compare the difference between OEMs' fleet emissions performance and their interim targets over 2012-2014, and multiply the difference by the corresponding annual sales to obtain the annual emissions "surplus" or "deficit" (i.e. emissions below or above the targets).
- We sum these annual emissions "surplus"/"deficit" and divide them by the sum of the sales over the same period.
- We rank OEMs based on the "surplus"/"deficit" per vehicle.
- We start from 2012 as this is the first year when the regulation was phased in.

US fleet emissions

- Mazda, Honda and Toyota are ranked joint first in the US fleet emissions.
- Only Japanese OEMs – Nissan, Mazda, Honda and Toyota – are on track to meet their 2016 passenger vehicle targets.
- The remaining six OEMs are at risk of missing their 2016 targets for passenger vehicles, with FCA being the worst performer.

Overview

11 of the 15 OEMs in our study are exposed to the US market[10], together representing a market share of 92%. In this report we focus on assessing whether OEMs are on or off track to meet their targets in 2016 based on their past performance.

Currently, there are two sets of regulation: the National Highway Traffic Safety Administration (NHTSA)'s fuel economy standards and the Environmental Protection Agency (EPA)'s GHG emissions standards. They are regulating virtually the same thing, as fuel consumption is directly linked to GHG emissions. However, NHTSA's fuel economy regulation allows OEMs to pay a fine in lieu of compliance whereas the EPA's GHG regulation does not allow this. Hence our analysis focuses on the EPA's rule.

The US EPA's industry fleet wide targets for passenger vehicles are 225 gCO_2/mile for 2016, and 143 gCO_2/mile for 2025 (measured under US combined cycle), which equate to 145 gCO_2/km and 87 CO_2/km on the NEDC test cycle. These targets are adjusted to give a specific target for each OEM according to its fleet average "footprint" (related to the size of a vehicle).

We do not address the 2025 target in this report because a ten-year period is inherently difficult to forecast, particularly when only four years of historic data are available (compared to the EU where fourteen years are available).

The 2016 target implies a total emissions reduction of 14% over the four-year period from 2012 (the first year when the regulation was in place), equating to an average 3.8% annual reduction, whereas the 2025 target implies a total reduction of 37% over the nine-year period from 2016, equating to an average 5% annual reduction. Similar to the situation in the EU, as OEMs have already picked the low-hanging fruit in early years, it will be increasingly more challenging for OEMs to achieve the targets for 2025.

We acknowledge that from a compliance perspective (considering OEMs' entire fleet comprised of passenger vehicles and trucks), all OEMs in our study have reported adherence in 2014 (the latest year the EPA provides such data). However, our study attempts to differentiate OEMs in US passenger vehicle emissions using two key metrics:

- **Metric 1) 2016 performance:** we rank OEMs based on the percentage that their projected fleet emissions in 2016 are over or under their respective targets.
- **Metric 2) Cumulative outperformance:** in addition to assessing whether OEMs meet/beat their targets in the target years, we compare OEMs' historical emissions over 2012-2014 against their interim targets (we start from 2012 as this is the first year when the regulation was in place). Evaluating historical emissions is crucial from a carbon budget perspective.

Highlights

- General Motors and Ford, two of the top three OEMs by market share in the US (with a combined share of 31%), are at risk of missing their 2016 passenger vehicle targets.
- Other OEMs at risk of missing their 2016 targets are Daimler, BMW, Hyundai and FCA, with a combined US market share of 19%.
- All Japanese OEMs with US exposure – Nissan, Mazda, Honda and Toyota – are the only OEMs that are on track to meet their 2016 targets.
- FCA is the worst performer in the US. It admits that purchasing credits from other OEMs is one of its strategies to comply with the regulation, we worry about its ability in technological advancement to meet the increasingly stringent target through 2025.

10. Suzuki and Tata Motors have very low exposure to the US market, at around 0.1% each, so we do not include them in the analysis of this chapter.

US fleet emissions summary

OEM	% US market share in 2014	2016 performance rank	Cumulative outperformance rank	Overall weighted rank	US fleet emissions rank	US fleet emissions grade	2015 report rank	2015 report grade
Mazda	2%	2	3	2.5	1	A	1	A
Honda	9%	3	2	2.5	1	A	4	B
Toyota	15%	4	1	2.5	1	A	2	A
Nissan	10%	1	5	3	4	B	3	A
Ford	14%	6	6	6	5	C	5	C
Hyundai	6%	9	4	6.5	6	C	N/A	N/A
BMW	3%	7	7	7	7	C	7	D
Daimler	3%	5	11	8	8	D	6	D
General Motors	17%	10	8	9	10	E	9	E
FCA	7%	11	10	10.5	11	E	10	E
Volkswagen	5%							
Total	**92%**							
	Weighting:	**50%**	**50%**					

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: US Environmental Protection Agency, CDP

Metric 1) 2016 performance

OEM	% US market share in 2014	2015 preliminary performance (gCO_2/mile)	% change in fleet emissions pa (forecast)	2016 projected performance (gCO_2/mile)	2016 target (gCO_2/mile)	Beat or Miss target?	% beat/ (miss) target	2016 performance rank
Nissan	10%	213	-6.1%	200	226	BEAT	12%	1
Mazda	2%	209	-4.2%	200	221	BEAT	9%	2
Honda	9%	222	-2.3%	217	222	BEAT	2%	3
Toyota	15%	220	-0.4%	219	221	BEAT	1%	4
Daimler	3%	266	-5.6%	251	238	MISS	-6%	5
Ford	14%	252	-1.2%	249	229	MISS	-9%	6
BMW	3%	256	-2.5%	250	228	MISS	-10%	7
Hyundai	6%	248	2.1%	253	222	MISS	-14%	8
General Motors	17%	274	-1.4%	270	230	MISS	-18%	9
FCA	7%	286	-1.6%	281	232	MISS	-21%	10
Volkswagen	5%							
Total	**92%**							

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: US Environmental Protection Agency, CDP

Metric 2) Cumulative outperformance

OEM	% US market share in 2014	Cumulative surplus/ (deficit) per vehicle over 2012-2014	Rank
Toyota	15%	6.8	1
Honda	9%	5.0	2
Mazda	2%	4.4	3
Hyundai	6%	3.9	4
Nissan	10%	3.4	5
Ford	14%	0.7	6
BMW	3%	-0.8	7
General Motors	17%	-2.2	8
FCA	7%	-5.1	10
Daimler	3%	-6.3	11
Volkswagen	5%		
Total	**92%**		

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: US Environmental Protection Agency, CDP

US penalties

We estimate potential financial penalties for those OEMs at risk of missing their targets. We calculate a penalty under 2 scenarios:

- **Scenario 1:** The EPA penalty under a Clean Air Act violation is up to US$37,500 per offending vehicle. We adopt this figure, although note in practice this is unlikely to happen.
- **Scenario 2:** We assume just US$1,000 per offending vehicle is levied by the EPA.

In order to estimate the number of offending vehicles, we use EPA data for all models registered for sales in the US for 2015, and from this determine the percentage of registrations that would not achieve the EPA intermediate targets in 2015 for each OEM. We recognize that the percentage of offending models may not necessarily reflect the percentage of offending vehicles but, given data limitations, this estimate may provide a sense of the potential penalties facing these OEMs. The penalties are for illustrative purposes only.

Our penalty estimates are based on the assumption that generous credits will not always be available to OEMs, as we believe the regulation needs to become tighter in order to align with science-based targets to limit global warming to a 2-degree rise. We acknowledge the limitations of this calculation. Firstly, we recognize that OEMs are allowed to generate credits for any over-compliance and these credits can be carried forward five years. Moreover, they can transfer credits between passenger vehicles and trucks within their own fleets. Secondly, the regulation allows credit trading between OEMs and we note that some OEMs in our study purchase credits as their strategy to comply with the regulation. However, there is no well-functioning vehicle credit trading market and no transparency on the price of credits (the regulatory agency provides data on quantities traded but not on prices). Hence we are unable to compare the costs of credit purchase and financial penalty. Thirdly, the EPA's penalty under the Clean Air Act violation does not provide much details (unlike the European regulation which clearly define the penalty for any gram of CO_2 in exceedance) but simply states it could be up to US$ 37,500 per offending car.

US penalties: estimated for the OEMs in our study that are off track to meet their 2016 passenger vehicle targets

	Scenario 1		Scenario 2	
OEM	Penalty (USDm)	% EBIT	Penalty (USDm)	% EBIT
General Motors	39,488	2581%	1,053	69%
Ford	33,347	768%	889	20%
FCA	11,003	327%	293	9%
BMW	15,466	154%	412	4%
Hyundai	8,869	142%	237	4%
Daimler	9,228	78%	246	2%

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: US Environmental Protection Agency, CDP

Methodology and limitations

The overall US fleet emissions rank and grades are determined as follows:

- We combine the weighted ranks of the two metrics using the following weightings: metric 1) 50% and metric 2) 50%. This determines the overall weighted rank for US fleet emissions. Compared to other markets, we assign a high weighting to the cumulative outperformance as we acknowledge that OEMs can carry credits forward in the US (but not the case for other markets we analyze).

- The US fleet emissions grade is awarded according to the overall weighted rank.

We apply the following methodologies to determine the weighted rank for each metric:

Metric 1) 2016 performance

- We collect OEMs' passenger vehicles emissions performance and sales data over 2012-2015 from the US EPA. We also source the OEM-specific targets from the EPA.

- As we only have four years' data and therefore just three years of percentage change of emissions reduction, we take the average of the three annual emissions reduction rates, based on which we forecast OEMs' performance in 2016.

- We rank OEMs based on the percentage that their projected fleet emissions are over or under their respective targets in 2016, and the US fleet emissions grade is awarded according to this rank.

Metric 2) Cumulative outperformance

- We compare the difference between OEMs' fleet emissions performance and their interim targets over 2012-2014, and multiply the difference by the corresponding annual sales and the 'vehicle miles traveled' factor to obtain the annual emissions "surplus" or "deficit" (i.e. emissions below or above the targets). This is the formula used by the US EPA.

- We sum these annual emissions "surplus"/"deficit" and divide them by the sum of the sales over the same period.

- We rank OEMs based on the "surplus"/"deficit" per vehicle.

China fleet emissions

- All OEMs' JVs are on track to meet their targets for 2015.
- In our view, for imported vehicles, five OEMs are at risk of missing their 2015 targets; any potential penalty would be the most material for FCA and Suzuki.
- BMW and Mazda maintain the top two ranks as last year.

Overview

All 15 OEMs in our study are exposed to the Chinese auto market, together representing a market share of 70%[11]. They mainly sell cars in China through forming joint ventures (JV) with Chinese OEMs and produce domestically (65% share of the Chinese market) but also export directly into China (5% share).

China's Corporate Average Fuel Consumption (CAFC) regulation uses the EU regulations as a template but with different hurdles and penalties. The industry fleet-wide target for passenger vehicles are 6.9 L/100km for 2015, and 5 L/100km for 2020, which equate to 161 gCO_2/km and 117 CO_2/km on the NEDC test cycle. These targets are adjusted for each OEM based on its fleet average weight.

The regulatory agency, the Ministry of Industry and Information Technology (MIIT), announced that OEMs which fail to meet their targets will face the following penalties:

- Publicly named and shamed;
- A ban on the production of new models that do not meet their specific weight-based targets (by not issuing type-approval certification);
- Any proposed investment projects of plant expansion or new plants will not be approved.

We are unable to forecast OEMs' emissions in China as we have insufficient historical data: MIIT has only published the data for 2013 and 2014. However, we assess whether each OEM is on track to meet its fleet emissions target for 2015 using two key metrics:

- **Metric 1) 2014 performance:** we assess OEMs' performance in 2014 against their interim target for 2014, with separate analysis on their JVs' and imports' performance[12]. The interim targets for 2014 are set at 103% of each OEM's target for 2015.
- **Metric 2) 2013 performance:** same as above but for the year of 2013. The interim targets for 2013 are set at 106% of each OEM's target for 2015.

Highlights

- BMW is ranked first with impressive rates of overachieving both targets for JVs and imports in 2014, at 20% and 15% respectively.
- All JVs of the OEMs in our study met their interim targets for 2013 and 2014 and they are on track to meet their targets for 2015, in our view.
- All OEMs except Renault have at least one JV in China. Renault's JV officially opened its plant and started production in 2016 so its performance is solely based on imports.
- All 15 OEMs in our study also export vehicles to China, though these exports account for just 5% of the Chinese market. The performance of Suzuki, General Motors, Honda, Nissan and FCA could not meet their interim target for 2014. The performance of Suzuki, General Motors and Honda in 2014 is worse than in 2013.
- FCA and Suzuki are the two OEMs where potential penalties, which include a ban on models that fail to meet their targets, are material. FCA's imports performance is slightly below the target but they constitute a much higher portion of its overall sales in China, at 67%, than other OEMs; Suzuki's imports only account for 2% of its sales in China but they are significantly under the target.
- Compared to our 2015 report, Daimler's overall China fleet emissions rank has improved the most thanks to the improvement in its JV with BAIC (Beijing Automotive).
- In contrast, Hyundai's rank decreased the most. However, this was not because its performance worsened but rather because its peers are improving at a faster rate.
- Surprisingly, PSA Peugeot Citroen receives an E-grade, in complete contrast to its A-grade for EU fleet emissions. However, we note that it meets both targets for JV and imports in both 2013 and 2014; its grade is low because other OEMs are meeting their targets by a larger margin.

11. Assuming 100% of JV sales are assigned to the non-Chinese OEMs; based on 2014 data.
12. While OEMs export to China, we call it "imports performance", the same way as the Chinese regulator categorize it.

China fleet emissions summary

OEM	% China market share in 2014	% of import as OEM's sales in China	% of JV as OEM's sales in China	2014 performance rank	2013 performance rank	Overall weighted rank	China rank	China grade	2015 report rank	2015 report grade
BMW	2%	40%	60%	1	1	1.6	1	A	1	A
Mazda	1%	1%	99%	2	2	2.0	2	A	2	A
Tata	1%	99.7%	0.3%	4	5	4.2	3	B	5	B
Daimler	1%	48%	52%	3	8	4.6	4	B	8	C
Ford	4%	5%	95%	6	3	4.8	5	B	3	A
Nissan	5%	3%	97%	8	6	7.3	6	C	6	B
Suzuki	1%	2%	98%	9	7	8.3	7	C	N/A	N/A
Renault	0%	100%	0%	7	12	8.8	8	C	12	E
Honda	4%	1%	99%	11	9	9.2	9	C	7	C
FCA	1%	67%	33%	10	10	9.3	10	C	10	D
Toyota	5%	9%	91%	12	15	10.8	11	D	14	E
Hyundai	6%	4%	96%	13	11	10.8	12	D	9	D
PSA Peugeot Citroen	4%	0.2%	99.8%	14	14	12.2	13	E	11	D
General Motors	16%	1%	99%	15	13	12.4	14	E	13	E
Volkswagen	18%									
Total (i)	**70%**									
			Weighting:	**60%**	**40%**					

(i) Assuming 100% of JV sales are assigned to the non-Chinese OEMs (though typically a JV is owned 50:50) by a non-Chinese OEM and a Chinese OEM.

Note: in calculating the overall weighted rank in this table, we use the weighted ranks for each metric. We display non-weighted ranks in this summary for simplicity only; the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: China's Ministry of Industry and Information Technology, CDP

China fleet emissions: JV performance

OEM	JV production, % share of China's total domestic production in 2014	2014 target (L/100km)	2014 performance (L/100km)	Beat or miss 2014 target	% beat/ (miss) 2014 target	% beat/ (miss) 2013 target
BMW	2%	8.9	7.1	BEAT	20%	20%
Mazda	1%	7.5	6.3	BEAT	17%	13%
Tata	<1%	9.5	8.1	BEAT	15%	N/A
Daimler	1%	9.4	8.3	BEAT	12%	1%
Ford	4%	8.0	7.2	BEAT	11%	12%
FCA	<1%	8.1	7.3	BEAT	10%	11%
Nissan	5%	7.5	6.8	BEAT	8%	10%
Suzuki	1%	6.4	5.9	BEAT	8%	8%
Honda	4%	7.9	7.2	BEAT	8%	7%
Toyota	5%	7.8	7.3	BEAT	6%	3%
Hyundai	6%	7.4	7.1	BEAT	4%	5%
PSA Peugeot Citroen	4%	7.6	7.3	BEAT	4%	5%
General Motors	17%	7.5	7.3	BEAT	3%	5%
Volkswagen	19%					
Renault (i)	N/A					

(i) Renault's JV officially opened its plant and started production in 2016 so there is no JV performance result in this analysis.

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: China's Ministry of Industry and Information Technology, CDP

China fleet emissions: imports performance

OEM	Imports, % share of China's total imports in 2014	2014 target (L/100km)	2014 performance (L/100km)	Beat or miss 2014 target	% beat/ (miss) 2014 target	% beat/ (miss) 2013 target
Daimler	11%	9.6	8.2	BEAT	15%	12%
BMW	15%	9.3	8.0	BEAT	15%	11%
Tata	10%	10.4	9.4	BEAT	9%	9%
Toyota	8%	9.3	8.5	BEAT	8%	9%
Ford	3%	10.2	9.4	BEAT	8%	10%
Mazda	<1%	8.7	8.4	BEAT	3%	11%
Renault	3%	8.6	8.5	BEAT	2%	-2%
Hyundai	4%	9.3	9.3	BEAT	0.3%	-7%
PSA Peugeot Citroen	<1%	7.8	7.8	BEAT	0%	2%
FCA	11%	9.4	9.5	MISS	-0.3%	-3%
Nissan	3%	9.5	9.6	MISS	-1%	-7%
Honda	<1%	9.3	9.6	MISS	-4%	0.1%
General Motors	3%	9.9	10.8	MISS	-9%	-7%
Suzuki	<1%	6.8	7.5	MISS	-9%	-6%
Volkswagen	11%					

Note: the analysis of Volkswagen is not included in this table due to its emissions scandal.
Source: China's Ministry of Industry and Information Technology, CDP

Methodology and limitations

The overall China fleet emissions rank and grades are determined as follows:

- We combine the weighted ranks of the two metrics using the following weightings: metric 1) 60% and metric 2) 40%. This determines the overall weighted rank for China fleet emissions.
- The China fleet emissions grade is awarded according to the overall weighted rank.

We apply the following methodologies to determine the weighted rank for each metric:

Metric 1) 2014 performance

- We collect OEMs' JV and import data on sales, fuel consumption performance and targets from MIIT's website.
- Where an OEM has more than one JV, we calculate the sales-weighted[13] fuel consumption performance and target for each OEM.
- We rank OEMs based on the percentage that their actual 2014 fuel consumption performance was over or under their respective targets. We assess JVs and imports separately and therefore determine separate ranks for each of them.
- We weight the JV rank and imports rank according to each OEM's exposure to each of these methods of sales in China in 2014 (see the table of China fleet emissions summary for the weightings used for each OEM).
- We sum the JVs' and imports' weighted ranks to get the score of 2014 performance.

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Metric 2) 2013 performance

- We apply the same methodology as above for 2013 performance.
- We weight the JV rank and imports rank according to each OEM's exposure to each of these methods of sales in China in 2013.

13. The data provided by MIIT is production, thus we use it as a proxy for sales.

Japan fleet emissions

- All five Japanese OEMs meet their 2015 targets.
- Toyota is ranked first, with historical emissions significantly lower than its targets when compared to other OEMs.
- Nissan is ranked bottom. However, the current regulation does not consider advanced vehicles so it disfavors Nissan's effort in this area.

Overview

The five Japanese OEMs in our study represent a market share of 77%[14]. In this chapter we assess whether they are able to meet the fuel economy target for 2015. The industry-wide fuel economy standards are 16.8 km/L for 2015 and 20.3 km/L for 2020 (measured under the JC08 test cycle), which equate to 143 gCO_2/km and 122 CO_2/km, respectively, on the NEDC test cycle.

Under the Japan fuel economy regulation, each vehicle has its own target based on its weight category. The target value for a given weight category is established based on the "best-in-class" fuel economy performance. The 2015 standard requires OEMs to meet targets within each weight category (with credits being transferrable between them) while the 2020 standards will use a corporate average approach.

The regulatory agency, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), announced that OEMs which fail to meet their targets will receive warnings, public naming and shaming and a fine up to one million yen (around US$ 8,800) per OEM per reporting year, but did not provide many details on how the penalties are calculated (unlike their European counterparts).

We identify leaders and laggard using two key metrics:

- **Metric 1) 2015 performance:** we assess the OEMs' fuel economy performance in 2015 against their targets for 2015.
- **Metric 2) Cumulative outperformance:** in addition to assess whether OEMs meet/beat their targets in the target year, we compare OEMs' historical emissions over 2012-2014 against their interim targets. Evaluating historical emissions is crucial from a carbon budget perspective.

Highlights

- All OEMs included in our analysis meet their 2015 targets, hence no penalties are calculated.
- Toyota is the best performer. It represents the highest market share in Japan, at 30%, and about 40% of its revenue in FY 2015 came from this market. This may be the incentive for it to become the "best-in-class" in order to set the fuel economy standards.
- Nissan is ranked bottom. However, the current regulation does not consider advanced vehicles so it disfavors Nissan – even though its battery electric vehicle LEAF accounts for nearly 40% of the advanced vehicle market share in Japan.
- Suzuki is ranked second from bottom. As Suzuki's sales exposure to Japan is 60% - twice as much as other OEMs (measured as normalized to the four key markets we analyze), any potential tightening of regulations resulting in penalties is the most material to Suzuki.
- Compared to other Japanese OEMs, Toyota has a significantly higher "surplus" over 2012-2014, meaning it outperformed the targets required.

14. Some non-Japanese OEMs in our study also have exposure to the Japanese market but it is very limited. The total imports from non-Japanese OEMs account for only 6% of the Japanese market.

Japan fleet emissions summary

OEM	% Japan market share 2014	2015 performance	Rank	Cumulative outperformance	Rank	Overall weighted rank	Japan fleet emissions rank	Japan fleet emissions grade
Toyota	30%	4.9	1	13.9	1	1.0	1	A
Mazda	4%	4.0	2	0.2	5	2.8	2	B
Honda	17%	3.8	3	2.9	2	2.8	2	B
Suzuki	13%	3.2	4	1.6	3	3.8	4	D
Nissan	12%	2.7	5	1.3	4	4.8	5	E
Total	**77%**							
		Weighting	**75%**		**25%**			

Source: Ministry of Land, Infrastructure, Transport and Tourism , CDP

Overachievement in Japan fleet emissions

The Japanese fleet average fuel economy reached 21.3 km/L in 2013[15], significantly outperforming the 2015 target by 27%, and even exceeding the 2020 target seven years ahead of schedule.

We compare the five Japanese OEMs' performance in 2015 against their 2020 targets by applying the methodology set by the regulation for the 2020 target. We find the following:

- The performance of Honda, Mazda and Toyota in 2015 is already 1-2% above their respective 2020 targets[16]. These results show that Japanese passenger vehicle standards could be more stringent, especially in the face of a tighter carbon budget agreed in COP21.
- OEMs can incorporate battery-electric and plug-in vehicle sales into their corporate fleet fuel economy in 2020 if they have achieved at least 90% of their respective target. With the current sales levels, the advanced vehicle fleets of Nissan and Toyota would improve their fleet performance by 2% and 0.1% respectively. They both comply with the 90% threshold.

15. Japan Automobile Manufacturer Association (JAMA), 2014. Achieving Greater Safety and Environmental Protection in Road Transport: On the Road to Sustainable Mobility.
16. Based on the assumption of the same vehicle weight distribution across their fleets.

Methodology and limitations

The overall Japan fleet emissions rank and grades are determined as follows:

- We combine the weighted ranks of the two metrics using the following weightings: metric 1) 75% and metric 2) 25%. This determines the overall weighted rank for Japan fleet emissions.
- The Japan fleet emissions grade is awarded according to the overall weighted rank.

We apply the following methodologies to determine the weighted rank for each metric:

Data collation:

- We collate vehicle sales data per model for 2015 from Bloomberg.
- We collate OEMs' fuel economy performance and target values by model in 2015 from the website of the regulator, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).
- MLIT's dataset provides details at sub-model level whereas the sales data we have is at model level. Due to the lack of granularity in sales data, we aggregate MLIT's sub-model level data by applying a straight average to get the model level data. We acknowledge that this approach could reduce the accuracy of our results.
- Although the regulator provides data on imported vehicles, we exclude them from the analysis due to the lack of sales data per model. Six OEMs in our study - BMW, Daimler, FCA, PSA Peugeot Citroen, Tata Motors and Volkswagen - export to Japan but at very low volumes; thus their exclusion in the Japanese fleet emissions analysis would not have a material impact on their overall emissions grade.

Metric 1) 2015 performance

- We assign sales data by model to the models listed in the regulator's dataset.
- For each OEM and each weight category, we calculate the sales-weighted harmonic average fuel economy (as set by the regulation).
- We compare it against the target value, then multiply the difference by the corresponding sales to get the absolute surplus/deficit within each weight category.
- We sum the surplus/deficit across all weight categories for each OEM and then divide it by the OEM's total sales to obtain the value of surplus/deficit per vehicle.
- We rank OEMs based on this value, with the first rank having more surplus per vehicle, and the Japan fleet emissions grade is awarded according to the rank.

Metric 2) Cumulative outperformance

- We apply the methodology used in metric 1) to the period of 2012-2014, and sum the annual surplus/deficit per vehicle.
- We rank OEMs based on the cumulative surplus/deficit per vehicle.

Advanced vehicles

- China could be a game-changer for the AV market – it may have nearly 2 million AV sales in 2020. However, OEMs in our study need to do more to capture this growth opportunity.
- Nissan, Renault and Volkswagen occupy the top three ranks.
- Toyota loses its top rank as it focuses on fuel cell vehicles (FCVs) in place of battery electric vehicles (BEVs).

Overview

Advanced vehicles (AVs) such as battery electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs) and fuel cell vehicles (FCVs) are potentially game-changing technologies for the auto industry for a number of reasons:

- OEMs have already increased the efficiency of internal combustion engine (ICE) vehicles in the past years. In order to meet the more stringent carbon emissions targets in the key auto markets, they will need to focus more on AVs to lower their total fleet emissions.
- Global AV sales grew by around 60% in 2015 whereas seven OEMs in our study have a YoY growth below this rate. OEMs can better prepare themselves to capture the growth opportunity of this nascent market.
- Although the oil price has plummeted in the past few months, battery prices – which account for around a third of the production cost of an electric vehicle – also fell 35% last year. Unsubsidized BEVs could already become cost competitive with ICE vehicles within 6 years[17].

In this chapter, we differentiate how well OEMs are capturing the advanced vehicle markets (for passenger vehicles only) using three key metrics:

- **Metric 1) Technical review:** we assess models of electric vehicles (EVs), including BEVs and PHEVs, available globally, based on a number of parameters: cost relative to vehicles in the same segment, mpg-equivalent (as a proxy for fuel saving), electric range and charge time. Besides the access to charging stations which will be addressed in metric 3, we believe these are the most important factors that consumers would consider when purchasing EVs.
- **Metric 2) Sales review:** we consider each OEM's sales of BEVs and PHEVs in the EU, US, China and Japan over 2010-2015.
- **Metric 3) Other considerations:** we analyze OEMs' actions and plans for FCVs and EVs, as well as the attractiveness of OEMs' domestic FCVs and EVs markets, including the current market size, governments' targets for both the vehicles and charging/refueling stations.

17. Bloomberg New Energy Finance, 2015.

Highlights

- Nissan is a clear leader as it is ranked first in all three metrics. It is well ahead of the second placed Renault.
- Suzuki and Tata Motors currently have no offerings of BEVs or PHEVs in the passenger vehicles markets we analyze so they are not assessed on metrics 1 and 2.
- The top-ranked AVs in our technical review are Renault's Zoe (BEV) and Volkswagen's XL1 (PHEV).
- Toyota is the most active OEM in developing FCV technology, with Japan being the most attractive FCV market.
- In terms of cumulative sales in EU, US, China and Japan (from 2010-2015), Nissan, General Motors and Volkswagen are ranked top three, whereas Volkswagen, Nissan and BMW are ranked top three in 2015 sales.
- Volkswagen improves greatly from last year mainly because it launched five new AVs and its AV sales had a three-fold increase in 2015.
- In contrast, Toyota drops from last year's top rank to seventh. This can be explained by its discontinuation of BEV technology and a pause in PHEV production in 2015, leading to a plunge in its AV sales.
- Honda's rank drops significantly also because of its discontinuation of PHEV production (its model had the best technical performance last year).
- FCA receives a D-grade, down from a B-grade last year, due to a lack of focus on AVs – its only sales are from a 'compliance vehicle' in the US (in order to gain access to the Californian vehicle market).
- We believe China could be a game-changer as the government has a target of 5 million EVs on its roads by 2020, and EVs are identified as one of the ten strategic industries in the recently released 13th Five Year Plan (2015-2020).
- China and Japan are the two most favorable markets for changing infrastructure development. The targeted ratio of electric vehicles (including both BEV and PHEV) to charging points by 2020 proposed by the governments are 1.1 and 1.5 respectively, compared to a range of 6 to 20 in other key markets we analyze.

Advanced vehicles summary

OEM	Technical review rank	Sales rank	Other considerations	Advanced vehicle rank	Advanced vehicle grade	2015 rank	2015 grade
Nissan	1	1.5	1	1	A	3	A
Renault	2	5.5	6	2	A	8	C
Volkswagen	6	2.0	10	3	A	9	C
General Motors	5	4.0	8	4	B	2	A
Ford	4	5.0	11	5	B	4	B
BMW	7	4.5	4	6	B	7	C
Toyota	9	6.0	2	7	B	1	A
Hyundai	3	12.0	6	8	C	12	D
Daimler	11	7.5	4	9	C	10	D
FCA	8	9.5	14	10	D	6	B
PSA Peugeot Citroen	10	9.5	12	11	D	11	D
Honda	12	11.0	2	12	D	5	B
Mazda	13	13.0	9	13	E	13	E
Suzuki	14	13.0	13	14	E	N/A	N/A
Tata Motors	14	13.0	15	15	E	N/A	N/A
Weightings	**40%**	**50%**	**10%**				

Note: in calculating the overall weighted rank in this table, we use the weighted ranks for each metric. We display non-weighted ranks in this summary for simplicity only.

Source: CDP

Technical review

In this section we present the findings of our technical review of BEVs and PHEVs. All OEMs, except Hyundai, Suzuki and Tata Motors, have at least one BEV model on the market in 2015. However, both Honda and Mazda offer their BEVs for lease only while Toyota ended its BEV production in 2015. For PHEVs, 7 OEMs out of 15 in our study have models currently available for sale.

Summary of findings: BEVs

- Renault's Zoe achieves the top technical rank while PSA Peugeot Citroen's Peugeot iOn (or Citroen C-Zero which is a rebadged variant) and Daimler's smart fortwo electric drive have the lowest technical rank.
- Renault's Twizy is the cheapest model in our analysis, both in absolute terms, at US$10,723, and relative to the average price of vehicles in the same segment, at 42% less.
- Volkswagen's e-up! has the highest mpg-equivalent of 171 while Renault's Zoe is a clear leader on electric range of 149 miles.
- Renault has three distinct models of BEVs on the market; Volkswagen and Daimler both have two each.
- Both Honda's FIT and Mazda's Demio EV are available for lease only.
- Toyota stopped its sales of RAV4 EV as it shifted its focus to PHEVs and FCVs.

Summary of findings: PHEVs

- Volkswagen added four PHEV models in 2015, meaning it now has six distinct models of PHEVs: two Porsche models, three Volkswagens and one Audi.
- Volkswagen's XL1 is ranked first and is the most fuel efficient vehicle in our study, with a remarkably high 313 mpg-equivalent. However, it is also the most expensive model.
- Ford's C-MAX Energi PiH FWD is the cheapest model in our analysis, both in absolute terms, at US$31,770, and relative to the average price of vehicles in the same segment, at 35% less.
- BMW's i3 REX has an electric range of 72 miles and the highest electric range to total driving range ratio, in contrast to the lowest of Toyota's Prius Plug-in Hybrid's 11 miles.
- Honda discontinued its Accord PiH in 2015 and is therefore not included in our analysis.
- Although Toyota paused its Prius Plug-in Hybrid production in 2015, we include it in our analysis as it will relaunch the new version in 2016.

Metric 1) Technical review

OEM	Technical BEV weighted score	Technical PHEV weighted score	Overall weighted score	Technical rank
Nissan	3.7	0.0	3.7	1
Renault	3.4	0.0	3.4	2
Hyundai	0.0	3.3	3.3	3
Ford	2.9	3.5	3.2	4
General Motors	3.0	3.3	3.1	5
Volkswagen	2.9	2.9	2.9	6
BMW	3.0	2.6	2.8	7
FCA	2.7	0.0	2.7	8
Toyota	0.0	2.7	2.7	9
PSA Peugeot Citroen	2.5	0.0	2.5	10
Daimler	2.7	2.0	2.4	11
Honda (i)	2.1	0.0	2.1	12
Mazda (i)	1.5	0.0	1.5	13
Suzuki	0.0	0.0	0.0	14
Tata Motors	0.0	0.0	0.0	14

Weightings	**50%**	**50%**
Adjusted weightings: OEMs with BEVs only	**100%**	**0%**
Adjusted weightings: OEMs with PHEVs only	**0%**	**100%**

(i) Both Honda and Mazda's BEVs are for lease only so they do not receive any score on the factor of relative cost. Details see the methodology section.

Source: CDP

Sales review

We assess OEMs' BEV and PHEV sales in 2015 and their cumulative sales over 2010-2015, in four key AV markets: the EU, the US, China and Japan. These markets account for 90% of global AV sales[18].

Summary of findings:

- Nissan's LEAF (BEV) is by far the best-selling vehicle, with nearly 200,000 units sold in the US, Japan and the EU. There is a good opportunity for Nissan to penetrate the Chinese market: the BEV model Venucia e30 that it produces with its JV Dongfeng is based on the Nissan LEAF platform.
- Nissan has the highest cumulative sales over 2010-2015 but Volkswagen's three-fold increase in sales in 2015 allows it to overtake Nissan to become the best-selling OEM in 2015. This was thanks to the launch of 1 BEV and 4 PHEV models in 2015.
- Honda's AV sales decreased by 89% YoY, due to its discontinuation of FIT (BEV) and Accord PiH (PHEV).
- General Motors is ranked second in cumulative sales, with the US accounting for over 90% of its total AV sales. In contrast, Nissan's AV sales have a broader geographical spread: 22% in the EU, 48% in the US, 30% in Japan and 1% in China.
- Toyota's AV sales in 2015 dropped 67% YoY as it discontinued its BEV and temporarily paused its PHEV production.
- Hyundai has very low sales in our study's key markets, partly because its AV sales are mainly in Korea and other markets (although they are still insignificant compared to other OEMs).
- Mazda, Suzuki and Tata Motors have no AV sales at all according to our dataset.
- While China is a rapidly growing AV market, Daimler and Nissan are the only two OEMs in our study that have a notable AV presence in China, with combined sales of just over 2,000 units in 2015. This still only represents 1% total AV market share in China.
- Of the OEMs that sell both BEVs and PHEVs, all (except General Motors) recorded a higher proportion of AV sales from PHEVs in 2015 relative to 2014. It appears that these OEMs are shifting their focus to PHEVs.

Other considerations

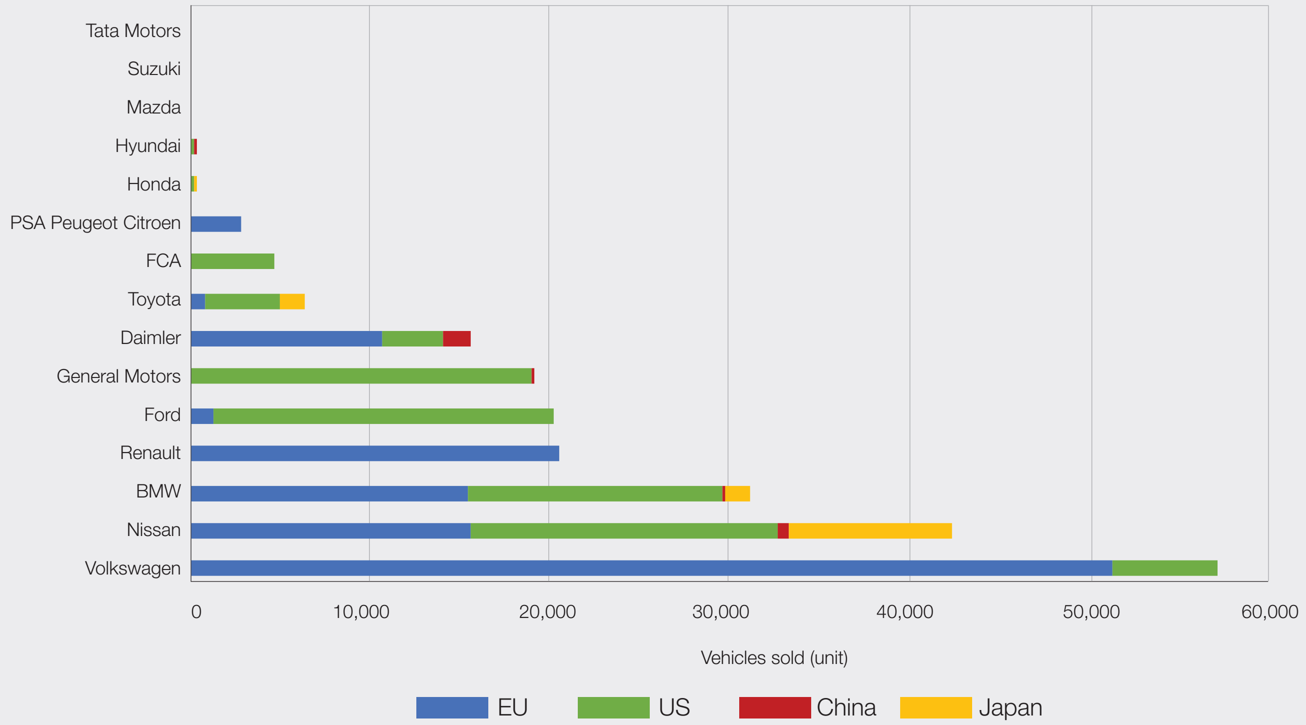
We assess OEMs' actions on FCVs, BEVs and PHEVs, as well as the attractiveness of OEMs' domestic markets. As FCV technology is yet to be commercially mature and there is not much information to make a meaningful analysis in the technical review section, we consider OEMs' efforts into FCV separately in this section.

Summary of findings:

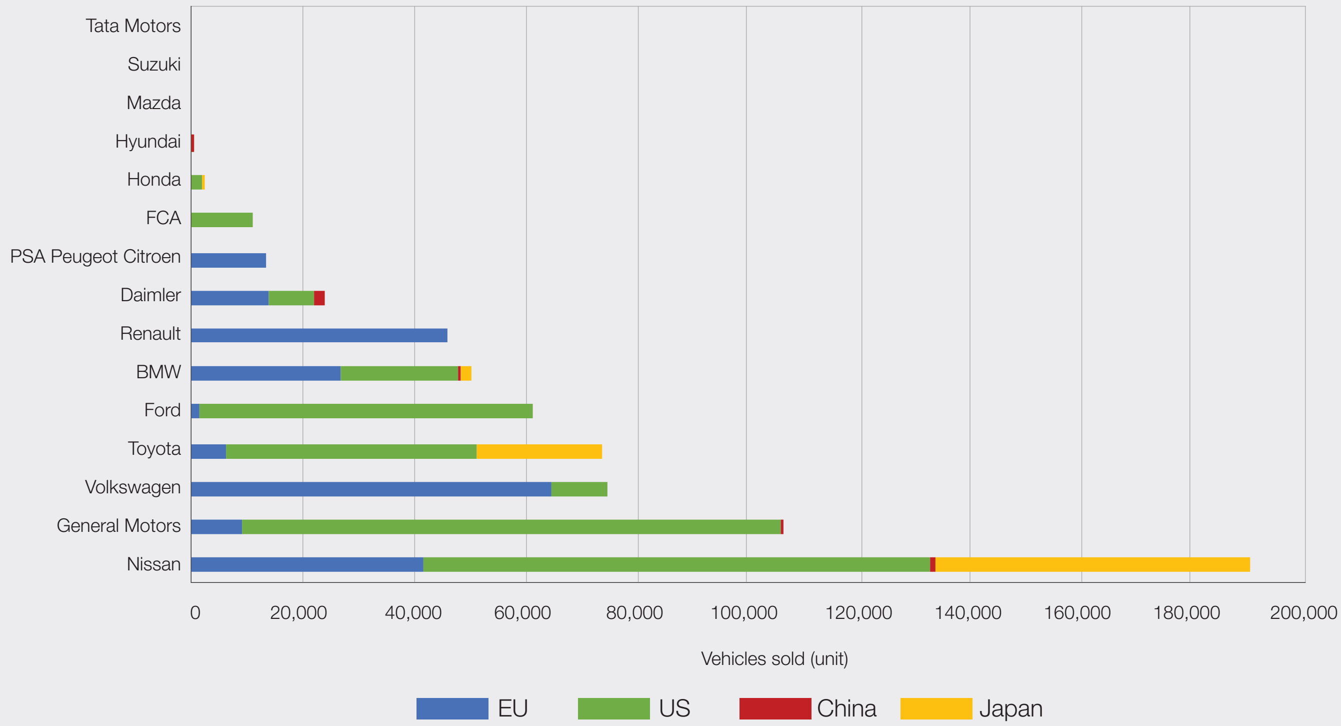
- Toyota is the most active OEM on developing FCV technology.
- Toyota, Hyundai, Honda and Mazda are the only OEMs that are active in developing FCV technology with models available in market. This is not surprising as Japan is considered the most attractive FCV market in our study, and Hyundai aims to enter the Japanese FCV market.
- BMW is a ranked top in EV development thanks to its aggressive development pipeline of PHEV: it will launch 5 models in 2016.
- Japan and France are considered as the most attractive EV markets in our study.

18. ICCT, 2015. Transition to a global zero-emission vehicle fleet: A collaborative agenda for governments.

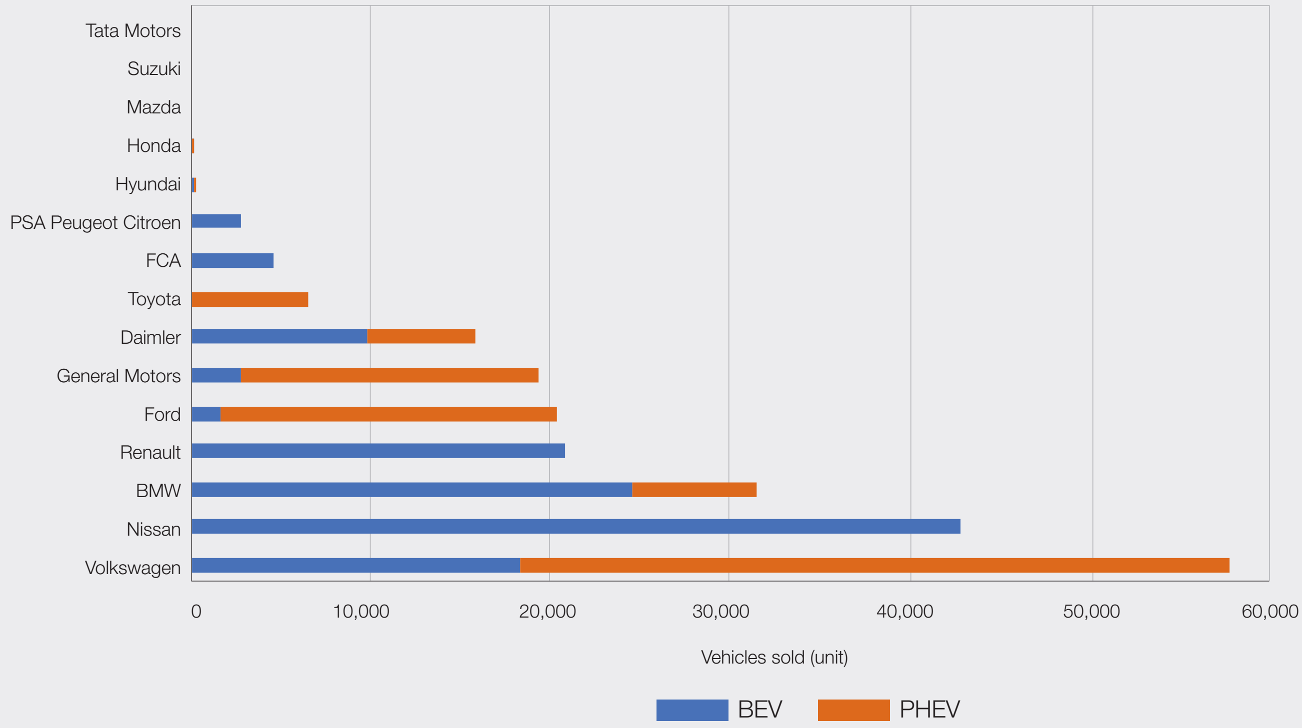
2015 AV sales split by key markets



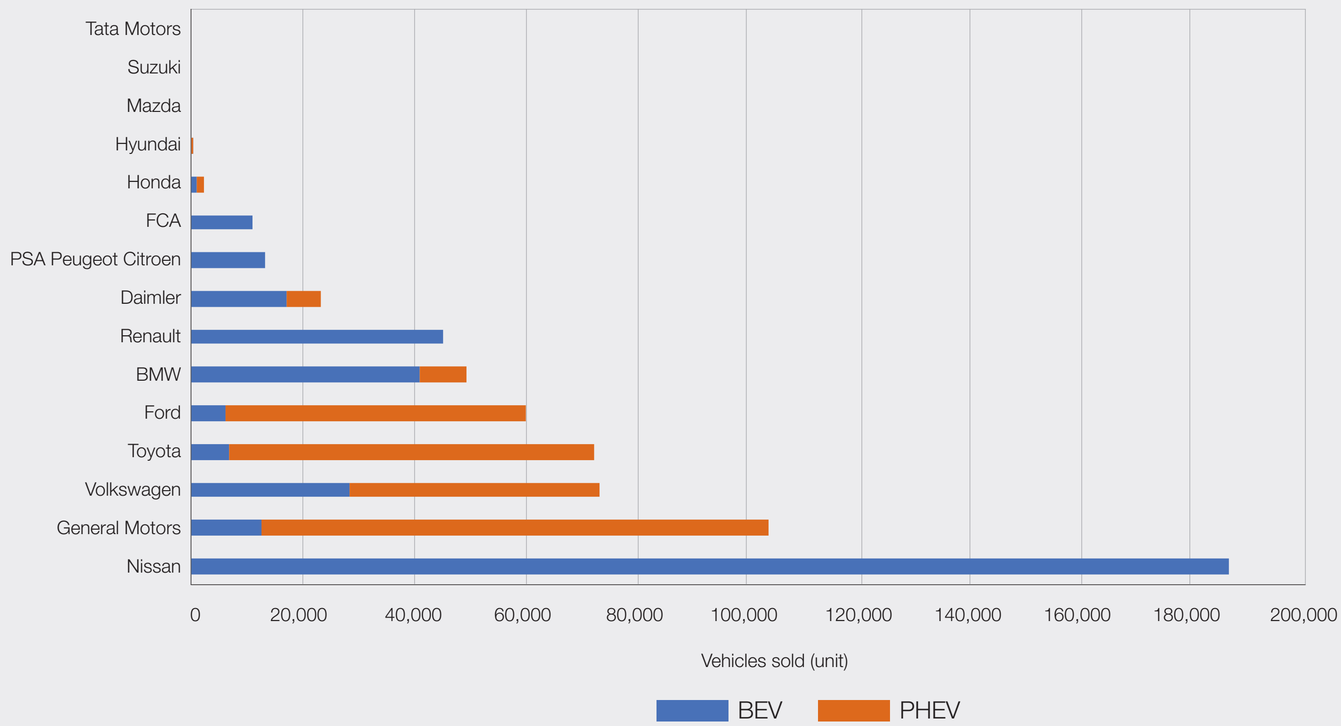
2010-2015 Cumulative AV sales split by key markets



2015 AV sales split by technology



2010-2015 AV sales split by technology



In focus: AVs in China

China is currently a small but fast-growing AV market. With the central and municipal governments' strong support, China's AV sales jumped to over 331,000 units in 2015, a threefold increase from 2014. The share of AVs in passenger vehicles increased from 0.3% in 2014 to 1% in 2015. We believe the market could potentially explode in the coming years and we highlight some reasons:

Strategic industry

- The "new energy vehicles" industry (the term used by the government covering BEVs, PHEVs and FCVs) is highlighted as one of the ten strategic industries in the blueprint of the 13th Five Year Plan (2015-2020). More details will be announced in March 2016.

Ambitious sales targets

- The government has set ambitious cumulative sales targets (BEVs and PHEVs) of 500,000 by 2015 and 5 million by 2020. We estimate that this target implies nearly 2 million AVs sales in 2020.

Generous subsidies and tax exemptions

- The national and some municipal governments offer generous subsidies to consumers. For example, the national government offers around US$4,800-8,200 (based on AV technology and electric range) in 2016 and municipal governments like Beijing, Guangzhou, Shanghai and Shenzhen also offer similar levels of subsidies.

- The vehicle purchase tax (around 10%) is exempted for qualified AVs.

- China offers one of the most attractive monetary incentives among the key markets we look at.

Preferential policies

- To curb air pollution and reduce urban congestion, major cities in China have set quotas for vehicle license plates. Cities use lottery, auction or a hybrid system to allocate licenses and they can be very difficult and/or costly to secure. However, these cities have earmarked a specific portion for AVs in order to help their deployment.

- For example, Beijing's most recent lottery result (released in February 2016) shows that only 0.15% of applications succeeded to secure the 13,700 quotas for conventional vehicles versus 100% for applications of AVs; Shanghai's auction in February sees the lowest auctioned price at around US$12,700, compared to free license plates given to AVs.

- These policies are definitely more attractive than the soft incentives used in other countries, e.g. use of bus lanes, free parking and exemption of toll charges, etc.

Supporting infrastructure

- As the cumulative sales are slightly below 2015 targets, the government will speed up the construction of the charging infrastructure to ensure the deployment of AVs, with a target of 4.5 million charging points in 2020 (meaning a ratio of AVs to charging points close to 1:1 which is the highest in the markets we study).

- The central government will subsidize major cities and provinces around US$18-30 million per annum based on their AV sales.

Implications for OEMs

- Since imported AVs are not eligible for subsidies, foreign OEMs that form joint ventures with Chinese OEMs to manufacture AVs domestically are better positioned to take advantage. Currently, only five OEMs in our study are doing so: BMW, Daimler, General Motors, Hyundai and Nissan.

- The proposed national subsidies and tax exemptions will end in 2020 and 2017 respectively, and there is a gradual decrease in the levels of subsidies. OEMs that launch qualified models within this period have an early-mover advantage to gain market share.

- Daimler's partner BYD (a Warren Buffet-backed Chinese OEM) has the largest AV market share at nearly 30% in 2015. Daimler could be well positioned to capture the market share through BYD's manufacturing scale, dealership network and customer management.

- Renault's newly formed joint venture will start the production of a BEV in 2017 based on its Fluence ZE.

- Volkswagen announced that it will partner with SAIC, a Chinese OEM, to introduce 15 AVs models in China by 2019, ranging from PHEVs and BEVs, from small cars to SUVs. This plan seems ambitious but it might be slightly late to enjoy the generous subsidies offered by the government.

Methodology and limitations

The overall advanced vehicles rank and grades are determined as follows:

- We combine the weighted ranks of the three metrics using the following weightings: metric 1) 40%, metric 2) 50% and metric 3) 10%. This determines the overall weighted rank for advanced vehicles.
- The advanced vehicles grade is awarded according to the overall weighted rank.

Metric 1) Technical review

- This metric assesses BEVs and PHEVs separately on four factors: i) relative cost compared to the average cost of vehicles in the same segment, ii) mpg-equivalent (mpg-e) as a proxy for fuel economy, iii) electric range (miles) for BEV and electric range to total driving range ratio for PHEV, and iv) charge time (hours). We assign the following weightings to the four factors:

Weightings for metrics used in determining the technical review score

Factors	BEV	PHEV
Relative cost (%)	30%	30%
Fuel economy (mpg-e)	30%	30%
BEV: electric range (miles) PHEV: electric range to total driving range ratio	25%	35%
Charge time (hours)	15%	5%

Source: CDP

- We collect information from the US DoE's website[19] and OEMs' publicly available sources.
- We assign scores from 1-5 based on the percentiles within each factor, with 5 being the best.
- For OEMs that have more than one model available in BEV or PHEV, we take the average of the score. We then sum the scores of the four factors and apply the respective weightings (as shown in the table above) to get the technical weighted scores for BEV and PHEV.
- We combine the weighted ranks of BEV and PHEV with a weighting of 50% for each technology when an OEM has models in both areas, or 100% to the only technology in which an OEM has the offering.
- As Honda and Mazda's only offerings of BEVs are for lease only and no retail prices are available, we are unable to score them for relative cost. However, instead of excluding them from the technical review and ranking them bottom in the metric, we award them scores based on the other three factors. We acknowledge that their technical BEV weighted scores are not directly comparable to other OEMs' but this at least differentiate them from OEMs which do not offer any BEV models.

Metric 2) Sales review

- This metric assesses sales of BEVs and PHEVs in four key markets over 2010-2015. We collect sales data from OEMs' publicly available sources, trade associations and other sources like insideevs.com, ev-sales.blogspot.co.uk that can complement the dataset.
- We rank OEMs based on their sales in 2015 as well as their cumulative sales over 2010-2015. We then assign the weightings of 50% to both areas to get the overall sales weighted rank.

Metric 3) Other considerations

- This metric consists of two components: i) OEMs' actions on various AV technologies, ii) key AV market attractiveness, with a 50% weighting each applied to the ranks that OEMs receive.
- We adopt a scorecard approach to rank OEMs' actions and AV market attractiveness.
- The AV market attractiveness score is assigned to OEMs based on their domestic market.
- For OEMs' actions, we collect quantitative and qualitative data on OEMs' development pipeline of and R&D collaboration on FCVs, BEVs and PHEVs, e.g. models announced to be released, demonstration cars shown, collaboration between OEMs or with other parties on technology development and charging/fueling infrastructure, etc. from OEMs' publicly available sources. We also collect data on the market status of available model and global sales for FCVs.
- For domestic market attractiveness, we collect data on country-level sales targets of AVs in 2020, their market size in 2015, estimated market growth rate in 2016, as well as current and targeted charging/fueling stations to vehicle ratio.

19. www.fueleconomy.gov

Manufacturing emissions

- The three German OEMs, Volkswagen, Daimler and BMW, are ranked in the top four.
- Suzuki and Tata Motors are clear laggards. Suzuki lacks comprehensive data on its global emissions footprint, while Tata Motors lacks monitoring of its suppliers' emissions.
- 12 out of the 15 OEMs set meaningful emissions reduction targets; 10 of those perform well against them.

Overview

Manufacturing emissions account for 8-39% of the industry's total lifecycle emissions[20], with one-sixth of it allocated to OEMs' own emissions and the remaining to their suppliers' emissions. We address manufacturing emissions in this report for two reasons. First, as the share of fleet emissions will decrease due to the electrification of the transport system as well as the growth of renewables in the power sector, the share of manufacturing emissions is expected to increase in the near future. Second, OEMs' and their suppliers' emissions can be a good proxy for assessing their manufacturing efficiency trends. Actions to reduce emissions range from material substitution to waste heat recovery systems. From an operational cost perspective, these measures can yield significant cost savings and thus improved margins. Additionally, OEMs that have started to engage with their suppliers on manufacturing efficiency issues are considered better prepared and more resilient to a low-carbon transition.

We identify leaders and laggards in manufacturing emissions using seven key metrics across four areas:

Manufacturing emissions performance

- **Metric 1) Scope 1 + 2 emissions intensity over 2012-2014:** this metric assesses OEMs' scope 1+2 emissions intensity normalized by revenue and volume sales (median of 2012-2014).
- **Metric 2) Reduction in scope 1 + 2 emissions intensity over 2010-2014:** this metric assesses OEMs' reduction in emissions intensity (calculated with the methodology described in metric 1) over 2010-2014. We use a proprietary function to calculate the rate of reduction, which takes into account the cumulative effect of greenhouse gas emissions in the atmosphere, instead of using CAGR which only looks at the first and final year's data.
- **Metric 3) Reduction in suppliers' emissions over 2012-2014:** this metric identifies the trend of emissions reduction of OEMs' scope 3 supplier-related emissions[21] intensity over 2012-2014. Since there is no consistent reporting and verification practices for Scope 3 supplier-related emissions across companies, we do not compare emissions intensity between OEMs, but rather on their YoY intensity change.

Suppliers' emissions reporting and engagement

- **Metric 4) Suppliers' emissions reporting and engagement:** we form a scorecard that assesses OEMs' scope 3 reporting methodology and their engagement with suppliers on emissions-related issues. The scorecard includes: i) OEMs' evaluation status and reporting methodology of their suppliers' emissions; ii) percentage of spend represented by the suppliers they engage with; and iii) OEMs' levels of engagement with their suppliers.

Emissions reduction targets

- **Metric 5) Quality of targets:** this metric assesses the ambitiousness of each OEM's emissions reduction targets.
- **Metric 6) Performance against targets:** we assess OEMs' performance against their targets. Our proprietary modelling enables us to assess the profile of the companies' historic emissions annually against their respective targets. This method highlights those companies whose emissions trajectory consistently outperforms what is required to meet their target. The benefits of this are two-fold: first, from a climate change perspective, reducing emissions on an annual basis is crucial, rather than, for example a company reducing emissions aggressively in the final year of its target. Second, companies that consistently outperform their emissions-reduction targets are those that consistently benefit from energy efficiency cost savings.

20. The range varies according to factors such as vehicle types (e.g. ICE or BEV) and the emissions factors of regional energy production. Ricardo-AEA. 2013. Current and Future Lifecycle Emissions of Key 'Low Carbon' Technologies and Alternatives.
21. Suppliers' emissions cover, in our analysis, Scope 3 Category 1 – Purchased Goods and Services emissions, as defined by the GHG Protocol.

Data transparency

- **Metric 7) Emissions data transparency:** we form a scorecard that assesses companies' emissions accounting procedures. The scorecard includes: method of consolidation for emissions (the reporting boundary), level of third party verification and assurance, scope of verification and any exclusions relative to the reporting boundary.

Highlights

- Volkswagen achieves an A-grade for manufacturing emissions (same as 2015). It has the most aggressive manufacturing emissions reduction target, at an annual reduction rate of 3.5%.
- Both Tata Motors and Suzuki are rock bottom. They perform consistently poorly across all metrics.
- Toyota, ranked sixth, and Nissan, ranked eleventh, swapped their positions from last year. This could be explained by the newly-added metric of emissions data transparency: Toyota's emissions accounting procedure is more comprehensive than Nissan.

Manufacturing emissions summary

OEM	Manufacturing emissions performance	Suppliers' emissions reporting and engagement	Emissions reduction targets	Emissions data transparency	Overall weighted rank	Manufacturing emissions rank	Manufacturing emissions grade	2015 report rank	2015 report grade
Volkswagen	7.9	N/A	1	4	5.2	1	A	2	A
Daimler	5.1	4	5	10	5.9	2	A	3	A
FCA	6.4	2	6	9	6.0	3	A	4	B
Mazda	5.6	3	3	14	6.3	4	A	7	C
BMW	5.3	1	12	8	6.3	5	A	1	A
Toyota	8.8	6	8	3	6.9	6	B	11	D
Renault	7.8	4	15	1	7.1	7	B	9	D
PSA Peugeot Citroen	6.1	14	4	7	7.5	8	C	4	B
Hyundai	8.5	12	9	2	8.0	9	C	7	C
Ford	8.6	11	2	13	8.7	10	D	13	E
Nissan	8.5	9	7	11	8.8	11	D	6	B
Honda	9.0	7	15	5	9.0	13	D	10	D
General Motors	10.8	7	10	6	8.9	12	D	12	E
Suzuki	10.1	9	11	15	11.1	14	E	N/A	N/A
Tata Motors	8.4	13	15	12	11.4	15	E	14	E

Weightings	**40%**	**20%**	**20%**	**20%**
Adjusted weightings for VW	**50%**		**25%**	**25%**

Source: CDP

Manufacturing emissions performance

- 13 OEMs have reduced their scope 1 + 2 emissions intensity normalized by both volume sales and revenue over 2010-14. Daimler, FCA and BMW have reduced their emissions intensity the most by both normalization factors.

- Tata Motors and Honda are the only two OEMs which increased their scope 1 + 2 emissions intensity normalized by volume sales.

- For reduction in suppliers' emissions over 2012-14, only seven out of the 15 OEMs provide sufficient data for us to assess them. Nissan, Renault and Honda are ranked top three. Honda in particular has the largest reduction in intensity normalized by revenue, at about 10% over 2010-14.

- Ford, PSA Peugeot Citroen and Tata Motors did not provide sufficient data on suppliers' emissions for us to assess their performance.

Manufacturing emissions performance summary

OEM	Scope 1 and 2 emissions intensity over 2012-2014	Reduction in scope 1 and 2 emissions intensity over 2010-2014	Reduction in supplier emissions over 2012-2014	Overall weighted rank	Manufacturing emissions performance rank
Daimler	9.5	2.0	7.0	5.1	1
BMW	6.0	4.5	6.0	5.3	2
Mazda	6.0	6.5	3.5	5.6	3
PSA Peugeot Citroen	1.5	5.0	13.0	6.1	4
FCA	13.5	2.0	8.0	6.4	5
Renault	5.5	11.5	2.5	7.8	6
Volkswagen	13.5	7.0	4.0	7.9	7
Tata Motors	5.5	7.5	13.0	8.4	8
Hyundai	9.0	8.5	8.0	8.5	9
Nissan	8.0	12.0	2.0	8.5	9
Ford	10.5	5.5	13.0	8.6	11
Toyota	10.0	8.5	8.0	8.8	12
Honda	3.0	15.0	3.0	9.0	13
Suzuki	5.5	13.5	8.0	10.1	14
General Motors	13.0	11.0	8.0	10.8	15
Weightings	**25%**	**50%**	**25%**		

Source: CDP

Metric 1) Scope 1 and 2 emissions intensity over 2012-2014 (tCO_2e per normalization factor)

OEM	Normalized by volume sales (unit)	Rank	Normalized by revenue (US$m)	Rank	Weighted rank	Overall rank
PSA Peugeot Citroen	0.29	2	11.5	1	1.5	1
Honda	0.44	3	14.7	3	3.0	2
Renault	0.47	4	23.6	7	5.5	3
Suzuki	0.28	1	30.2	10	5.5	3
Tata Motors	0.71	9	14.0	2	5.5	3
BMW	0.68	8	17.6	4	6.0	6
Mazda	0.54	6	23.4	6	6.0	6
Nissan	0.66	7	27.8	9	8.0	8
Hyundai	0.52	5	36.6	13	9.0	9
Daimler	0.94	14	17.9	5	9.5	10
Toyota	0.86	12	27.6	8	10.0	11
Ford	0.76	10	34.6	11	10.5	12
General Motors	0.86	11	53.5	15	13.0	13
FCA	0.94	15	35.6	12	13.5	14
Volkswagen	0.93	13	38.2	14	13.5	14
Weightings		**50%**		**50%**		

Source: CDP

Metric 2) Reduction in scope 1 and 2 emissions intensity over 2010-2014 (tCO_2e per normalization factor)

OEM	Normalized by volume sales (unit)	Rank	Normalized by revenue (US$m)	Rank	Weighted rank	Overall rank
Daimler	-13%	1	-13%	3	2.0	1
FCA	-9%	2	-13%	2	2.0	1
BMW	-8%	3	-8%	6	4.5	3
PSA Peugeot Citroen	-5%	6	-12%	4	5.0	4
Ford	-6%	4	-7%	7	5.5	5
Mazda	-6%	5	-7%	8	6.5	6
Volkswagen	-4%	9	-9%	5	7.0	7
Tata Motors	1%	14	-22%	1	7.5	8
Hyundai	-5%	7	-5%	10	8.5	9
Toyota	-4%	8	-6%	9	8.5	9
General Motors	-4%	10	-3%	12	11.0	11
Renault	-2%	12	-4%	11	11.5	12
Nissan	-3%	11	-1%	13	12.0	13
Suzuki	-2%	13	-1%	14	13.5	14
Honda	7%	15	-1%	15	15.0	15
Weightings		**50%**		**50%**		

Source: CDP

Metric 3) Reduction in suppliers' emissions over 2012-2014 (tCO_2e per normalization factor)

OEM	Normalized by volume sales (unit)	Rank	Normalized by revenue (US$m)	Rank	Weighted rank	Overall rank
Nissan	-1.3%	2	-5.0%	2	2.0	1
Renault	-2.0%	1	1.6%	4	2.5	2
Honda	0.3%	5	-10.1%	1	3.0	3
Mazda	-0.5%	4	-0.4%	3	3.5	4
Volkswagen	-1.2%	3	1.8%	5	4.0	5
BMW	0.4%	6	6.0%	6	6.0	6
Daimler	10.1%	7	11.2%	7	7.0	7
FCA		8		8	8.0	8
General Motors		8		8	8.0	8
Hyundai		8		8	8.0	8
Suzuki		8		8	8.0	8
Toyota		8		8	8.0	8
Ford		13		13	13.0	13
PSA Peugeot Citroen		13		13	13.0	13
Tata Motors		13		13	13.0	13
Weightings		**50%**		**50%**		

Source: CDP

Suppliers' emissions reporting and engagement

- BMW is a clear leader in suppliers' emissions reporting and management as it receives full scores in all areas in this scorecard.
- PSA Peugeot Citroen is a clear laggard as it considered suppliers' emissions not relevant and has the lowest engagement score.

Metric 4) Suppliers' emissions reporting and engagement

OEM	Evaluation status of suppliers' emissions	Calculation methodology of suppliers' emissions	% of suppliers engaged with (i)	Engagement score (ii)	Total score	Overall rank
BMW	Relevant, calculated	Hybrid	100%	10.0	20	1
FCA	Relevant, calculated	Spend-based method	100%	8.0	16	2
Mazda	Relevant, calculated	Material-based	100%	6.0	15	3
Daimler	Relevant, calculated	Material-based	100%	5.5	15	4
Renault	Relevant, calculated	Hybrid	79%	5.5	15	4
Toyota	Relevant, calculated	Material-based	100%	4.5	14	6
General Motors	Relevant, calculated	Spend-based method	75%	5.5	13	7
Honda	Relevant, calculated	Material-based	80%	4.5	13	7
Nissan	Relevant, calculated	Material-based	86%	3.5	12	9
Suzuki	Relevant, calculated	N/A	100%	4.5	12	9
Ford	Relevant, not yet calculated	N/A	60%	7.0	11	11
Hyundai	Relevant, not yet calculated	N/A	1%	5.5	8	12
Tata Motors	Relevant, not yet calculated	N/A	0%	3.0	5	13
PSA Peugeot Citroen	Not relevant, explanation provided	N/A	40%	1.0	4	14
Volkswagen	N/A	N/A	N/A	N/A	N/A	N/A

(i) % spend represented by suppliers the OEMs engage with.
(ii) Engagement score is based on OEMs' engagement activities with their suppliers. Details see the methodology section.

Source: CDP

Emissions reduction targets

- 12 out of the 15 OEMs set meaningful emissions reduction targets; 10 of those perform well against them.
- Volkswagen has the most aggressive target, at an annual reduction rate of 3.5%.
- Only 3 OEMs set both absolute and intensity targets – FCA, Daimler and PSA Peugeot Citroen.
- Honda, Renault and Tata Motors did not provide sufficient data for us to make a meaningful assessment of their targets, although we acknowledge that Honda and Renault set aggregated scope 1+2+3 targets and Tata Motors a scope 2 target.
- Mazda, Ford and Volkswagen are ranked top three in performance against targets. However, Mazda's overall position in this metric falls to third place, as its target only covers about 90% of its emissions.
- It is worth noting that Tata Motors reported a renewable energy target for its energy demand, though it cannot be assessed due to a lack of data.

Emissions reduction targets summary

OEM	Quality of target	Performance agains target	Overall weighted rank	Emissions reduction targets rank
Volkswagen	1	3	2.4	1
Ford	6	2	3.2	2
Mazda	10	1	3.7	3
PSA Peugeot Citroen	5	4	4.3	4
Daimler	3	6	5.1	5
FCA	8	5	5.9	6
Nissan	4	8	6.8	7
Toyota	2	11	8.3	8
Hyundai	12	7	8.5	9
General Motors	7	10	9.1	10
Suzuki	11	9	9.6	11
BMW	9	12	11.1	12
Honda	15	15	15.0	15
Renault	15	15	15.0	15
Tata Motors	15	15	15.0	15
Weightings	**30%**	**70%**		

Source: CDP

Metric 5) Quality of targets

OEM	Absolute target CAGR over target lifetime	Intensity target CAGR over target lifetime	Strongest target selected	Selected target's CAGR over target lifetime	Scope of strongest target	Adjusted result	Rank
Volkswagen		-3.5%	Intensity	-4%	98%	-3.5%	1
Toyota		-2.9%	Intensity	-3%	100%	-2.9%	2
Daimler	-0.9%	-2.8%	Intensity	-3%	100%	-2.8%	3
Nissan		-2.8%	Intensity	-3%	90%	-2.5%	4
PSA Peugeot Citroen	-0.8%	-2.6%	Intensity	-3%	95%	-2.5%	5
Ford		-2.3%	Intensity	-2%	100%	-2.3%	6
General Motors		-2.2%	Intensity	-2%	100%	-2.2%	7
FCA	-0.3%	-3.8%	Intensity	-4%	55%	-2.1%	8
BMW	-1.2%		Absolute	-1%	100%	-1.2%	9
Mazda	-1.1%		Absolute	-1%	88%	-1.0%	10
Suzuki	-1.6%		Absolute	-2%	51%	-0.8%	11
Hyundai		-1.0%	Intensity	-1%	61%	-0.6%	12
Honda							15
Renault							15
Tata Motors							15

Source: CDP

Metric 6) Performance against targets

OEM	Absolute target % beat/(miss)	Intensity target % beat/(miss)	Best performing target selected	Best performing target % beat/(miss)	Rank
Mazda	24%		Absolute	24%	1
Ford		13%	Intensity	13%	2
Volkswagen		12%	Intensity	12%	3
PSA Peugeot Citroen	9%	7%	Absolute	9%	4
FCA	6%	7%	Intensity	7%	5
Daimler	7%	7%	Absolute	7%	6
Hyundai		5%	Intensity	5%	7
Nissan		4%	Intensity	4%	8
Suzuki	3%		Absolute	3%	9
General Motors		1%	Intensity	1%	10
Toyota		-1%	Intensity	-1%	11
BMW	-8%		Absolute	-8%	12
Honda					15
Renault					15
Tata Motors					15

Source: CDP

Data transparency

- Renault and Hyundai are ranked first and second. They are the only OEMs with a reasonable level of assurance of their emissions data.
- Mazda and Suzuki are ranked bottom mainly because they set equity share boundaries when reporting scope 1 + 2 emissions, which is considered the least comprehensive.

Metric 7) Emissions data transparency

OEM	Boundaries (i)	Scope 1 verification	Scope 1 assurance type	Proportion of scope 1 verified	Uncertainty scope 1 verified	Scope 2 verification	Scope 2 assurance type	Proportion of scope 2 verified	Uncertainty scope 2 verified	Scope 3 assurance type	Proportion of scope 3 verified	Total score (ii)	Rank
Renault	OC	Complete	Reasonable	97%	-2%	Complete	Reasonable	98%	-2%	Limited	96%	22.9	1
Hyundai	OC	Complete	Reasonable	100%	-2%	Complete	Reasonable	100%	-2%	NR	NR	20.0	2
Toyota	OC	Complete	Limited	100%	-2%	Complete	Limited	100%	-2%	Limited	100%	17.5	3
Volkswagen	OC	Complete	Limited	100%	NA	Complete	Limited	100%	N/A	Limited	93%	17.3	4
Honda	OC	Complete	Limited	100%	-2%	Complete	Limited	100%	-2%	Limited	90%	17.2	5
General Motors	OC	Complete	Limited	86%	-5%	Complete	Limited	100%	-5%	Limited	94%	16.3	6
PSA Peugeot Citroen	OC	Complete	Moderate	95%	-2%	Complete	Moderate	95%	-2%	Moderate	85%	16.3	7
BMW	OC	Complete	Limited	92%	-2%	Complete	Limited	92%	-2%	Limited	91%	16.1	8
FCA	FC	Complete	Limited	100%	-2%	Complete	Limited	100%	-5%	Limited	93%	13.8	9
Daimler	FC	Complete	Limited	100%	-2%	Complete	Limited	100%	-5%	Limited	65%	12.8	10
Nissan	FC	Complete	Limited	96%	-5%	Complete	Limited	89%	-5%	Limited	86%	12.7	11
Tata Motors	FC/OC	Complete	Limited	90%	-10%	Complete	Limited	100%	-10%	NR	NR	11.6	12
Ford	OC	Underway	Limited	100%	-2%	Underway	Limited	100%	-2%	NR	NR	10.5	13
Mazda	ES	Complete	Limited	63%	-10%	Complete	Limited	74%	-10%	NR	NR	4.8	14
Suzuki	ES	None	NR	NR	-10%	None	NR	NR	-10%	NR	NR	0.0	15

(i) OC = operational control; FC = financial control; ES = equity share.
(ii) Refer to methodology section for steps used to calculate the total score.
Legend: NR - No response; N/A - Not available

Source: CDP

Methodology and limitations

The overall manufacturing emissions rank and grades are determined as follows:

- We combine the weighted ranks of the four areas using the following weightings: manufacturing emissions performance 40%, suppliers' emissions reporting and engagement 20%, emissions reduction targets 20%, and emissions data transparency 20%. This determines the overall weighted rank for manufacturing emissions. These weightings are recalibrated for VW as it is not assessed on metric 2).
- The manufacturing emissions grade is awarded according to the overall weighted rank.

We apply the following methodologies to determine the weighted rank for each area:

Manufacturing emissions performance

We combine the weighted ranks of the three metrics in the area using the following weightings: metric 1) 25%, metric 2) 50% and metric 3) 25%.

Data collation:

We apply the following steps to ensure the data is as consistent and credible as possible for our intensity calculations:

- Collate emissions, revenue and passenger vehicle volume sales data for each year for the five year period of 2010-14 from CDP's database and company sources.
- Replace this with restated emissions data, where available (for instance, after an acquisition or divestment), subject to equivalent restated revenue and volume sales data being available.

- In the absence of restated normalization factors (i.e. revenue and volume sales) over the entire period of restatement, we are unable to calculate the restated emissions intensity and thus reflect the most accurate position of the companies' emissions reductions (as per the GHG Protocol). That said, as we are calculating emissions intensity, this limitation is mitigated somewhat as long as any acquisitions or divestments do not have significant impact on emissions intensity.

- We exclude the share of revenues from financial services, under the assumption that their contribution to companies' emissions is relatively insignificant. Financial services accounted for, on average, about 9% of revenue (with a range of 1-23%) in our study.

- The lack of emissions split by production of various types of vehicles limits our ability to accurately assess OEMs' emissions intensity. However, most of the OEMs in our study have passenger vehicles accounting for the major share of vehicle volume sales (usually more than 85%), hence this limitation mainly affects OEMs with a significant share of other vehicle types, e.g. Honda and Suzuki have a big share of motorcycle sales. For these two OEMs, we adjust their emissions by applying an emissions factor[22] that correlates manufacturing emissions of motorcycles and that of passenger vehicles.

- We convert revenue in local currency to US$ using the average daily foreign exchange rate during 2010. We peg the US$ exchange rate at this level for all years to avoid distortion in the intensity metric due to foreign exchange movements.

- We urge companies to provide better transparency on emissions data as follows: firstly, make data for any restated emissions publicly available (we require the emissions data to go at least as far back as the base year of the company target); secondly, ensure that relevant normalization factors including revenue and sales volumes are also available for all the restated years.

Metric 1) Manufacturing emissions intensity over 2012-2014:

- We collate Scope 1 and 2 emissions, financial and volume sales data for the five year period of 2010-2014.

- We calculate the emissions intensity over the period for each company, using two different normalization factors: revenue and sales volume.

- We use sales volume as a proxy for production volume[23], due to the lack of data in company sources and historically they tend to be similar.

- For each normalization factor, we take the median of the three year period of 2012-2014.

- We combine the ranks for each normalization factor in a ratio of 50:50, which determines the weighted rank for this metric.

Metric 2) Reduction in Scope 1 and 2 emissions intensity over 2010-2014:

- Based on the annual emissions intensity calculated above, we use our proprietary function to assess companies' emissions performance over 2010-2014.

- The function measures the total emissions (or intensity) over a period and calculates the implied constant growth rate per annum required to create the same aggregate emissions (over the same period) starting from the base year for the period. We then rank companies based on the implied growth rate.

- We apply the above methodology for each of the two normalization factors, revenue and volume sales, and combine the ranks in a ratio of 50:50. This determines the weighted rank for this component.

Metric 3) Reduction in suppliers' emissions intensity over 2012-2014:

- We collate Scope 3, Category 1 emissions – Purchased goods[24] and services, financial and volume sales data for the four year period of 2011-2014.

- We calculate the emissions intensity over the period for each company where more than three years of comparable data is available, using two different normalization factors; revenue and volume sales.

- For each normalization factor, we use our proprietary function to assess the companies' emissions performance over 2012-2014.

- We rank companies based on the implied growth rate.

- For companies where comparable data over 2012-2014 is not available, but at least one year of data has been submitted, they are ranked second last. Companies that do not submit any Scope 3 Category 1 data are ranked bottom.

22. A ratio of 0.8 is used. UC Berkeley Center for Future Urban Transport, 2009. Life-cycle Energy and Emissions Inventories for Motorcycles, Diesel Automobiles, School Buses, Electric Buses, Chicago Rail, and New York City Rail.
23. Using production volume as a normalization factor would correlate directly with the emissions arising from the manufacturing processes.
24. As defined by the GHG Protocol.

- We apply the above methodology for each of the two normalization factors, revenue and volume sales, and combine the ranks in a ratio of 50:50. This determines the weighted rank for this component.

- We acknowledge the challenges of comparing Scope 3 supplier-related emissions due to the lack of consistent reporting and verification practices across companies. This limits our ability to compare companies amongst themselves, thus this component only looks at the progress made within each company.

Suppliers' emissions reporting and engagement

Metric 4) Suppliers' emissions reporting and management:

- We collate quantitative and qualitative data on OEMs' Scope 3 emissions methodology and their engagement with suppliers from responses to the 2015 CDP climate change questionnaire (CC14.1 and CC14.4).

- We adopt a scorecard approach to assess companies on a scale of 0-20 (5 for Scope 3 Category 1 calculation, 5 for scope of engagement, and 10 for level of engagement). We rank OEMs according to their score.

- We use the following scoring approach:
  - We attribute a score from 0-2 based on OEMs' responses on the evaluation status of their Scope 3 Category 1 emissions as follows: not relevant = 0; relevant, not yet calculated = 1; relevant, calculated = 2.
  - We attribute a score from 0-3 based on the type of methodology[25] applied as follows: No response = 0; spend-based method = 1; material-based method = 2; hybrid method = 3.
  - We attribute scores according to the following intervals of percentage spend represented by the suppliers the OEM engages with: 0-10% = 1; 11-30% = 2; 31-70% = 3; 71-90% = 4; 91-100% = 5.
  - We assign scores for OEMs' demonstration of engagement with their suppliers in the following sub-components (with score 1 for demonstration shown and 0 otherwise, and different weightings for each category): 1) the requirement of their suppliers to sign up code of conduct 10%, 2) the assessment of suppliers' self-reported risks 10%, 3) the auditing level of that self-reported assessment 10%, 4) OEMs' efforts in building capacities and educating their suppliers on sustainability issues 20%, 5) OEMs' ability to drive emissions reduction actions 25%, and 6) OEMs' collaboration and innovation 25%.
  - We sum the scores across the 3 components to get the final score (from 0-20).

Emissions reduction targetsand engagement

We combine the weighted ranks of the two metrics in this area: metric 5) 30%, metric 6) 70%.

Metric 5) Quality of targets:

- We assess the quality of targets by calculating the CAGR of emissions reduction based on the base year's and target year's emissions.

- Targets that have a higher annual reduction rate are deemed more ambitious.

- If a company has both absolute and intensity targets, we rank the strongest target amongst the two.

- In assessing the quality of companies' targets, we are unable to compare the ambitiousness of each target with a 2-degree pathway using the Sectoral Decarbonization Approach methodology of the Science-Based Targets Initiative, as it does not provide an auto-industry specific emissions reduction pathway.

- For emissions intensity targets, we use the normalization factor chosen by the company.

Metric 6) Performance against targets:

- In assessing companies' targets, we reward those companies who have created a carbon surplus relative to their target pathway (over the entire forecast period), rather than simply comparing their latest reported emissions against the target.

- Moreover, if a company is consistently off track to meet its target over the entire target period, its carbon exposure will be higher than a company that consistently outperforms the level required to meet its target.

- We assess all relevant and meaningful absolute and intensity targets for Scope 1 and 2 emissions (i.e. those with sufficient scope and with a significant degree of ambition). We exclude scope 3 targets due to the lack of verifiable historical data.

25. The different types of methodologies to calculate Scope 3 Category 1 emissions are as described in the GHG Protocol. None of the companies in our study use the most accurate supplier-specific method.

- For both absolute and intensity targets we apply the following steps:
  - We assume that the level required to meet the target follows a constant annual growth rate (CAGR) from the base year emissions over the period to the target[26].
  - The CAGR is derived from the base year, target year, base year emissions and % reduction targeted by the company.
  - We compare the actual emissions of each company with the level required to meet the target for each year of the forecast period (the annual hurdle).
  - We apply the following formula for each year assessed: annual hurdle less actual emissions = beat (positive value) or miss (negative value) the annual hurdle (for the year).
  - We sum the annual beats or misses from the base year to 2014 and divide this aggregate value by the aggregate value of the annual hurdle over the same period.
  - This gives the % beat or miss used to determine the ranking for this component.
- We adjust the base years of targets for which we cannot get historical company data back to the same year. The adjusted base year reflects the latest year to which we can collate historical data.
- The % beat or miss is essentially a measure of the carbon surplus (credit) or deficit created by the company relative to its target. We believe that analyzing targets in terms of a carbon surplus or deficit is particularly important in relation to science-based targets, which are based on a global 'carbon budget'.
- If a company has both absolute and intensity targets, we rank the strongest target amongst the two.

Data transparency

Metric 7) Emissions data transparency:

We adopt a scorecard approach to analyze companies in terms of their emissions data transparency on a scale of 0-25 (10 for transparency on Scope 1, 10 for transparency on Scope 2, and 5 for transparency on Scope 3). We rank companies according to their score.

- We use the following approach to score companies according to their Scope 1 data transparency. The procedure is exactly the same for Scope 2.
  - The start point in the analysis is the proportion of emissions verified by a third party. We score this out of 10. If 100% are verified, this achieves 10 points. Then, points are awarded according to the proportion verified, i.e. a company with 86% of emissions verification is awarded 8.6 points.
  - We multiply this score according to the level of assurance as follows: high assurance = 100%; reasonable = 90%; moderate = 80%; limited = 70%; don't know yet = 50%; none = 0%.
  - We then multiply the remaining score (still max 10) according to the status of the verification: complete = 100%; underway = 75%; none = 0%.
- We apply the above steps to transparency on both Scope 1 emissions and Scope 2 emissions. We then combine the score (max 10 each).
- Finally, we multiply the combined score (out of 20) according to the boundary of the emissions reported as follows: operational control = 100%; financial control = 75%.
- We score companies for their Scope 3 data transparency as follows:
  - We multiply the level of assurance with the proportion of scope 3 emissions verified, based on the scales described above.
  - We divide this value by a factor of 2 in order to scale down the scoring scale to 0-5. This approach gives a lower weighting to Scope 3 data transparency, to reflect the current level of verification of Scope 3 emissions compared to Scope 1 and 2.
- We sum the Scope 3 data transparency score to the combined Scope 1 and 2 score, to get a final score on a scale of 0-25.
- Operational control is the most comprehensive boundary. It reflects accounting consolidation, i.e. 100% of emissions for all subsidiaries controlled by the group regardless of ownership share and % owned (or controlled) of JVs and associated companies.
- Financial control requires consolidation of 100% of emissions for subsidiaries controlled by the group (regardless of ownership share) but does not require emissions from JVs or associated companies to be included.

26. We acknowledge that there is not always such a CAGR relationship over the life of the target.

Carbon regulation supportiveness

- Both OEMs of the Renault-Nissan alliance are ranked in the top three. They are supportive of progressive low-carbon regulations.
- Daimler is the clear laggard due to its continued stated opposition to the Corporate Average Fuel Economy standards in the US and the fleet emissions standard in the EU.
- Unlike some other industries, the auto industry seems to have no regional trends, possibly due to the global nature of auto sales.

Overview

The auto industry is facing increasingly stringent fleet emissions standards in numerous jurisdictions. It is therefore important to understand how OEMs are preparing themselves for a transition to a low-carbon regulatory regime. We believe that OEMs that are supportive of low-carbon regulatory measures, and are strategically aligning themselves accordingly, are more likely to be better placed should regulations tighten. Conversely, OEMs engaged in overt or covert obstruction of climate change policies may be less likely to be strategically shifting their activities and thus could be at a higher risk from regulatory shocks. However, we recognize that some OEMs may be lobbying against climate regulation for short-term gain yet simultaneously preparing for a longer-term shift towards a low-carbon economy.

In this chapter, we adopt InfluenceMap's[27] proprietary analysis to assess OEMs' supportiveness for a shift to a low-carbon regulatory framework. InfluenceMap analyses the behavior of the OEMs regarding key regulatory items affecting their business, including the fleet emissions-related regulations (e.g. emissions standards and emissions testing procedures), as well as policy measures aimed at expanding the roll-out of advanced vehicles in EU, US and Japan.

InfluenceMap scores OEMs in two ways:

- **Organizational score**: represents the stance an OEM takes on climate policies and legislations as well as its transparency on such positions on key climate issues.
- **Relationship score:** represents the strength of an OEM relationships with trade bodies or other entities and its ability to influence climate policies and legislations.

The two scores for each OEM are combined[28] along with other factors in InfluenceMap's algorithmic calculation to produce a total score (InfluenceMap score). This score determines our carbon regulation supportiveness rank.

Carbon regulation supportiveness summary

OEM	InfluenceMap score	Carbon regulation supportiveness rank	Carbon regulation supportiveness grade (i)
Nissan	60.5	1	A
Honda	57.6	2	A
Renault	56.4	3	A
PSA Peugeot Citroen	54.8	4	B
Toyota	53.7	5	B
BMW	52.3	6	B
General Motors	51.8	7	B
Volkswagen	47.0	8	C
Tata Motors	46.9	9	C
Suzuki	46.8	10	C
Mazda	45.1	11	D
Ford	43.1	12	D
FCA	41.5	13	E
Hyundai	41.4	14	E
Daimler	38.9	15	E

(i) This is CDP carbon regulation readiness grade which is relative to the companies involved in our study only. It is connected to InfluenceMap's own grades, which are relative to a wider and cross-sector sample.
Source: CDP

27. A UK-based non-for profit whose remit is to map, analyze and score the extent to which corporations are influencing climate policy and legislation. http://www.influencemap.org/
28. The scores are combined in varying proportions on a company by company basis.

Highlights

- Both OEMs of the Renault-Nissan Alliance are ranked top three due to their consistent support of strands of climate change regulations. Developing the first mass-produced BEVs, the Nissan LEAF, and half of electric vehicle sales globally, the Renault-Nissan Alliance is preparing itself well for a low-carbon transition in the auto industry.
- Daimler is ranked rock bottom. It has by far the lowest InfluenceMap score, mostly due to its continued stated opposition to the Corporate Average Fuel Economy standards in the US and the fleet emissions standard in the EU.
- Hyundai is ranked second from last, mostly due to its engagement with policy makers to postpone the introduction of a tax on vehicle carbon emissions in South Korea, as well as its misreported GHG emissions to the EPA in US (which led to a fine of US$100 million in 2014).
- FCA is ranked third from last. It advocated for a delay in the implementation of the 2025 CAFE target. FCA also admitted that purchasing credits from other OEMs is one of its main strategies to comply with the US EPA's GHG regulations. This strategy may imply that FCA is less prepared to meet increasingly stringent regulations.
- Ford, ranked fourth from last, voiced concerns on the commercial feasibility of the 2022-2025 model year GHG and CAFE standards and stated that its ability to comply with the 2022-2025 standards remained unclear.
- Unlike some other industries, the auto industry seems to have no regional trends related to where the OEMs are headquartered. For example, the German OEMs BMW and Daimler both oppose certain strands of climate policies, but BMW seems to have a more prominent electric vehicle program so it may have a vested interest in supporting relevant policies like the Germany's 2020 electricmobility development plan. This explains why BMW is ranked much higher than Daimler (corresponding to their respective grades in the Advanced Vehicle chapter). Similarly, Nissan is the biggest seller of electric vehicles globally while Mazda has a much lower exposure in the electric vehicle markets. Hence it is not surprising to see Mazda is ranked much lower than Nissan.

Methodology

Our CDP carbon regulation supportiveness metric uses InfluenceMap's total score which combines the organization score and relationship score according to their proprietary algorithm. From this, we determine the carbon regulation supportiveness rank and grade.

A full description of InfluenceMap's detailed methodology can be found on its website. Its methodology comprises three stages: (a) aggregation of suitable data sources (SEC disclosures, legislative consultations, CDP responses etc.); (b) assessment (via raw scores) of those data sources using suitable queries; and (c) input of the raw scores and other factors into its algorithm to arrive at comparable metrics of regulatory supportiveness for corporations. It analyzes these data sources with a series of 12 queries relating to various aspects of climate change policy and legislation (e.g. fleet emissions, fuel economy, fuel consumption, deployment of electric vehicles, etc.). It then scores each data source/query intersection (or cell) on a 5-point scale, with clearly consistent evidence and guidelines.

- **Organizational score:** is computed over 96 scoring cells by InfluenceMap's proprietary algorithm that accounts for weightings and irrelevant data sources/ queries. The organizational score is expressed as a percentage, with 100% representing very supportive influence on climate policy.
- **Relationship score:** is a reflection of a corporation's climate influencing activities through its influencers (i.e. trade association etc.). The relationship score is also expressed as a percentage, with 100% representing very supportive influence over climate policy.

Appendix: investor engagement themes for auto OEMs

Sector engagement themes:

In order to ensure robust and resilient business strategies as well as encouraging a smooth transition to a low-carbon economy, we are recommending some areas of engagement for investors to raise in their discussions with OEM management. These are intended as proxies under which to ‘stress test’ a company’s business strategy to prepare for the medium and long-term.

CDP is actively supporting institutional investors in their discussions with OEMs and will provide additional information, support and coordination where needed.

A) Fleet emissions

- Provide transparency (including split) on the cost of complying with fleet emissions targets. Cost may include R&D spend on both increasing the efficiency of internal combustion energy (ICE) vehicles and advanced vehicles (includes BEV, PEV and FCV), and the purchase of credits.
- Provide strategy on how fleet emissions regulations in various jurisdictions are to be met.

B) Advanced vehicle

- Provide strategy and development pipeline on different technologies of advanced vehicles for key markets.
- Provide AV sales data spilt by technology and key markets.

C) Manufacturing emissions

- Set clear, strong and long-term emissions-reduction targets (for scope 1&2 and scope 3 emissions separately), both by absolute levels and intensity, and perform well against them.
- Provide more detailed suppliers’ emissions information and the calculation methodology.

D) Carbon regulation readiness

- Provide a clear stance on climate policy consistent with action and disclosure on policymaker engagement.

Company engagement: traffic light system

We use a traffic light system for each metric to highlight areas of engagement focus for each OEM:

Green = good performance

Amber = monitor performance, possible concern

Red = area of concern, engage with company

We have not assigned a uniform number of green, amber and red across the metrics according to rank. Instead, we have reviewed the results of each metric in detail and assigned the above colors according to the underlying quantities for each metric.

SLT

		Engagement area:	Fleet emissions					Advanced vehicles				Manufacturing emissions								Carbon regulation supportiveness	Number of RGA		
SLT rank	**OEM**	**Country**	**Fleet emissions rank**	**EU fleet emissions**	**US fleet emissions**	**China fleet emissions**	**Japan fleet emissions**	**Advanced vehicles rank**	**Technical review**	**Sales review**	**Other considerations**	**Manufacturing emissions rank**	**Scope 1 and 2 emissions intensity over 2012-2014**	**Reduction in scope 1 and 2 emissions intensity over 2010-2014**	**Reduction in suppliers' emissions over 2012-2014**	**Suppliers' emissions reporting and engagement**	**Quality of targets**	**Performance against targets**	**Emissions data transparency**	**Carbon regulation supportiveness rank**	**Green**	**Amber**	**Red**
1	Nissan	Japan	7	2	4	7	5	1	1	1	1	11	8	13	1	9	4	8	11	1	7	6	2
2	Renault	France	4	5	N/A	9	N/A	2	2	6	6	7	3	12	2	4	15	15	1	3	4	7	2
3	BMW	Germany	5	8	7	1	N/A	6	7	4	4	4	6	3	6	1	9	12	8	6	4	10	0
4	Toyota	Japan	2	1	1	12	1	7	9	7	2	6	11	9	8	6	2	11	3	5	6	8	1
5	Daimler	Germany	3	4	8	4	N/A	9	11	8	4	2	10	1	7	4	3	6	10	15	4	8	2
6	Honda	Japan	6	15	1	10	2	12	12	11	2	13	2	15	3	7	15	15	5	2	4	6	5
7	Ford	US	9	9	5	5	N/A	5	4	5	11	12	12	5	13	11	6	2	13	12	2	10	2
8	PSA Peugeot Citroen	France	8	3	N/A	14	N/A	11	10	9	12	8	1	4	13	14	5	4	7	4	2	8	3
9	Mazda	Japan	1	6	1	2	2	13	13	13	9	5	6	6	4	3	10	1	14	11	3	10	2
10	General Motors	US	14	14	10	15	N/A	4	5	3	8	10	13	11	8	7	7	10	6	7	1	9	4
11	Volkswagen	Germany	15	15	11	15	N/A	3	6	2	10	1	14	7	5	N/A	1	3	4	8	4	5	4
12	FCA	Italy	13	10	11	11	N/A	10	8	9	14	3	14	1	8	2	8	5	9	13	3	6	5
13	Hyundai	South Korea	12	13	6	13	N/A	8	3	12	6	9	9	9	8	12	12	7	2	14	2	7	5
14	Tata Motors	India	10	11	N/A	3	N/A	15	14	13	15	15	3	8	13	13	15	15	12	9	0	5	8
15	Suzuki	Japan	11	11	N/A	8	4	14	14	13	13	14	3	14	8	9	11	9	15	10	0	8	6
	Weighting	**Metric:**	**Varies based on OEMs' sales exposure to each market**						**40%**	**50%**	**10%**		**10%**	**20%**	**10%**	**20%**	**6%**	**14%**	**20%**				
		Area	**40%**					**30%**				**15%**								**10%**			
		Adjusted area (i)	**42%**					**32%**				**16%**								**11%**			

Notes:
(i) Adjusted weighting applied to Volkswagen

Source: CDP

Fleet emissions: engagement areas through traffic light

SLT rank	OEM	Country	Fleet emissions rank	EU fleet emissions	US fleet emissions	China fleet emissions	Japan fleet emissions
9	Mazda	Japan	1	6	1	2	2
4	Toyota	Japan	2	1	1	12	1
5	Daimler	Germany	3	4	8	4	N/A
2	Renault	France	4	5	N/A	9	N/A
3	BMW	Germany	5	8	7	1	N/A
6	Honda	Japan	6	15	1	10	2
1	Nissan	Japan	7	2	4	7	5
8	PSA Peugeot Citroen	France	8	3	N/A	14	N/A
7	Ford	US	9	9	5	5	N/A
14	Tata Motors	India	10	11	N/A	3	N/A
15	Suzuki	Japan	11	11	N/A	8	4
13	Hyundai	South Korea	12	13	6	13	N/A
12	FCA	Italy	13	10	11	11	N/A
10	General Motors	US	14	14	10	15	N/A
11	Volkswagen	Germany	15	15	11	15	N/A

	Weighting	**Metric:**		**Varies based on OEMs' sales exposure to each market**
		Area:	**40%**	
		Adjusted area (i):	**42%**	

Notes:
(i) Adjusted weighting applied to Volkswagen

Source: CDP

Advanced vehicles: engagement areas through traffic light

SLT rank	OEM	Country	Advanced vehicles rank	Technical review	Sales review	Other considerations
1	Nissan	Japan	1	1	1	1
2	Renault	France	2	2	6	6
11	Volkswagen	Germany	3	6	2	10
10	General Motors	US	4	5	3	8
7	Ford	US	5	4	5	11
3	BMW	Germany	6	7	4	4
4	Toyota	Japan	7	9	7	2
13	Hyundai	South Korea	8	3	12	6
5	Daimler	Germany	9	11	8	4
12	FCA	Italy	10	8	9	14
8	PSA Peugeot Citroen	France	11	10	9	12
6	Honda	Japan	12	12	11	2
9	Mazda	Japan	13	13	13	9
15	Suzuki	Japan	14	14	13	13
14	Tata Motors	India	15	14	13	15

	Weighting	**Metric:**		**40%**	**50%**	**10%**
		Area:	**30%**			
		Adjusted area (i):	**32%**			

Notes:
(i) Adjusted weighting applied to Volkswagen

Source: CDP

Manufacturing emissions: engagement areas through traffic light

SLT rank	OEM	Country	Manufacturing emissions rank	Scope 1 and 2 emissions intensity over 2012-2014	Reduction in scope 1 and 2 emissions intensity over 2010-2014	Reduction in suppliers' emissions over 2012-2014	Suppliers' emissions reporting and engagement	Quality of targets	Performance against targets	Emissions data transparency
11	Volkswagen	Germany	1	14	7	5	N/A	1	3	4
5	Daimler	Germany	2	10	1	7	4	3	6	10
12	FCA	Italy	3	14	1	8	2	8	5	9
9	Mazda	Japan	4	6	6	4	3	10	1	14
3	BMW	Germany	5	6	3	6	1	9	12	8
4	Toyota	Japan	6	11	9	8	6	2	11	3
2	Renault	France	7	3	12	2	4	15	15	1
8	PSA Peugeot Citroen	France	8	1	4	13	14	5	4	7
13	Hyundai	South Korea	9	9	9	8	12	12	7	2
10	General Motors	US	10	13	11	8	7	7	10	6
1	Nissan	Japan	11	8	13	1	9	4	8	11
7	Ford	US	12	12	5	13	11	6	2	13
6	Honda	Japan	13	2	15	3	7	15	15	5
15	Suzuki	Japan	14	3	14	8	9	11	9	15
14	Tata Motors	India	15	3	8	13	13	15	15	12
	Weighting	**Metric:**		**10%**	**20%**	**10%**	**20%**	**6%**	**14%**	**20%**
		Adjusted metric (i):		**13%**	**25%**	**13%**		**8%**	**18%**	**25%**
		Area:	**15%**							
		Adjusted area (i):	**16%**							

Notes:
(i) Adjusted weighting applied to Volkswagen

Source: CDP

Carbon regulation supportiveness: engagement areas through traffic light

SLT rank	OEM	Country	Carbon regulation supportiveness rank
1	Nissan	Japan	1
6	Honda	Japan	2
2	Renault	France	3
8	PSA Peugeot Citroen	France	4
4	Toyota	Japan	5
3	BMW	Germany	6
10	General Motors	US	7
11	Volkswagen	Germany	8
14	Tata Motors	India	9
15	Suzuki	Japan	10
9	Mazda	Japan	11
7	Ford	US	12
12	FCA	Italy	13
13	Hyundai	South Korea	14
5	Daimler	Germany	15

Weighting	**Area:**	**10%**
	Adjusted area (i):	**11%**

Notes:
(i) Adjusted weighting applied to Volkswagen

Source: CDP

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