



MANAGEMENT QUALITY AND CARBON PERFORMANCE OF AUTOMOBILE MANUFACTURERS: A COMMENTARY

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EXECUTIVE SUMMARY

The TPI and this report

The Transition Pathway Initiative (TPI) is a global, asset owner-led initiative, supported by asset owners and managers with over £5/\$6.5 trillion of assets under management. The initiative assesses how companies are preparing for the transition to a low-carbon economy.

This report contains our assessment of the management quality and carbon performance of the global top 20 automobile manufacturers.

Management quality refers to the quality of companies' governance/management of their greenhouse gas emissions and of risks and opportunities related to the low-carbon transition.

Carbon performance refers to how the emissions intensity of automobile manufacturers' new fleets compares with the international targets and national pledges made as part of the UN Paris Agreement on climate change.

Management quality

Our management quality assessment rates companies on 14 indicators, including whether the company has a policy on climate change, the extent of its emissions disclosures and targets, and whether climate change is demonstrably a boardroom issue. Companies are placed on a staircase comprising five levels, from 0 (worst) to 4 (best).

We find that automobile manufacturers divide into two clusters on management quality (see Figure ES1). Six companies are relatively poor performers. Of these, 3 companies are on Level 0 (Unaware of, or not Acknowledging, Climate Change as a Business Issue): Brilliance, Ferrari and Tesla. The other 3 companies are on Level 1 (Acknowledging Climate Change as a Business Issue): Geely, Subaru and Suzuki.

The other cluster of 14 companies rates highly on management quality; companies are on either Level 3 (Integrated into Operational Decision-Making) or Level 4 (Strategic Assessment). Seven companies are on Level 4: Daimler; Fiat Chrysler; Groupe PSA; Mazda; Renault; Toyota; and Volkswagen. Only Daimler satisfies all 14 criteria.

On average, automobile manufacturers are the joint top performer on management quality of the 7 sectors assessed by TPI to date, alongside electricity utilities. The average management quality score of the 20 companies in automobile manufacturing is 2.6. Automobile manufacturers perform particularly well, relative to other sectors, on issues such as having long-term quantitative targets for operational emissions, and providing information on the business costs of climate change.

Carbon performance

We also provide an in-depth assessment of the carbon performance of these automobile manufacturers. We profile companies on the basis of the CO₂ emissions performance of their fleets of new vehicles, because the majority of the sector's lifecycle emissions originate from fuel combustion in downstream automobile usage, rather than from manufacturing.

Companies' fleet emissions are benchmarked against three scenarios, using modelling from the International Council for Clean Transportation. The three benchmark scenarios are:

1. *2 Degrees (High Efficiency)* – this benchmark achieves the overall aim of the Paris Agreement to limit global warming to below 2°C primarily through vehicle efficiency improvements and alternative fuel technologies.
2. *2 Degrees (Avoid-Shift-Improve)* – this benchmark achieves the Paris Agreement's 2°C target by placing more emphasis on avoiding the need for travel and shifting modes of transportation, which allows for higher average new vehicle emissions.
3. *A Paris Pledges* scenario, reflecting the global aggregate of emissions reductions actually pledged by countries as part of the Paris Agreement in the form of Nationally Determined Contributions or NDCs.

Seven out of the 19 automobile manufacturers disclosing sufficient data on new vehicle emissions have been aligned with the benchmarks over the period 2013 to 2016, meaning that their fleet emissions performance has been better than the benchmarks in recent years (Table ES1). They are: Groupe PSA; Mazda; Nissan; Renault; Suzuki; Tesla; and Toyota. The remaining 12 companies have not been aligned during this period.

We estimate companies' future carbon intensity on the basis of quantitative targets they have set themselves to reduce new vehicle emissions (Table ES1 and Figure ES2). A total of 12 out of 20 companies have set such targets, five of which extend beyond 2020. Consequently TPI has more data on future carbon performance in automobile manufacturing than it has in any other sector, although the picture remains incomplete.

Eight out of 11 companies are aligned with the 2 Degrees benchmarks in 2020: Geely; Groupe PSA; Mazda; Nissan; Renault; Suzuki; Tesla; and Toyota. The companies with the lowest-carbon fleets of all in 2020 are Tesla, which only makes electric vehicles, and Suzuki, which specialises in small, efficient vehicles for the Indian and Japanese markets.

Only 3 companies have targets extending to 2030. Of these, Tesla is aligned with both 2 Degrees benchmarks, Nissan is aligned with the less ambitious 2 Degrees (Avoid-Shift-Improve) benchmark, while Mazda is aligned with the Paris Pledges benchmark.

Tesla's best possible carbon performance contrasts markedly with its management quality score of zero, which is attributable to an absence of suitable disclosures. Without these, we cannot judge the extent of the company's operational emissions, for example. Tesla could likely improve its management quality score quickly, if it were to provide disclosures on its governance of climate issues.

We provide a regional breakdown of historical emissions intensity, focusing on 3 main markets, the EU, US and China. Variation in company performance partly reflects the geography of each company's sales. New passenger cars in Chinese and US markets emit more CO₂ on average than those sold in Europe and some other markets, so companies with more exposure to the former markets tend to sell vehicles with higher average CO₂ emissions per kilometre.

Figure ES1 Management quality of the world's top 20 automobile manufacturers

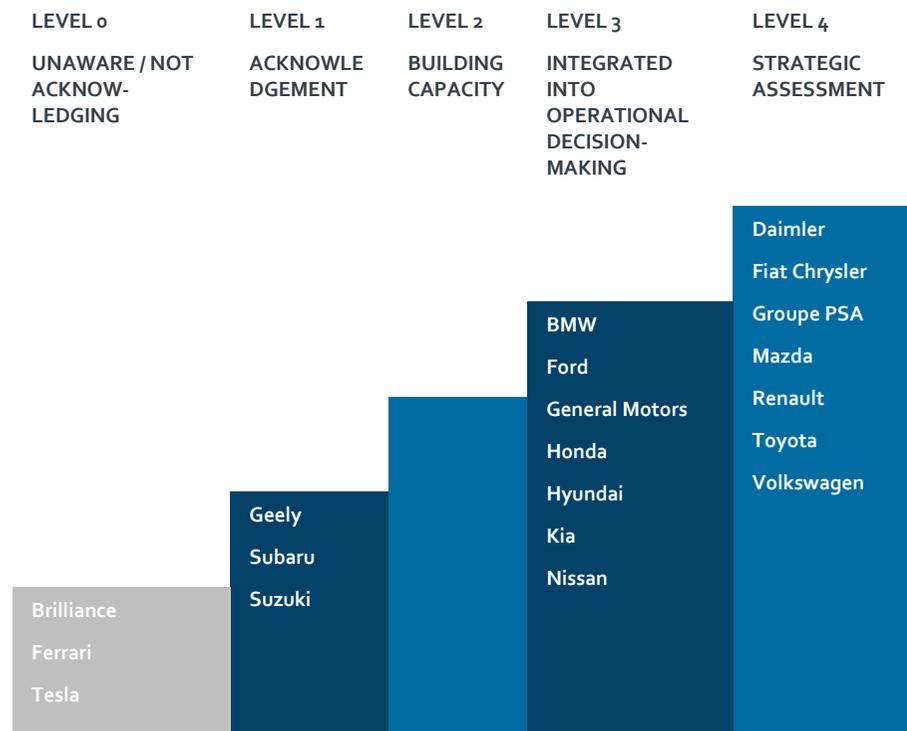
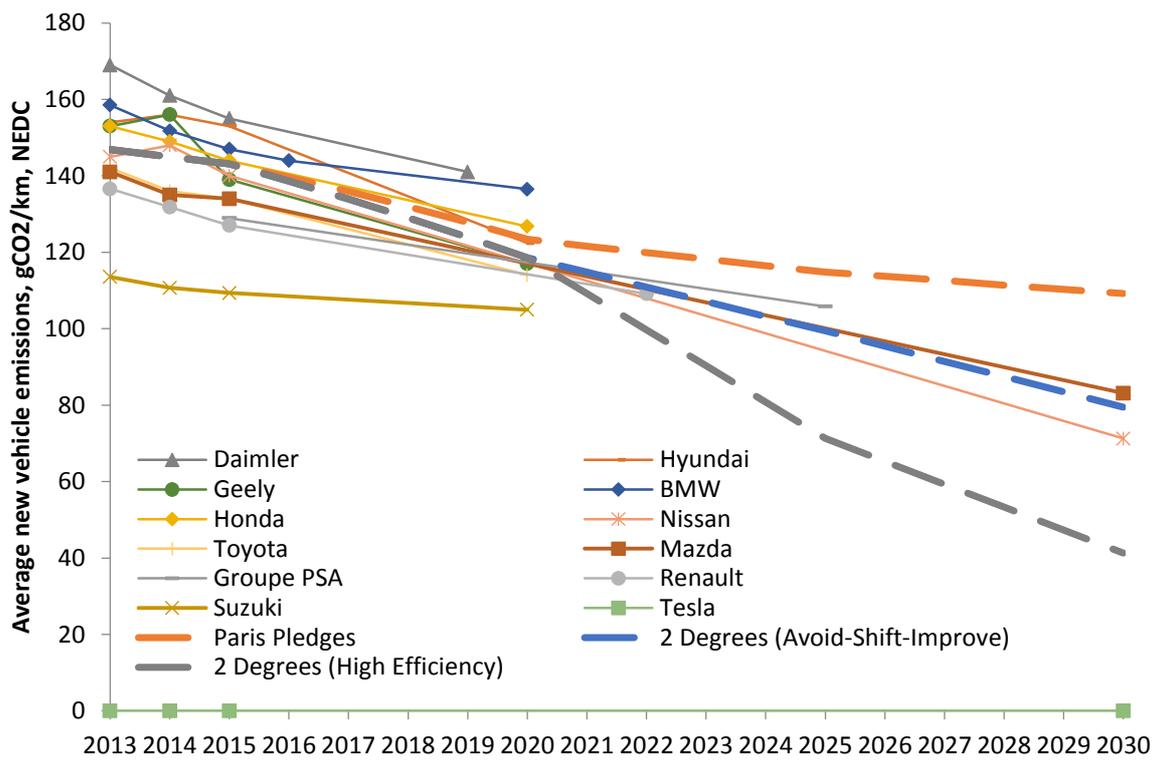


Table ES1 Carbon performance of world's top 20 automobile manufacturers

Company	New vehicle average carbon emissions (gCO ₂ /km, NEDC)							
	2013	2014	2015	2019	2020	2022	2025	2030
BMW	159	152	147	138	137			
Brilliance	174	171	157					
Daimler	169	161	155	141				
Ferrari	No data							
Fiat Chrysler	176	182	170					
Ford	156	155	156					
Geely	153	156	139	121	117			
General Motors	168	166	165					
Groupe PSA			129	120	117	113	106	
Honda	153	149	144	130	127			
Hyundai	154	156	153	129	122			
Kia	154	160	157					
Mazda	141	135	134	120	117	110	100	83
Nissan	145	148	140	117	112	102	89	71
Renault	137	132	127	117	114	109		
Subaru	160	160	157					
Suzuki	114	111	109	106	105			
Tesla	0	0	0	0	0	0	0	0
Toyota	142	136	134	118	114			
Volkswagen	152	148	144					
2 Degrees (Avoid-Shift-Improve)	147	145	143	124	119	111	99	80
2 Degrees (High Efficiency)	147	145	143	124	119	100	71	41
Paris Pledges	147	145	143	128	123	120	115	109
Key	Aligned with 2C (High Efficiency)		Aligned with 2C (Avoid-Shift-Improve)		Aligned with Paris Pledges		Not aligned	

Figure ES2 Fleet emissions paths for companies with targets



1. INTRODUCTION

1.1. The Transition Pathway Initiative

The TPI is a global, asset owner-led initiative, supported by asset owners and managers with over £5/\$6.5 trillion of assets under management. The TPI aims to evaluate what the transition to a low-carbon economy looks like for companies in high-impact sectors, such as coal mining, electricity, oil and gas, steel and automobiles, and to assess how well-prepared companies in these sectors are for the transition to a low-carbon economy. Companies are analysed in two ways:

1. *Management Quality*: TPI evaluates and tracks the quality of companies' governance/management of their greenhouse gas emissions and of risks and opportunities related to the low-carbon transition. Companies are assigned to one of five levels, from level 0 ("Unaware of, or not Acknowledging, Climate Change as a Business Issue") to level 4 ("Strategic Assessment"), based on how they perform against 14 criteria.
2. *Carbon Performance*: TPI also evaluates how companies' recent and future carbon performance might compare to the international targets and national pledges made as part of the Paris Agreement.

TPI publishes the results of its analysis through an open online tool hosted by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics (LSE): <http://www.transitionpathwayinitiative.org>. TPI encourages investors to use the data, indicators and online tool to inform their investment research, decision-making, engagement with companies, proxy voting and dialogue with fund managers and policy makers, bearing in mind the Disclaimer that can be found in Section 5.

1.2. About this report and the companies assessed

This report discusses the results of the TPI assessment of the management quality and carbon performance of the world's 20 largest automobile manufacturing companies, selected on the basis of market capitalisation. The companies that it assesses are set out in Table 1.

The results of the assessment are also available to browse on the TPI's online toolkit, at <http://www.transitionpathwayinitiative.org>. This report provides a more detailed analysis of the results, as well as a commentary.

Table 1 Automobile manufacturers covered in this report, further details

Company	Country	Investibility-weighted ¹ market capitalisation (USD millions)
BMW	Germany	32,678
Brilliance	China	7,976
Daimler	Germany	76,757
Ferrari	Italy	14,304
Fiat Chrysler	Italy	19,596
Ford	United States	46,026
Geely	China	14,365
General Motors	United States	52,056
Groupe PSA	France	10,312
Honda	Japan	53,345
Hyundai	South Korea	17,859
Kia	South Korea	6,853
Mazda	Japan	8,537
Nissan	Japan	19,831
Renault	France	16,731
Subaru	Japan	22,074
Suzuki	Japan	22,145
Tesla	United States	45,517
Toyota	Japan	157,211
Volkswagen	Germany	30,150

¹ Using free-float methodology, as of 25 September 2017.

2. AN OVERVIEW OF THE METHODOLOGY

2.1. Management quality²

In practice, companies tend to implement their carbon management systems and processes in a relatively staged and structured manner. They often start by publicly acknowledging the relevance of climate change to their business and developing a high-level policy or statement. They then tend to set some relatively short-term, process-oriented targets, before progressively extending the duration and stringency of their targets, and defining these in a more precise, quantitative way. A similar phenomenon is often seen in reporting: companies tend to start by reporting on the operational (or Scope 1 and 2) carbon emissions from part of their business, and then progressively extend this reporting to apply to more of the business and, in time, to cover some of the emissions from their supply chains and from the use of their products (Scope 3 emissions).

Accordingly, TPI's management quality framework tracks the progress of companies through the following five levels:

- **Level 0 – Unaware of (or not Acknowledging) Climate Change as a Business Issue.**
- **Level 1 – Acknowledging Climate Change as a Business Issue:** the company acknowledges that climate change presents business risks and/or opportunities, and that the company has a responsibility to manage its greenhouse gas emissions. This is often the point where companies adopt a climate change policy.
- **Level 2 – Building Capacity:** the company develops its basic capacity, its management systems and processes, and starts to report on practice and performance.
- **Level 3 – Integrated into Operational Decision-Making:** the company improves its operational practices, assigns senior management or board responsibility for climate change and provides comprehensive disclosures on its carbon practices and performance.
- **Level 4 – Strategic Assessment:** the company develops a more strategic and holistic understanding of risks and opportunities related to the low-carbon transition and integrates this into its business strategy and capital expenditure decisions.

Some companies are still at an early stage of establishing carbon management and reporting processes, whereas others have assessed the resilience of their businesses and business models to a range of future low-carbon scenarios, published details of their low-carbon energy research and development (R&D) and investment strategies, and aligned their strategic key performance indicators (KPIs) on climate change and their executive incentives. Companies can move both up and down levels; for example, if the threat of carbon regulation or taxation recedes, companies may assign a lower priority to efforts to reduce emissions or improve energy efficiency.

Fourteen criteria are used to map companies on to the 5 levels of the TPI management quality framework (see Table 2 and Appendix 1 for more detail). Answers to the 14

² A fuller description of the methodology is provided in Sullivan, R., Dietz, S., Garcia-Manas, C., Matthews, A. and Ward, F. (2017), *Methodology and Indicators Report. Version 1.0.* 11 January 2017 (Transition Pathway Initiative, London, UK), <http://www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2017/01/Methodology.pdf>

questions are based on data provided by FTSE Russell, specifically the data and indicators it uses to develop its ESG Ratings.³ These data are based on public disclosures by the companies themselves, which encourages companies to provide a better account of how they manage climate change, and ensures that companies are assessed consistently. Improved company disclosures on climate change are a core objective of TPI.

Table 2 TPI management quality indicators

Level 0: Unaware of (or not Acknowledging) Climate Change as a Business Issue	
Question 1	Does the company acknowledge climate change as a significant issue for the business? (Yes/No) If the company does not acknowledge climate change as a significant issue for the business, it is considered to be at Level 0.
Level 1: Acknowledging Climate Change as a Business Issue	
Question 2	Does the company explicitly recognise climate change as a significant issue for the business? (Yes/No)
Question 3	Does the company have a policy (or equivalent) commitment to action on climate change? (Yes/No)
Level 2: Building Capacity	
Question 4	Has the company set energy efficiency or relative or absolute greenhouse gas emission reduction targets? (Yes/No)
Question 5	Has the company published information on its operational (Scope 1 and 2) greenhouse gas emissions? (Yes/No)
Level 3: Integrated into Operational Decision-Making	
Question 6	Has the company nominated a board member or board committee with explicit responsibility for oversight of the climate change policy? (Yes/No)
Question 7	Has the company set quantitative relative or absolute targets for reducing its operational greenhouse gas emissions (Scope 1 and/or 2)? (Yes/No)
Question 8	Does the company report on Scope 3 emissions? (Yes/No)
Question 9	Has the company had its operational (Scope 1 and 2) greenhouse gas emissions data verified? (Yes/No)
Question 10	Does the company support domestic and international efforts to mitigate climate change? (Yes/No)
Level 4: Strategic Assessment	
Question 11	Has the company reduced its total operational (Scope 1 and 2) greenhouse gas emissions over the past 3 years? (Yes/No)
Question 12	Does the company provide information on the business costs – for example, capital investments, costs of carbon permits – associated with climate change? (Yes/No)
Question 13	Has the company set long-term relative or absolute targets for reducing its operational greenhouse gas emissions (Scope 1 and/or 2)? (Yes/No)
Question 14	Has the company incorporated environmental, social and governance issues into executive remuneration? (Yes/No)

³ For further information see <http://www.ftse.com/products/downloads/ESG-ratings-overview.pdf?800>.

With the exception of Level 0, companies need to be assessed as Yes on all of the questions on a level before they can advance to the next level. For example, in order to be on Level 3, companies need to score Yes on each of Questions 1 to 5. Similarly, in order to be on Level 4, companies need to score Yes on each of Questions 1 to 10.

2.2. Carbon performance⁴

TPI's carbon performance assessment is based on the Sectoral Decarbonization Approach (SDA).[1] The SDA translates greenhouse gas emissions targets made at the international level (e.g. under the Paris Agreement) into appropriate benchmarks, against which the performance of individual companies can be compared.

As the name suggests, the SDA takes a sector-by-sector approach, comparing companies within each sector against each other and against sector-specific benchmarks, which establish the performance of an average company that is aligned with international emissions targets.

In each sector, TPI evaluates companies against two benchmark paths:

1. A **2 Degrees scenario**, which is consistent with the overall aim of the Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels".[2]
2. A **Paris Pledges scenario**. The Paris Agreement also incorporates emissions reduction pledges by individual countries, called Nationally Determined Contributions (NDCs). There is variation in the ambition of countries' NDCs.[3] On aggregate, they are forecast to reduce global emissions well below business as usual (assuming they are fully implemented), but they are currently insufficient to put the world on a path to limit warming to 2°C.[4]–[6]

For both benchmark paths, the key inputs to the SDA are:

- A time path of carbon emissions;
- A breakdown of this economy-wide emissions path into emissions from key sectors (the numerator of sectoral emissions intensity), including the sector in focus;
- Consistent estimates of the time path of physical production from, or economic activity in, these key sectors (the denominator of sectoral emissions intensity).

A central feature of automobile manufacturing is that the majority of the sector's lifecycle emissions, of the order of three quarters,⁵ originate downstream from fuel combustion as the vehicles that have been manufactured and sold are driven (these emissions are categorised as "use of sold products", a subset of Scope 3 emissions).

Therefore it is more appropriate to measure companies according to the performance of their vehicles than it is according to the operational emissions involved in manufacturing (i.e. companies' Scope 1 and 2 emissions). This is in contrast to other sectors TPI has assessed, such as cement, electricity and steel, where most lifecycle emissions belong to

⁴ The methodology followed in assessing the carbon performance of automobile manufacturers is described in detail in a separate report, "Carbon Performance Assessment of Automobile Manufacturers: Note on Methodology", which is also available on the TPI website. Therefore we will only provide a condensed version here.

⁵ Source: ICCT.

Scopes 1 and 2. New vehicles are also the most appropriate focus, as existing stock usage is not normally within the scope of influence of manufacturers' sustainability policies.

It has thus been suggested that a suitable measure of carbon performance in the automobile manufacturing sector is the **average emissions intensity of a company's fleet of new vehicles**.^[7] This is the approach being followed by TPI.

TPI's benchmark paths for fleet emissions are based on research by the International Council on Clean Transportation (ICCT), in particular the outputs from its Roadmap model of global transportation.^[8] Roadmap provides detailed, integrated modelling of emissions and activity for different modes of transportation.

For each scenario, Roadmap provides a pathway for lifecycle (known as Well-to-Wheel) emissions from Light Duty Vehicles (LDVs), including passenger cars specifically, as well as the level of use of these vehicle classes in terms of distance travelled. The scope of TPI's analysis is limited to passenger cars, due to the greater availability of manufacturer data on this subset of LDVs. Roadmap also incorporates a model of the stock of vehicles in use at any point in time, which can be used to assess the emissions intensity of new vehicles specifically, which is what is required for carbon performance assessment.⁶

In order to ensure the benchmarks are comparable with data on fleet emissions intensity commonly reported by manufacturers, the precise measure of fleet emissions intensity that TPI uses is Tank-to-Wheel CO₂ emissions per kilometre. In order to obtain this measure using output from the Roadmap model, the following conversions are necessary:

- Well-to-Wheel emissions are converted to Tank-to-Wheel emissions using ICCT data.
- Tank-to-Wheel emissions based on real-world driving conditions are converted into equivalent emissions in test-cycle conditions, using detailed analysis from ICCT showing that nowadays real-world emissions exceed test-cycle emissions by a significant margin, which varies depending on the precise test cycle.^[9] TPI uses the New European Driving Cycle (NEDC) as the common basis for comparison.

There are in fact two variants of our 2 Degrees scenario, reflecting an important but contentious assumption in modelling emissions from the transportation sector:

- The **2 Degrees (High Efficiency)** scenario assumes that emissions reductions associated with the use of passenger cars are achieved mainly by improving the carbon efficiency – reducing the emissions intensity – of new cars, resulting in a global average emissions intensity of new passenger cars of just 41 grams of CO₂ per kilometre in 2030. This is more than 70% below the 2015 level, but is technically feasible, consistent with policy commitments in some regions, such as the EU and India, and it is forecast to be achievable at a tolerable cost.^[10]
- The **2 Degrees (Avoid-Shift-Improve)** scenario, by contrast, assumes that emissions reductions associated with road transportation are delivered through a mixture of measures that place relatively more emphasis on avoiding the need for travel altogether (Avoid) and shifting to more energy-efficient modes of travel

⁶ We verified that emissions from passenger cars and LDVs in the Roadmap model scenarios are consistent, in terms of cumulative emissions from 2015 to 2050, with the scenarios provided by the International Energy Agency (IEA),^[11] which TPI has used to derive benchmark pathways in other sectors. Doing so ensures the economy-wide carbon budget is not exceeded once automobile manufacturing is included.

(Shift), compared with improving vehicle carbon efficiency (Improve). In this variant, the global average emissions intensity of new passenger cars is 80 gCO₂ / km in 2030.

To estimate the global-average emissions intensity of manufacturers' fleets today, TPI combines regulatory data on test results for new cars in different jurisdictions with individual companies' regional sales figures. Emissions or fuel economy data for new car registrations are published by regulators in the EU, US and China. These data are often published by companies too, in their annual reports, sustainability reports, or CDP disclosures, in some cases complemented by coverage of other jurisdictions. Sales data are published by companies in annual reports, sales reports, or CDP disclosures. For other regions where companies report sales, we estimate new vehicle emissions based on historical average emissions per kilometre in those regions relative to vehicles in the EU and US.

To estimate future emissions intensity, we use quantitative targets companies have set to reduce the emissions of their new cars.

2.3. Quality assurance

Both TPI's management quality and carbon performance assessments are subject to internal quality assurance, as well as a company review stage, in which all companies are contacted with a draft of TPI's assessment and invited to check the veracity of the disclosed data being used, as well as being requested to answer specific queries in some cases. The process is described in more detail in the TPI Methodology and Indicators Report.⁷ The underlying data used in the management quality assessment are also subject to quality assurance by the provider, FTSE Russell.

Twenty companies in the automobile sector were contacted by TPI on 19th December 2017 with a draft of their assessment, and given until 23rd January 2018 to respond. In total, 8 out of 20 companies responded, as a result of which the assessments of 3 companies changed.

⁷ Sullivan, R., Dietz, S., Garcia-Manas, C., Matthews, A. and Ward, F. (2017), *Methodology and Indicators Report. Version 1.0*. 11 January 2017 (Transition Pathway Initiative, London, UK), <http://www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2017/01/Methodology.pdf>

3. FINDINGS

3.1. Management quality

3.1.1. Overview

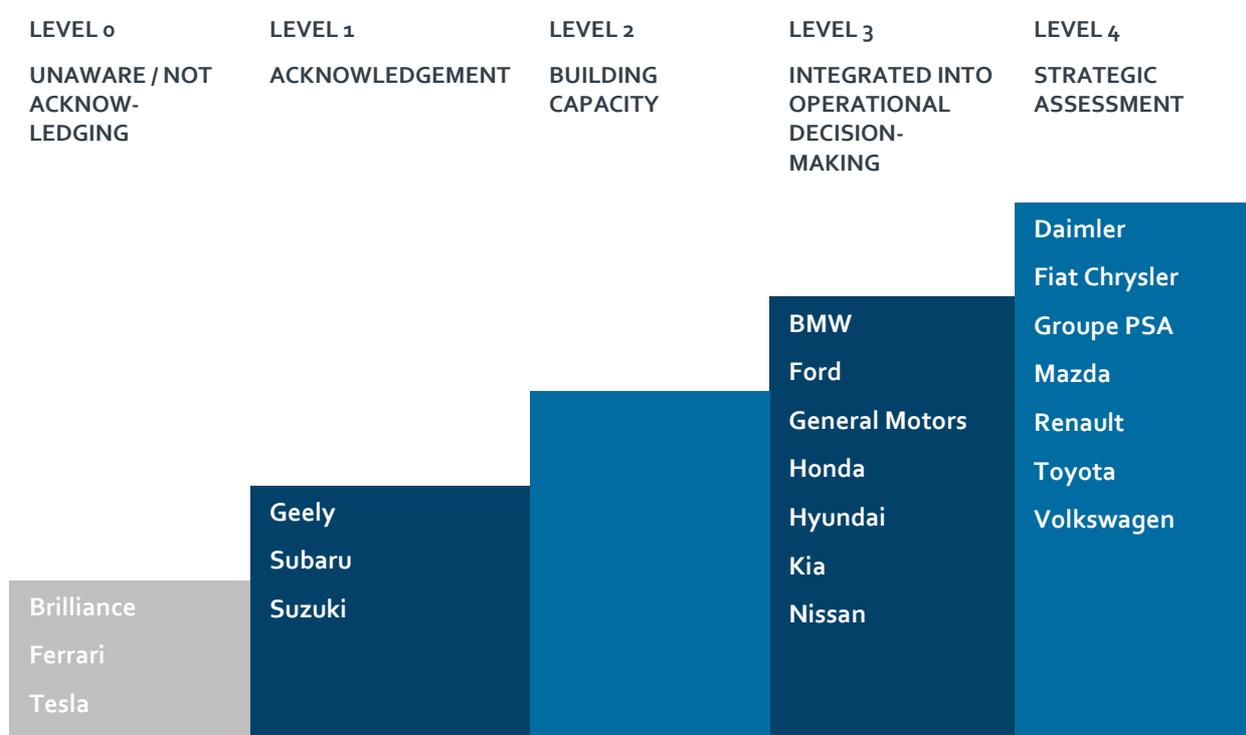
Figure 1 shows where the 20 automobile manufacturers sit on the management quality framework. Readers may refer to Appendix 2 for a question-by-question assessment of each company.

Three companies are assessed as being “Unaware of (or not Acknowledging) Climate Change as a Business Issue” (Level 0): Brilliance, Ferrari and Tesla. This means they do not have any of the following:

- A policy or an equivalent statement committing them to take action on their greenhouse gas emissions;
- A formal statement recognising climate change and its potential impacts as a significant or material issue for their business;
- Time-specific targets, even qualitative, relating to energy efficiency or relative or absolute greenhouse gas emissions; or
- Disclosures on their operational greenhouse gas emissions.

Tesla’s poor rating on management quality contrasts sharply with its best possible carbon performance (see below). Its poor rating on management quality is the direct consequence of an absence of appropriate climate change disclosures.

Figure 1 Management quality of the world's top 20 automobile manufacturers



Three companies are assessed as “Acknowledging Climate Change as a Business Issue” (Level 1): Geely, Subaru and Suzuki. As Appendix 2 shows, all 3 of these companies have a published policy or statement on climate change, which commits them to addressing the

issue or to reducing or avoiding their impact on climate change. However, none of them is assessed as formally recognising climate change and its potential impacts as a significant or material issue for the business. There are no companies on Level 2, defined as “Building Capacity”.

Seven companies are on Level 3, where climate change has been “Integrated into Operational Decision-Making”: BMW; Ford; General Motors; Honda; Hyundai; Kia; and Nissan. As Level 3 companies, these automobile manufacturers all publish information on their operational emissions, and have all set time-specific targets for improving their energy efficiency or reducing their emissions. In addition, all 7 have set quantitative targets to reduce their operational emissions, 6 out of 7 report on their Scope 3 emissions, 6 out of 7 have had their operational emissions data verified, and 5 out of 7 are assessed as supporting domestic and international efforts to mitigate climate change. However, only Ford and Hyundai have assigned explicit board responsibility for oversight of the climate change policy.

A further **seven** companies are on Level 4, meaning they have reached the stage of “Strategic Assessment” of climate change: Daimler; Fiat Chrysler; Group PSA; Mazda; Renault; Toyota; and Volkswagen. Reaching Level 4 means that these companies have assigned board responsibility for climate change, set quantitative targets for their operational emissions, had their operational emissions data verified, report on their Scope 3 emissions, and demonstrate support for domestic and international efforts to mitigate climate change. In addition, all 7 have set long-term targets for reducing their operational emissions, 4 out of 7 have achieved reductions in their total operational emissions over the past 3 years, 5 out of 7 provide information on the business costs associated with climate change, and 5 out of 7 have incorporated environmental, social and governance issues into executive remuneration. Only one company, Daimler, fulfils all these criteria.

The average level-score of all 20 automobile manufacturers is 2.6. There is a cluster of 6 companies on Levels 0 and 1, and 14 companies on Levels 3 and 4.

3.1.2. Scores against individual criteria

Figure 2 looks at how the 20 automobile manufacturers as a whole perform against the 14 individual criteria/questions (details in Appendix 2). It helps us identify areas of strength and weakness across all companies.

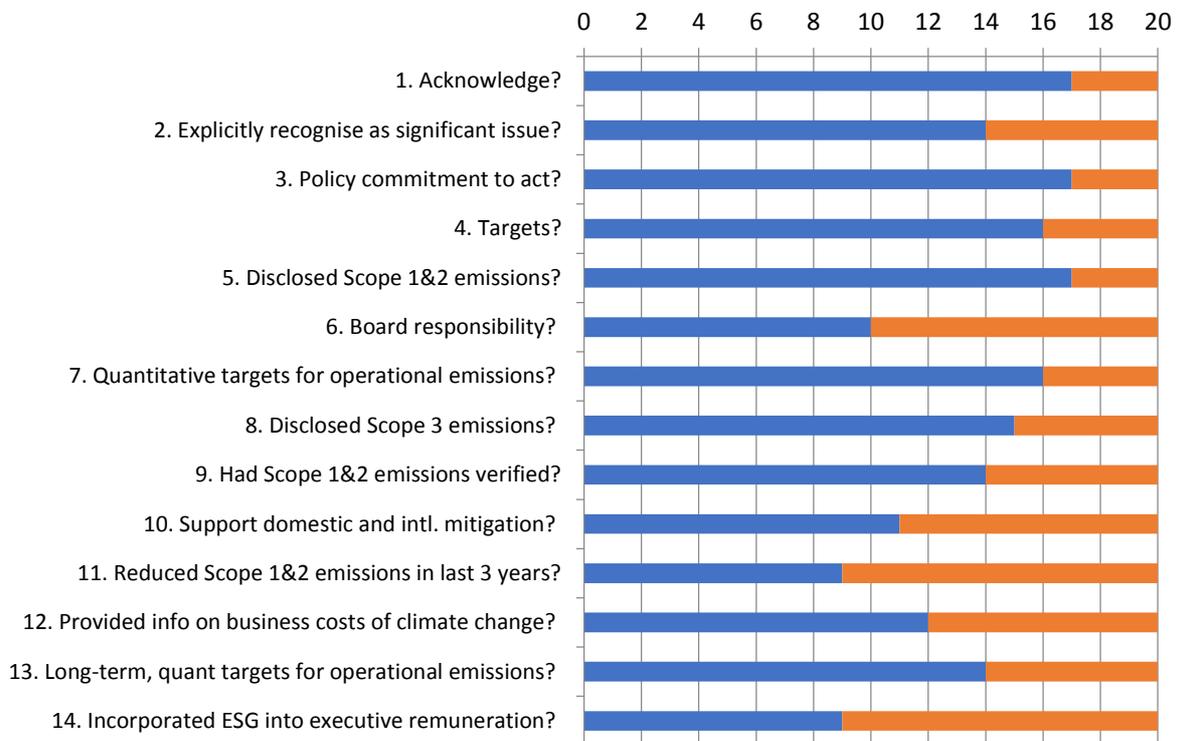
Results for the automobile sector display a similar pattern to other sectors whose management quality has been assessed by TPI at the time of writing,⁸ insofar as a majority of companies satisfy the criteria on Levels 0 to 2, particularly acknowledging climate change as a significant issue (i.e. question 1), and having a policy (or equivalent) commitment to action on climate change (question 3). Seventeen of the 20 companies assessed also disclose information on their Scope 1 and 2 emissions (question 5).

Performance against the more demanding Level 3 and 4 criteria is naturally weaker. However, it is still strong in comparison with other sectors that TPI has assessed. At least half of the automobile manufacturers satisfy each criterion, with two exceptions: whether

⁸ Besides the 20 automobile manufacturers assessed in this particular report, TPI has also assessed the management quality of the global top 20 coal mining companies, electricity utilities, steel makers, and oil and gas producers, and the global top 19 cement producers, and paper producers. These data can be viewed at <http://www.lse.ac.uk/GranthamInstitute/tpi/the-toolkit/>

the company reduced total Scope 1 and 2 emissions over the previous 3 years (question 11), and whether ESG issues are incorporated into executive remuneration (question 14). Performance in the automobile sector is comparatively strong on issues such as having long-term quantitative targets for operational emissions (question 13) and providing information on the business costs of climate change (question 12).

Figure 2 Number of companies scoring Yes (blue) against individual questions, and No (red)



3.1.3. Comparison with other sectors

Since the beginning of 2017, TPI has assessed the management quality of 138 companies across 7 high-impact sectors:

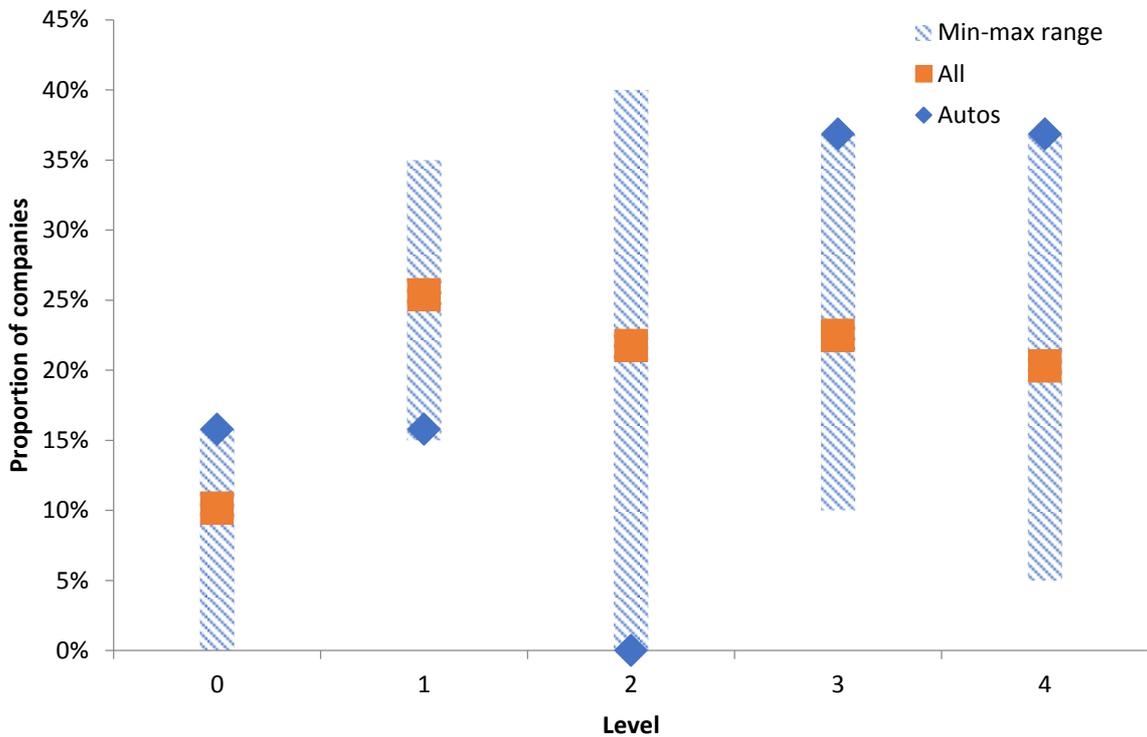
- In the electricity utilities sector, TPI's assessment of which was launched in January 2017, there were no Level 0 companies, there were 10 companies on Levels 3 or 4, and the average score for the sector was a relatively impressive 2.6.
- In the oil and gas sector, also launched in January 2017, there was one Level 0 company, there were 5 companies on Levels 3 or 4, and the average score for the sector was 2.0.
- In the coal mining sector, the assessment of which was released in July 2017, there were 3 companies on Level 0, 7 companies on Levels 3 or 4, and the average score for the sector was 2.1. There was also a stark difference in the coal mining sector between the performance of the diversified miners (average score 3.8) and the coal mining specialists (average score of 1.3).
- In the cement sector, TPI's assessment of which was launched in September 2017, there were 3 companies on Level 0, 9 companies on Levels 3 and 4, and the sector's average score was 2.1.
- In the steel sector, also launched in September 2017, there were 2 companies on Level 0, 6 companies on Levels 3 or 4, and the sector's average score was 1.8.

- In the paper sector, TPI's assessment of which is being launched at the same time as this assessment of the automobile sector, there are 2 companies on Level 0, 9 on Levels 1 and 2, and 8 on Levels 3 and 4. The sector's average score is 2.1.

Figure 3 compares the share of automobile manufacturers on each level with the overall share of all 138 companies on each level. It also shows the range from the minimum share of companies on a level in any sector, to the maximum.

Not only do automobile manufacturers perform better on average, more automobile manufacturers are on Levels 3 and 4 than in any other sector. But this is also true of Level 0, illustrating that our sample of 20 automobile manufacturers falls into two distinct clusters on management quality, reminiscent of coal mining.

Figure 3 Comparison of management quality in automobile manufacturing with other sectors



3.2. Carbon performance

3.2.1. Data availability

TPI's historical data on carbon performance are based on regulatory data on emissions test results for new cars in different jurisdictions, chiefly the EU, US and China, combined with individual companies' regional sales figures. To estimate future carbon performance, we use quantitative targets companies have set to reduce the emissions of their new cars. Table 3 summarises the availability of data.

Table 3 Publicly disclosed information on company emissions intensity and targets

Company	Country	2013-15 emissions intensity coverage?	Quantitative emissions target
BMW	Germany	Yes	2020
Brilliance	China	Yes	
Daimler	Germany	Yes	2019
Fiat Chrysler	Italy	Yes	
Ford	United States	Yes	
Ferrari	Italy	No	
Geely	China	Yes	2020
General Motors	United States	Yes	
Groupe PSA	France	Yes	2025
Honda	Japan	Yes	2020
Hyundai	South Korea	Yes	2020
Kia	South Korea	Yes	
Mazda	Japan	Yes	2030
Nissan	Japan	Yes	2030
Renault	France	Yes	2022
Subaru	Japan	Yes	
Suzuki	Japan	Yes	2020
Tesla	United States	Yes	2030
Toyota	Japan	Yes	2020
Volkswagen	Germany	Yes	

We can provide recent and current carbon performance data on **19 out of 20** companies. We have not been able to profile Ferrari due to a lack of available emissions data for a sufficiently high proportion of new vehicle sales.⁹ We can estimate performance beyond 2015 for a total of **12** companies, and beyond 2020 for **5** companies.

Some targets set by companies cannot be used in our analysis, even though they may imply or require falling new vehicle carbon emissions. This is the case if a company sets a target

⁹ Vehicle emissions or fuel efficiency data are not available for sales outside the EU and China, while sales breakdowns specify that only 8% of sales were in China and 45% in Europe, the Middle East and Africa in 2016.

that covers total emissions from vehicle usage, but does not supply sufficient information for per vehicle reductions to be calculated. This is the case for Volkswagen. Alternatively, some companies have set targets for reducing emissions from new vehicles relative to the models they replace. This is the case for Fiat Chrysler's US sales. Lastly, General Motors has set targets by geography, but they do not cover a high enough proportion of expected sales, as the company's US target expired in 2016 and has not been renewed.

3.2.2. Overview of results

Table 4 summarises the automobile manufacturers' carbon performance data and also includes emissions intensity along the 2 Degrees and Paris Pledges benchmark pathways. A company whose emissions intensity is below the benchmarks can be said to be aligned with those benchmarks and therefore with the international commitments underpinning them. A company whose emissions intensity is above the benchmarks is not aligned.

Table 4 Company emissions intensity paths and automobile sector benchmarks, 2013-2030

Company	New vehicle average carbon emissions (gCO ₂ /km, NEDC)							
	2013	2014	2015	2019	2020	2022	2025	2030
BMW	159	152	147	138	137			
Brilliance	174	171	157					
Daimler	169	161	155	141				
Fiat Chrysler	176	182	170					
Ford	156	155	156					
Geely	153	156	139	121	117			
General Motors	168	166	165					
Groupe PSA			129	120	117	113	106	
Honda	153	149	144	130	127			
Hyundai	154	156	153	129	122			
Kia	154	160	157					
Mazda	141	135	134	120	117	110	100	83
Nissan	145	148	140	117	112	102	89	71
Renault	137	132	127	117	114	109		
Subaru	160	160	157					
Suzuki	114	111	109	106	105			
Tesla	0	0	0	0	0	0	0	0
Toyota	142	136	134	118	114			
Volkswagen	152	148	144					
2 Degrees (Avoid-Shift-Improve)	147	145	143	124	119	111	99	80
2 Degrees (High Efficiency)	147	145	143	124	119	100	71	41
Paris Pledges	147	145	143	128	123	120	115	109
Key	Aligned with 2C (High Efficiency)		Aligned with 2C (Avoid-Shift-Improve)		Aligned with Paris Pledges		Not aligned	

Between 2013 and 2015, **12 out of 19** companies had an emissions intensity¹⁰ that was higher than either the 2 Degrees or Paris Pledges benchmarks. The remaining 6 automobile manufacturers had an emissions intensity that was below the benchmarks. These companies, which were aligned during the period, are Groupe PSA, Mazda, Nissan, Renault, Tesla and Toyota.

On average, the 19 automobile manufacturers included had an emissions intensity of 142 gCO₂ / km over the period 2013 to 2015, which is below the benchmarks (see Figure 5).¹¹ Of the 19 companies, the average emissions intensity of the 12 companies with future targets was 130 gCO₂ / km, while the average of the 7 companies without targets was 161 gCO₂ / km. This suggests that the presence of future targets is associated with lower vehicle emissions intensity today, though this finding is sensitive to the inclusion of Tesla in the group of companies with targets. Without Tesla, the average emissions intensity of the remaining 11 companies with targets was 142 gCO₂ / km between 2013 and 2015.

There is wide variation in recent and current emissions intensity across the 19 companies, from a low of 0 gCO₂ / km (Tesla) to a high of 182 gCO₂ / km (Fiat Chrysler, 2014). New passenger cars in Chinese and US markets emit more CO₂ on average than their counterparts in Europe and some other markets, so companies with more exposure to these markets tend to sell vehicles with higher average emissions. Average vehicle size and the proportion of sales of different engine types are particularly significant as factors differentiating manufacturers' results. Vehicles in markets including Europe, Japan and India are on average smaller, while a higher proportion of European vehicles are powered by diesel engines, which emit less CO₂ than vehicles with petrol engines. Figure 4 plots emissions intensity paths for the 12 companies with quantitative targets for their future vehicle emissions that TPI could use to estimate carbon performance. The chart uses data from Table 4 and allows us to see more clearly whether companies' emissions intensities are aligned with the benchmarks in the future.

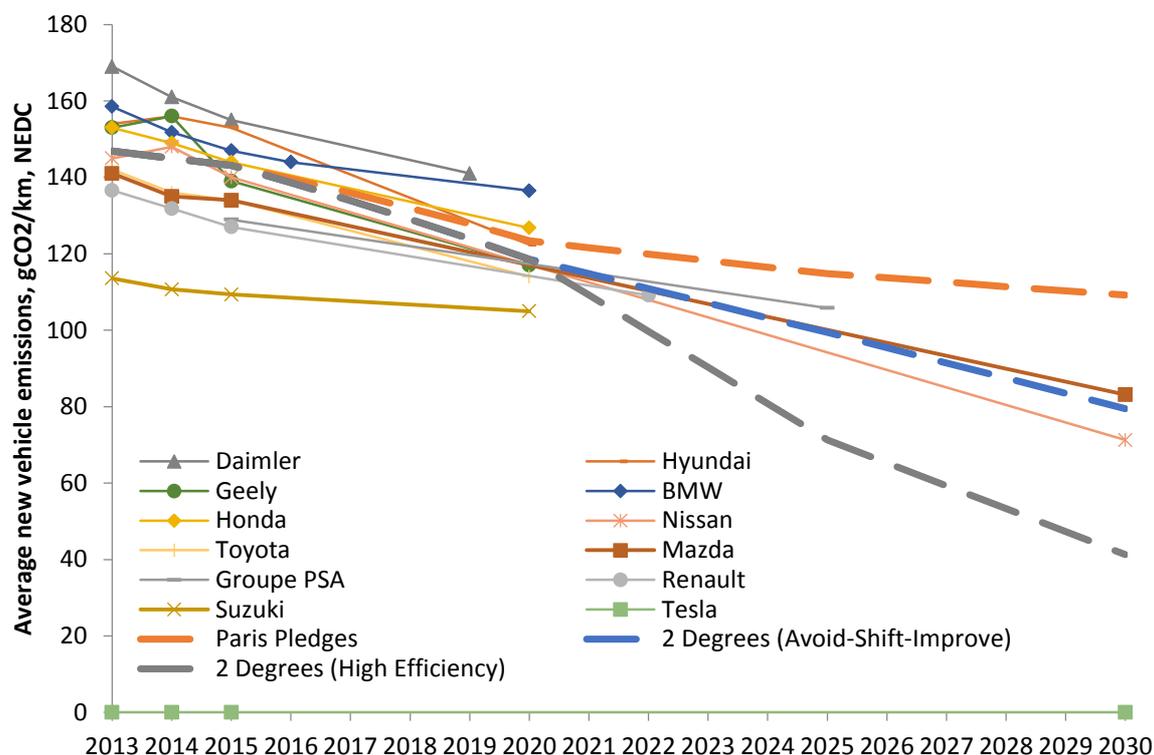
The benchmarks differ relatively little before 2020, at which point emissions intensity on the 2 Degrees benchmark is 4% lower than on the Paris Pledges benchmark. This is because what happens in the coming few years is largely driven by current regulations. New regulated vehicle targets are due in the EU and China after 2020 and in the US after 2025.

The two variations of the 2 Degrees benchmark diverge from each other after 2020. Emissions intensity on the Avoid-Shift-Improve pathway falls by 33% between 2020 and 2030, while on the High Efficiency pathway it falls by 65%. This divergence reflects the influence that slower increases in private vehicle usage can have on reducing total passenger car CO₂ emissions.

¹⁰ Calculated as the unweighted average of each company's emissions intensity between 2013 and 2015.

¹¹ This is the unweighted average emissions intensity across companies.

Figure 4 Emissions intensity paths for companies with targets



Assuming company targets are met, **8 out of 11** companies with targets extending to 2020 and beyond are aligned with the 2 Degrees benchmarks in 2020: Geely; Groupe PSA; Mazda; Nissan; Renault; Suzuki; Tesla; and Toyota. Hyundai is not aligned with either of the 2 Degrees benchmarks in 2020, but it is aligned with the Paris Pledges benchmark. Neither BMW nor Honda is aligned with any of the benchmarks in 2020. Daimler’s vehicle emissions target only extends to 2019, by which time it is also out of alignment with the benchmarks.

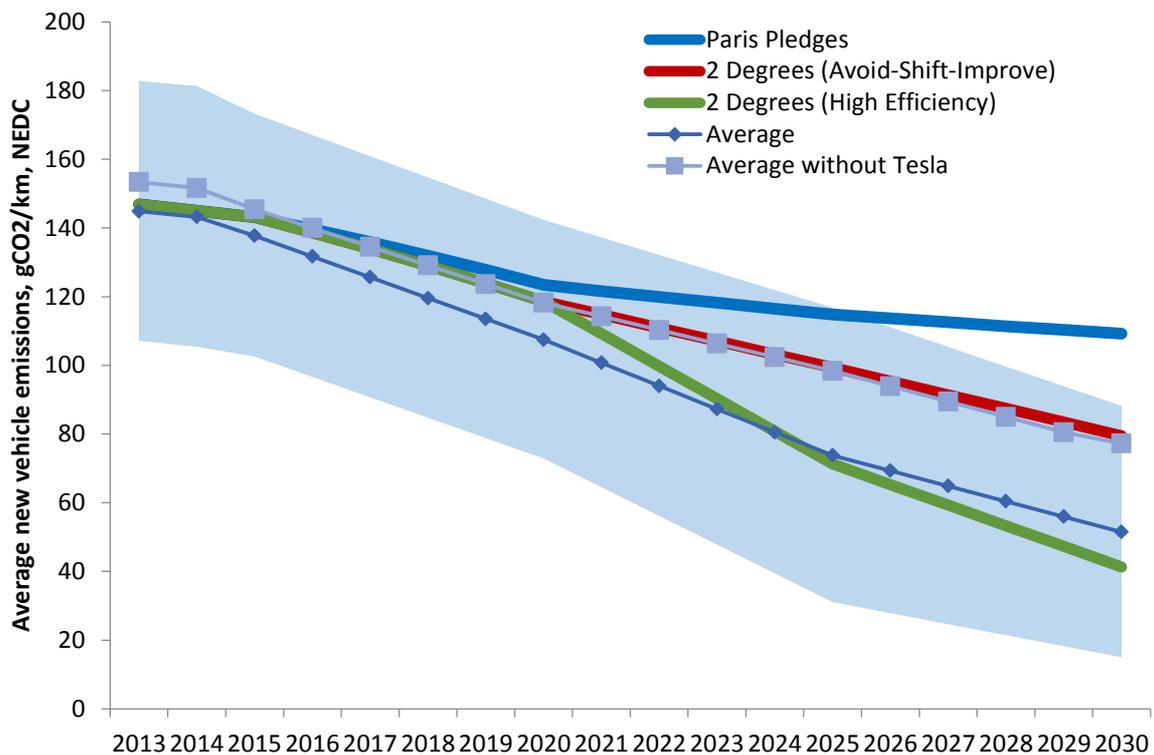
Only **3** companies have set targets extending to 2030. Of the 3, Tesla is aligned with the most demanding 2 Degrees (High Efficiency) benchmark, as it is committed to the production of electric vehicles only, Nissan is aligned with the less ambitious 2 Degrees (Avoid-Shift-Improve) benchmark, while Mazda is aligned with the Paris Pledges benchmark.

Figure 5 shows the average new vehicle emissions intensity of the car companies covered by TPI, with and without Tesla. Averages after 2015 are calculated on the basis of the pathways of companies that have set targets. The chart shows that the average new vehicle emissions intensity of the 11 companies with targets is aligned with the Paris Pledges benchmark throughout, and with both 2 Degrees benchmarks up to 2024. Thereafter the average is aligned with 2 Degrees (Avoid-Shift-Improve), but it does not fall fast enough to remain in alignment with 2 Degrees (High Efficiency).

However, because only 5 automobile manufacturers have targets extending beyond 2020, and because automobile manufacturers with targets also have, on average, lower vehicle

emissions intensity today, care must be taken in drawing broader conclusions. In particular, Tesla, which targets continued zero gCO₂ / km vehicle emissions, is an outlier that exerts a significant influence on the results. Figure 5 therefore also shows the potential industry pathway without Tesla. Average emissions intensity excluding Tesla is aligned with the Paris Pledges benchmark from 2021, but is never in alignment with either 2 Degrees benchmark.

Figure 5 Average emissions intensity of companies, with and without Tesla, including range +/-1 standard deviation for companies with data



3.2.3. Regional results

It is also valuable to analyse carbon performance on a regional basis. This is because the main automobile markets for which TPI has consistent, detailed information – the EU, US and China – vary significantly. This variation between markets drives important differences in global performance. Analysing regional performance thus provides granularity on companies' performance and insight into their global positioning.

Differences between regional markets are attributable to a range of factors, including consumer tastes, economic conditions including fuel prices, and regulation. The higher proportion of sales of more fuel efficient diesel cars in Europe is significant: diesel cars can emit up to 17% less CO₂ / km than their petrol equivalents (1) and make up 50% of sales in the EU. Regulation is also important. Automobile manufacturers must comply with fuel economy or average emissions standards in each market, facing fines per vehicle sold if their average for a given year exceeds them. These standards vary markedly: for passenger

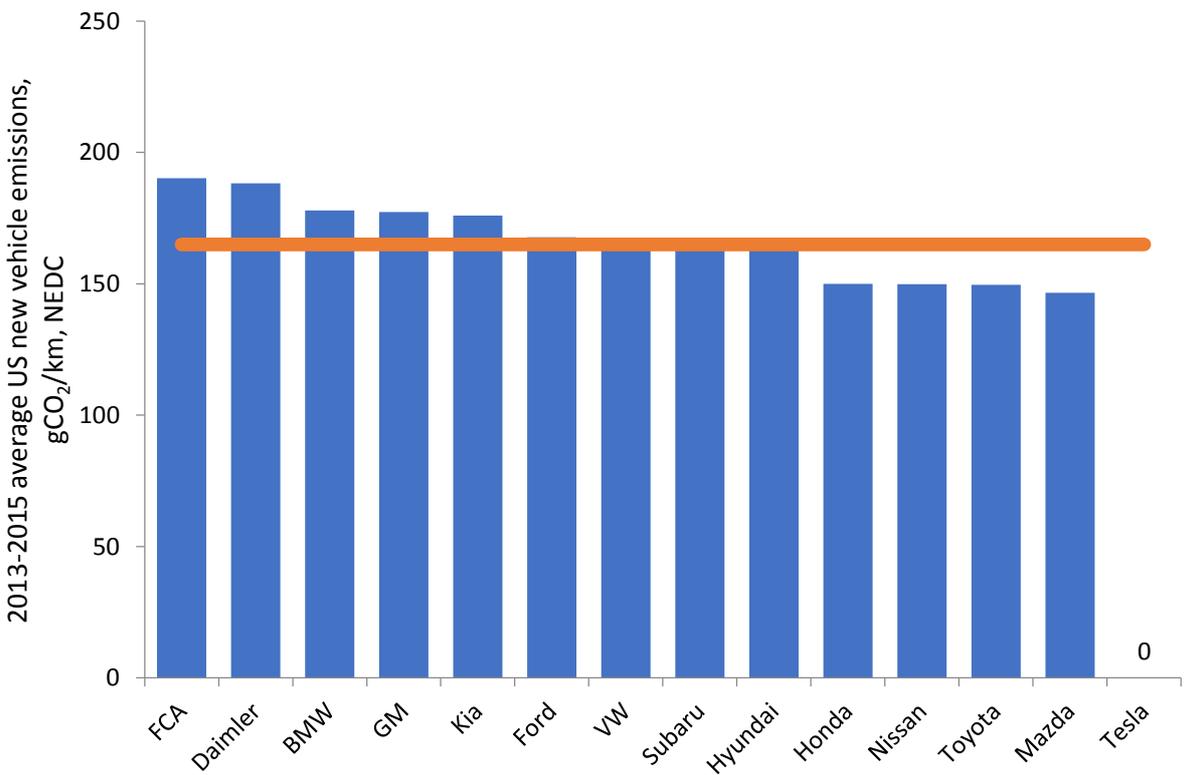
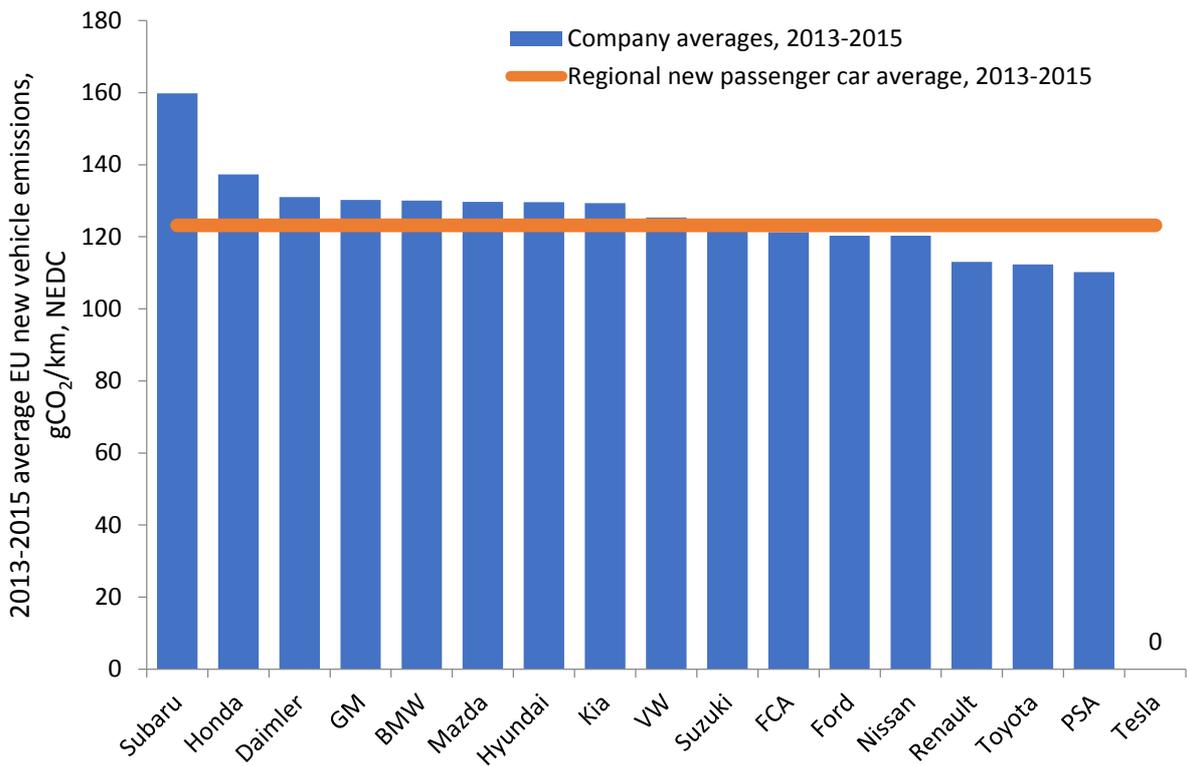
cars in 2015 for example, it was 130 gCO₂ / km in the EU, 161 gCO₂ / km in China and 154 gCO₂ / km (NEDC converted) in the US.¹²

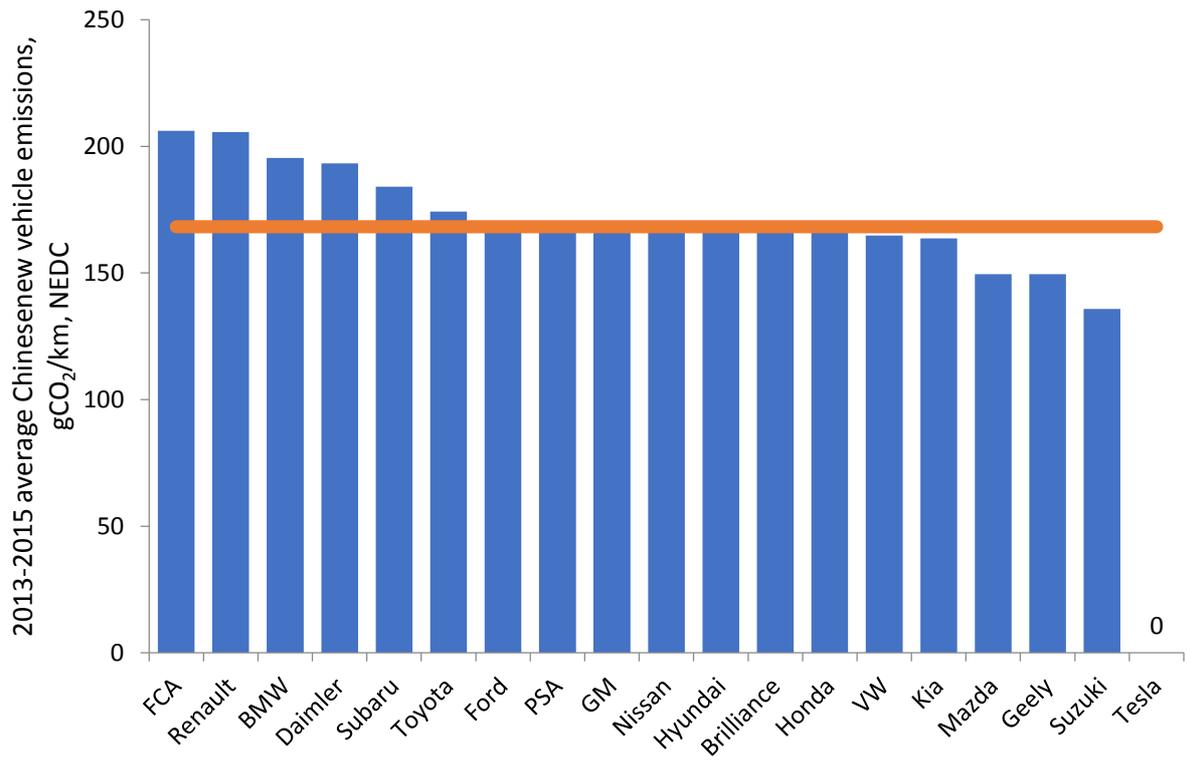
Figure 6 shows companies' historical carbon performance in the EU, US and China, along with regional averages. Since most companies with future emissions targets set them at the global level, regional breakdowns can only be provided for historical emissions. The analysis yields numerous insights, including:

- Groupe PSA and Renault have no sales in North America and sell relatively efficient cars in Europe, largely explaining their good global performance. In the case of Renault, European sales disguise the fact that its Chinese fleet is the second dirtiest and has an emissions intensity 82% higher than in the EU.
- Fiat Chrysler's European fleet has a lower-than-average emissions intensity (where most cars sold are Fiat models), but, unlike Groupe PSA and Renault, it has significant sales in the US, and here it has the least efficient fleet in the market (it also has the least efficient fleet in the Chinese market).
- Volkswagen's fleet emissions intensity is close to the average in each of the EU, US and Chinese markets, but, with an above-average 35% of sales in the EU, the company's global average emissions intensity is relatively low and it places sixth lowest in our sample of nineteen when assessed on the global level.
- Hyundai's regional profile is similar to Volkswagen, in that its fleet emissions intensity is close to the average in each of the three major markets. However, unlike Volkswagen, Hyundai has relatively lower sales in Europe and its global average fleet emissions are higher as a consequence.
- Geely is a mid-table performer at the global level, in terms of historical emissions intensity, but its only major exposure is to the Chinese market and Geely has the third cleanest fleet in China.
- Suzuki is the best-performing company in our sample besides Tesla. This is partly a result of sales of 50% and 25% in India and Japan respectively, where smaller cars are popular. However, it also benefits from not developing and selling higher-emissions models specifically for the Chinese and similar markets. Its Chinese fleet emits 19% less CO₂ / km than the national average.

¹² These limits are then applied to individual manufacturers taking into account factors such as vehicle weight (EU) and vehicle footprint (US). There is therefore some allowance in the application of limits for companies that produce larger cars. In the US, vehicles with a footprint of 55 square feet or more (5.1m²) are subject to a separate standard, which was 206 gCO₂ / km (NEDC converted) in 2015. In addition, special status is given to companies that are classified as selling in niche markets, allowing them higher emissions; e.g. Subaru and Ferrari in the EU.

Figure 6 Regional performance from 2013-15 for the EU (top), US (middle) and Chinese (bottom) markets





4. SUMMARY

4.1. Summary of the results

This report has assessed the management quality and carbon performance of the world's 20 largest publicly-listed automobile manufacturers.

Automobile manufacturers' average management quality score is 2.6, which, alongside electricity utilities, is the joint highest of the 7 sectors assessed by TPI so far. Automobile manufacturers perform particularly well, relative to other sectors, on issues such as having long-term quantitative targets for operational emissions, and providing information on the business costs of climate change.

The 20 companies assessed in this report divide into two clusters on management quality. Six companies are relatively poor performers. Of these, 3 companies are on Level 0 (Unaware of, or not Acknowledging, Climate Change as a Business Issue): Brilliance, Ferrari and Tesla. The other 3 companies are on Level 1 (Acknowledging Climate Change as a Business Issue): Geely, Subaru and Suzuki.

The other cluster of 14 companies rates highly on management quality; companies are on either Level 3 (Integrated into Operational Decision-Making) or Level 4 (Strategic Assessment). Seven companies are on Level 4: Daimler; Fiat Chrysler; Groupe PSA; Mazda; Renault; Toyota; and Volkswagen. Only Daimler satisfies all 14 criteria.

We also provide an in-depth assessment of the carbon performance of these automobile manufacturers. We profile companies on the basis of the CO₂ emissions performance of their fleets of new vehicles, because the majority of the sector's lifecycle emissions originate from fuel combustion in downstream automobile usage, rather than from manufacturing.

Seven out of the 19 automobile manufacturers disclosing sufficient data on new vehicle emissions have been aligned with the benchmarks over the period 2013 to 2016, meaning that their fleet emissions performance has been better than the benchmarks in recent years. They are: Groupe PSA; Mazda; Nissan; Renault; Suzuki; Tesla; and Toyota. The remaining 12 companies have not been aligned during this period.

We estimate companies' future carbon intensity on the basis of quantitative targets they have set themselves to reduce new vehicle emissions. A total of 12 out of 20 companies have set such targets, five of which extend beyond 2020. Consequently TPI has more data on future carbon performance in automobile manufacturing than it has in any other sector, although the picture remains incomplete.

Eight out of 11 companies are aligned with the 2 Degrees benchmarks in 2020: Geely; Groupe PSA; Mazda; Nissan; Renault; Suzuki; Tesla; and Toyota. The companies with the lowest-carbon fleets of all in 2020 are Tesla, which only makes electric vehicles, and Suzuki, which specialises in small, efficient vehicles for the Indian and Japanese markets.

Only 3 companies have targets extending to 2030. Of these, Tesla is aligned with both 2 Degrees benchmarks, Nissan is aligned with the less ambitious 2 Degrees (Avoid-Shift-Improve) benchmark, while Mazda is aligned with the Paris Pledges benchmark.

We provide a regional breakdown of historical emissions intensity, focusing on 3 main markets, the EU, US and China. Variation in company performance partly reflects the

geography of each company's sales. New passenger cars in Chinese and US markets emit more CO₂ on average than those sold in Europe and some other markets, so companies with more exposure to the former markets tend to sell vehicles with higher average CO₂ emissions per kilometre.

4.2. Limitations

The current version of TPI's management quality assessment framework was developed from October 2015 to December 2016. The development work involved: a comprehensive review of the literature, in particular to ensure alignment with existing initiatives and disclosure frameworks; piloting the indicators on a sample of 60 companies across 4 high-impact sectors (automobiles, diversified mining, electricity utilities, and oil and gas); and review by the TPI Steering Group, and by investment and climate change experts. The choice of indicators/questions and their ordering in the management quality framework are inevitably subjective, but the iterative process of research, testing and review just described was designed to make the framework as robust as possible. At present the breadth and depth of indicators is limited by the data FTSE Russell collected in their 2015-16 and 2016-17 research cycles, but enhancements to the 2017-18 FTSE Russell data set, building on the recommendations of Financial Stability Board's (FSB's) Task Force on Climate-related Financial Disclosures (TCFD), will provide TPI with the opportunity to extend and refine the management quality framework next year.

TPI's carbon performance assessment is subject to a number of limitations. Perhaps the most obvious of these is that, like any forward-looking exercise, the accuracy of the conclusions is limited by the accuracy of the projections.

TPI's projections could turn out to be inaccurate for two broad reasons. One is that the benchmarks turn out to be inaccurate, because reality turns out differently to what the ICCT's Roadmap model, allied with our assumptions, predicts. In addition, benchmarking in the automobile sector involves contestable assumptions about the degree to which the burden of emissions reductions falls on vehicle emissions, compared with slowing increases in private vehicle usage. This explains why we have two variants of our 2 Degrees benchmark in this sector.

The second is that the company emissions intensity paths turn out to be inaccurate. For 15 of the 19 companies profiled, data covering historical vehicle emissions are only available for vehicles sold in the EU, US and China (in 2 cases we also have data for Japan). Calculating carbon performance therefore requires estimation of vehicle emissions for sales in other markets. Estimating the future emissions intensity of companies' new vehicles usually involves a number of specific assumptions, which could turn out to be wrong. Moreover future estimates are based on company targets, which may be exceeded or overshot.

As a result of these caveats, it is clear that the closer a company is to a benchmark, the less confident we can be in conclusions regarding whether it is aligned or not. It is beyond the scope of this study to formally quantify the degree of confidence in the benchmarks.¹³

¹³ Without a random sample of companies, standard statistical measures of confidence cannot be applied.

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APPENDIX 1 TPI MANAGEMENT QUALITY INDICATORS

Level 0: Unaware of (or not Acknowledging) Climate Change as a Business Issue	
Question 1	Does the company acknowledge climate change as a significant issue for the business? (Yes/No)
Explanatory Notes	<p>Acknowledging climate change as a business issue is an important first step towards implementing a comprehensive approach to the low-carbon transition.</p> <p>Companies are assessed as Yes if they:</p> <ul style="list-style-type: none"> • Have a policy or an equivalent statement committing them to take action on their greenhouse gas emissions (e.g. to reduce emissions, to improve their energy efficiency); or • Have a formal statement recognising climate change and its potential impacts as a significant or material issue for their business; or • Have set energy efficiency or relative or absolute greenhouse gas emission reduction targets; or • Have published information on their operational (Scope 1 and 2) greenhouse gas emissions. <p>Companies are assessed as No if they do not meet any of these conditions.</p>
Level 1: Acknowledging Climate Change as a Business Issue	
Question 2	Does the company explicitly recognise climate change as a significant issue for the business? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they have a formal statement recognising climate change and its potential impacts as a significant or material issue for their business.
Question 3	Does the company have a policy (or equivalent) commitment to action on climate change? (Yes/No)
Explanatory Notes	<p>It is good practice for companies to formalise their approach to climate change in a policy (or equivalent document, such as a statement of guiding principles, a code of practice, or a sourcing charter). While the existence of a policy does not speak to the level of ambition or implementation, the absence of a policy is a clear sign that climate change is not on the business agenda.</p> <p>Companies are assessed as Yes if they have a published policy or commitment statement on climate change that commits them to addressing the issue or to reducing or avoiding their impact on climate change (e.g. to reduce emissions or improve their energy efficiency).</p>
Level 2: Building Capacity	
Question 4	Has the company set energy efficiency or relative or absolute greenhouse gas emission reduction targets? (Yes/No)
Explanatory Notes	<p>Objectives and targets are the point where policy commitments are translated into substantive action, and where resources and responsibilities are allocated for the delivery of these objectives and targets.</p> <p>Companies are assessed as Yes if they have time-specific targets, covering part or all of the business, to reduce energy consumption or</p>

	<p>greenhouse gas emissions. These can be process or performance targets, they can focus on energy or on greenhouse gas emissions, they can be expressed in qualitative or quantitative terms, and they can be expressed in relative or absolute terms.</p> <p>This question is intended to assess whether companies have started the target-setting process. Questions 7 and 13 ask more detailed questions about whether companies have set targets for the reduction of greenhouse gas emissions over the short and long term. Companies that are assessed as Yes on either of these questions (i.e. Questions 7 and 13) are also assessed as Yes on Question 4.</p>
Question 5	Has the company published information on its operational (Scope 1 and 2) greenhouse gas emissions? (Yes/No)
Explanatory Notes	<p>Companies are assessed as Yes if they report on their Scope 1 and 2, or their combined Scope 1, 2 and 3 emissions.</p> <p>Companies that only report Scope 1 emissions are assessed as No.</p> <p>Companies that report normalised emissions only are assessed as No.</p>
Level 3: Integrated into Operational Decision-Making	
Question 6	Has the company nominated a board member or board committee with explicit responsibility for oversight of the climate change policy? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they provide evidence of clear board or board committee oversight of climate change, or if they have a named individual/position responsible for climate change at board level.
Question 7	Has the company set quantitative relative or absolute targets for reducing its operational greenhouse gas emissions? (Yes/No)
Explanatory Notes	<p>Companies are assessed as Yes if they have set quantified targets to reduce operational (Scope 1 and/or 2) greenhouse gas emissions in relative or absolute terms.</p> <p>This question is more demanding than Question 4, as it is looking for companies to have set quantitative targets to reduce operational greenhouse gas emissions, at least in the short term (i.e. with a target year up to 5 years away). In contrast, Question 4 allows companies to set process targets (e.g. to take particular actions) and to focus these on energy or on greenhouse gas emissions.</p> <p>This question differs from Question 13, which asks whether companies have set targets for the reduction of operational greenhouse gas emissions in the long term (i.e. with a target year more than 5 years away). Companies that are assessed as Yes on Question 13 are also assessed as Yes on this question.</p>
Question 8	Does the company report on Scope 3 emissions? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they report on Scope 3 emissions separately, or if they provide a total for Scope 1, 2 and 3 emissions.
Question 9	Has the company had its operational greenhouse gas emissions data verified? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if their operational greenhouse gas emissions have been independently verified by a third party, or if they state

	the international assurance standard they have used and the level of assurance.
Question 10	Does the company support domestic and international efforts to mitigate climate change? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they demonstrate support for mitigating climate change through membership of business associations that are supportive, and if they have a clear company position on public policy and regulation.
Level 4: Strategic Assessment	
Question 11	Has the company reduced its total Scope 1 and 2 greenhouse gas emissions over the past 3 years?
Explanatory Notes	Companies are assessed as Yes if their total Scope 1 and 2 greenhouse gas emissions have reduced over the past 3 years. For companies that do not report a breakdown of Scope 1, 2 and 3 emissions, total Scope 1, 2 and 3 emissions are used in this calculation. Companies that do not report Scope 1 and 2 emissions are assessed as No, as are companies that report less than 3 years' data.
Question 12	Does the company provide information on the business costs – for example, capital investments, costs of carbon permits – associated with climate change? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they quantify the business costs associated with climate change.
Question 13	Has the company set long-term relative or absolute targets for reducing its operational greenhouse gas emissions? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they have set quantified long-term targets (i.e. with a target year more than 5 years away) to reduce operational (Scope 1 and/or 2) greenhouse emissions in relative or absolute terms. This question is more demanding than Question 7, as it looks for companies to have set long-term quantitative targets (i.e. that are more than 5 years in duration from start to end) to reduce operational greenhouse gas emissions. By contrast, Question 7 asks whether the company has set short-term targets (i.e. less than 5 years in duration).
Question 14	Has the company incorporated environmental, social and governance issues into executive remuneration? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if executive remuneration includes incorporates environmental, social and governance performance.

APPENDIX 2 DETAILED ASSESSMENT OF COMPANIES' MANAGEMENT QUALITY

Company	Level	Level 0	Level 1	Level 2	Level 3	Level 2	Level 3	Level 2	Level 3	Level 2	Level 3	Level 4	Level 4	Level 4	Level 4
		1. Does the company acknowledge climate change as a significant issue for the business?	2. Does the company explicitly recognise climate change as a significant issue for the business? 3. Does the company have a policy (or equivalent) commitment to action on climate change?	4. Has the company set energy efficiency or GHG emission reduction targets? 5. Has the company published information on its Scope 1 and 2 GHG emissions?	6. Has the company assigned explicit board responsibility for oversight of the climate change policy? 7. Has the company set quantitative targets for reducing its operational GHG emissions? 8. Does the company report on Scope 3 emissions?	9. Has the company had its Scope 1 and 2 GHG emissions data verified?	10. Does the company support domestic and international efforts to mitigate climate change?	11. Has the company reduced its total operational Scope 1 and 2 GHG emissions over the past 3 years? 12. Does the company provide information on the business costs associated with climate change? 13. Has the company set long-term targets for reducing its operational GHG emissions? 14. Has the company incorporated ESG issues into executive remuneration?							
BMW	3	Yes	Yes Yes	Yes Yes	No Yes Yes Yes Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Brilliance	0	No	No No	No No	No No No No No No	No	No	No	No	No	No	No	No	No	No
Daimler	4	Yes	Yes Yes	Yes Yes	Yes Yes Yes Yes Yes Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ferrari	0	No	No No	No No	No No No No No No	No	No	No	No	No	No	No	No	No	No
Fiat Chrysler	4	Yes	Yes Yes	Yes Yes	Yes Yes Yes Yes Yes Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Ford	3	Yes	Yes Yes	Yes Yes	Yes Yes Yes Yes Yes Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Geely	1	Yes	No Yes	No Yes	No No No No No No	No	No	No	No	No	No	No	No	No	No
General Motors	3	Yes	Yes Yes	Yes Yes	No Yes Yes Yes Yes Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Groupe PSA	4	Yes	Yes Yes	Yes Yes	Yes Yes Yes Yes Yes Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Honda	3	Yes	Yes Yes	Yes Yes	No Yes Yes Yes Yes Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Hyundai	3	Yes	Yes Yes	Yes Yes	Yes Yes Yes Yes Yes Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No

KIA	3	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	No	No	No	No
Mazda	4	Yes	No												
Nissan	3	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Renault	4	Yes	No	Yes	Yes	Yes									
Subaru	1	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Suzuki	1	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Tesla	0	No													
Toyota	4	Yes	No												
Volkswagen	4	Yes	No	No	Yes	Yes									

BIBLIOGRAPHY

- [1] O. Krabbe *et al.*, "Aligning corporate greenhouse-gas emissions targets with climate goals," *Nat. Clim. Chang.*, vol. 5, pp. 1057–1060, 2015.
- [2] UNFCCC, "Paris Agreement," 2015.
- [3] J. Aldy *et al.*, "Economic tools to promote transparency and comparability in the Paris Agreement," *Nat. Clim. Chang.*, vol. 6, no. 11, pp. 1000–1004, 2016.
- [4] United Nations, "Adoption of the Paris Agreement," 2015.
- [5] UNEP, "The Emissions Gap Report 2015: A UNEP Synthesis Report," Nairobi, 2015.
- [6] R. Boyd, J. Cranston Turner, and B. Ward, "Intended nationally determined contributions: what are the implications for greenhouse gas emissions in 2030?," London, 2015.
- [7] Science Based Targets, "Sectoral Decarbonization Approach (SDA): a Method for Setting Corporate Emission Reduction Targets in line with Climate Science," 2015.
- [8] C. Façanha, K. Blumberg, and J. Miller, "Global Transportation Energy and Climate Roadmap," 2012.
- [9] U. Tietge, S. Díaz, Z. Yang, and P. Mock, "From Laboratory to Road International: a Comparison of Official and Real-World Fuel Consumption and CO₂ Values for Passenger Cars in Europe, the United States, China and Japan," 2017.
- [10] ICCT, "2020-2030 CO₂ standards for new cars and light-commercial vehicles in the European Union," 2017.
- [11] International Energy Agency, *Energy Technology Perspectives 2016*. Paris: International Energy Agency, 2016.