Asia Investor Group on Climate Change

Investor Group on Climate Change

Investor Network on Climate Risk, a project of Ceres

IIGCC Institutional Investors Group on Climate Change

INVESTOR EXPECTATIONS OF AUTOMOTIVE COMPANIES

Shifting gears to accelerate the transition to low carbon vehicles

The Institutional Investors Group on Climate Change (IIGCC) is a forum for collaboration on climate change for investors. IIGCC's network includes 128 members, with some of the largest pension funds and asset managers in Europe, representing over €13 trillion in assets. IIGCC's mission is to provide investors a common voice to encourage public policies, investment practices and corporate behaviour which address long-term risks and opportunities associated with climate change.

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The Asia Investor Group on Climate Change (AIGCC) is an initiative to create awareness among Asia's asset owners and financial institutions about the risks and opportunities associated with climate change and low carbon investing. It provides capacity for investors to share best practice and to collaborate on investment activity, credit analysis, risk management, engagement and policy. AIGCC represents the Asian voice in the evolving global discussions on climate change and the transition to a greener economy.

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Executive Summary

- Escalating risks arising from climate change mean the automotive industry is likely to undergo a significant transformation in the short to medium term.
- The move towards a low carbon economy, climate change regulation, changing demand patterns and technological achievements will impose significant challenges on automotive companies.
- To remain competitive and successful in the long run, automotive companies must develop more resilient business models that adapt to the challenges imposed by climate change and stricter environmental regulation.
- A viable and sustainable business model for automotive companies should rely on the companies' acceptance of the move towards a low carbon economy and the resulting need for more sustainable driving technologies: Automotive companies should become holistic mobility service providers.
- The role of policy makers is also not to be underestimated: It will depend on the policy makers' willingness to invest in the necessary infrastructure and advanced vehicle purchase and use incentives in order to successfully penetrate the market with advanced, sustainable vehicles.

This document formulates five key expectations that investors have of automotive companies:

1 **Governance:** Investors expect that a proper governance structure is in place which ensures that board and management responsibilities regarding climate change risks and opportunities are clearly defined.

2 **Strategy implementation:** Investors expect that automotive companies develop a long-term strategy which makes the business resilient to climate change and which incorporates key industry trends such as sustainable vehicles technology and digitalisation.

3 **Emissions management:** Investors expect that a robust greenhouse gas emission reduction plan is in place for the fleet and assembly operations which is sufficient to close the gap between real world and laboratory testing conditions.

4 **Public policy:** Investors expect that automotive companies engage pro-actively with public policy makers in partnership with other stakeholders to accelerate the transition to a low-carbon economy in line with a 2°C scenario.

5 **Transparency and disclosure:** Investors expect that automotive companies disclose in annual reports and financial filings the company's position regarding the questions set out in this document, and that they are transparent about fleet and manufacturing emission related to the company.

Glossary

AFV	Alternative fuel vehicle also referred to as advanced vehicles: New lower emission vehicles with alternative technologies to the traditional Internal Combustion Engine (ICE). These can include: Battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV), and fuel cell vehicles (FCV).
BEV	Battery electric vehicles, also referred to as EV's or Electric vehicles.
FCV	Fuel cell vehicles use hydrogen gas to power an electric motor by combining hydrogen and oxygen to produce electricity. While there is no tailpipe pollution from fuel cell vehicles, producing hydrogen can produce varying amounts of GHG emissions depending on the fuel source used to generate it.
HAV	Highly Autonomous Vehicles. The US Department of Transportation defines five levels of automation where at level on the vehicle can automate some process of driving and level 6 where the driver doesn't need to participate at all.
HDV	Heavy duty vehicles, such as buses and cargo trucks (semis or lorries).
ICCT	International Council on Clean Transportation.
ICE	Internal combustion engines burn fuel to produce heat to drive the engine. ICE's have had the historic advantage of portability but disadvantage in emitting Greenhouse Gas emissions such as Carbon dioxide (CO_2) as well as other air pollutants such as Particulate matter (PM), Hydrocarbons (HC), Nitrogen oxides (NO_x), Sulfur dioxide (SO_2) and Carbon monoxide (CO).
LDV	Light duty vehicles, refers to passenger cars and trucks. Classifications vary by region but maybe used for fuel efficiency standards.
NDC	National Development Contribution.
NEDC	New European Driving Cycle.
OEM	Original equipment manufacturer, a term which refers to the car manufacturing companies (following CDP's definition).
PHEV	Plug-in hybrid electric vehicles.
WLTP	Worldwide Harmonised Light Vehicles Test Procedures.
VMT	Vehicle miles travelled.
ZEV	Zero Emissions Vehicles include Fuel Cell Vehicle's (FCV's) and Battery Electric Vehicles (BEV's) and may refer to policy mandates in California and other US states.

Introduction

Institutional investors recognise that the challenge of climate change will have an impact on their holdings, portfolios, and asset values in the short, medium, and long term. To achieve sustainable long-term returns on our investments for clients and beneficiaries, investors must both ensure that each investment is prepared for the challenges of climate change and ensure that robust policy action is taken to address the energy transition. Furthermore, investors also recognise that regulators and consumers are becoming more aware of climate change issues. Certain industry sectors will therefore experience disruptive changes through significant shifts in demand trends and/or the introduction of new technologies.

According to the International Energy Agency (IEA), transportation makes up nearly a quarter of energy-related emissions globally, and within this Light Duty Vehicles (LDVs) and trucks form over half this total. To limit global warming to 2°C or less, the automotive industry has an important role to play in curbing emissions and is exposed itself at several levels to climate change. On the one hand, the industry's key outputs, LDV such as passenger cars and heavy duty vehicles (HDV) such as trucks and buses, are contributing significantly to the overall levels of greenhouse gas emissions. On the other hand, the manufacturing facilities and global supply chains of automotive companies also contribute significantly to the carbon footprint of the entire industry. Consequently, the sector is highly exposed to tightening climate change regulation.

Several automotive companies have recognised their exposure to climate change and that they must undertake necessary actions in order to preserve the long-term viability of their business models. Against the backdrop of the United Nations Climate Change Conference of the Parties 21 (COP21), the CEOs of thirteen automotive companies (suppliers and original equipment manufacturers or OEM's) from China, France, Germany, India, Italy, Japan, Sweden, and the USA issued a public statement about their willingness to combat climate change and commit to a vision to decarbonise the automotive industry, by highlighting the key future challenges which could put the long-term sustainability of the entire sector at risk.[1] Recently, public statements by CEOs from some of the world-leading automotive companies allude to an increased awareness amongst industry leaders that the sector – particularly in regards to its underlying business models – has to undergo a significant change in order to be fit for the digital future and the low-carbon economy.[2]

Following the Paris Agreement reached at the COP21 in 2015, investors expect climate-related environmental regulations that address greenhouse gas emissions, LDV and HDV emissions testing procedures and fuel performance standards to become more stringent as new regulatory frameworks emerge across countries and markets in order to fulfil the requirements of the pact.

Making it a smoother ride

To remain competitive and successful in the long run it is important that automotive companies develop more resilient business models that can adapt to the challenges imposed by climate change and stricter environmental regulation. In addition, the sector will also become increasingly exposed to changing levels and patterns of demand as mobility patterns evolve as a consequence of global trends such as demographic change, digital transformation and urban growth.

Given that it faces multiple challenges from the demand side, new competitive forces from other industries, and societal changes, innovation will be key for the sector. Investors therefore look to the boards of major automotive companies to make decisions which address these future challenges and act in the long-term interests of investors and their beneficiaries.

The expectations formulated in this document go further than merely suggesting automotive companies should support compliance with 2°C regulatory regimes; they call on these companies to actively engage with the climate agenda and advocate this approach publicly. Investors also encourage automotive companies to proactively adjust their business models, capital expenditure in sustainable driving technology and product pipelines as well as to actively engage with policy makers, investors and the rest of the sector to put sustainability at the heart of the industry's future.

[1] See, World Economic Forum, "CEO Climate Leadership for Automotive": http://www3.weforum.org/docs/Media/WEFUSA_CEOClimateLeadershipforAutomotiveDeclaration.pdf

[2] See, for example, Renault-Nissan's CEO Carlos Ghosn in the Harvard Business Review: "Making the car a mobile, connected, workspace", Harvard Business Review, October 2016, pp. 100-106.

Purpose

The purpose of this document is to provide a guide for investors to have constructive engagement with the boards of automotive companies to consider and direct more sustainable strategies that aim to mitigate the long term climate change-related risks to investors. It is to be used as required by investors in their engagement with companies.

This document can also be used for engagements with suppliers of auto components to discuss how cars and demand for their products will change. Ultimately, the envisaged transformation of the automotive sector will have significant implications for suppliers of automotive companies as well, forcing them to also re-think their business models and contribute directly to the development of more sustainable driving technologies.

Sector dynamics: A winding road to a low carbon transport system

Public Policy: Building a bridge with policy makers

Under the Paris Agreement over 180 countries committed to National Development Contributions (NDCs) which were comprised of individual packages of climate and energy policies along with transition plans. A recent report by Moody's[3] finds that the automotive sector faces rising credit risks under what they call a plausible central scenario where all NDC's are implemented even though this scenario still falls short of a 2°C global target.

The auto sector should embrace these transition plans as an opportunity for improving its overall sustainability and should work pro-actively with governments to implement them effectively. Recent analysis has demonstrated that for three major US automakers, current fuel economy and emissions standards extending to 2025 are in the economic interest of these companies, acting as an insurance policy against oil price volatility (and also providing significant benefits for suppliers).[4]

Given these policy-related developments, the long-term success of automotive companies will depend partly on the extent to which they can cope with tighter emission testing procedures and stricter emission regulations.

Emission targets

The automotive industry is exposed to a plethora of CO_2 and pollutant emission reduction targets in all major markets. The expectations formulated in this document also address the issue of the increasing gap, reflecting institutional investors' concerns regarding the difference between actual and testing emission levels. The following offers a high-level overview of the most important developments regarding emission targets for vehicles and testing regimes in some of the world's largest car markets (see table opposite, note that emerging markets will dominate future vehicle sales growth; for example, India is projected to be the world's third largest car market by 2025.)[5]

- **Australia:** The Australian government has started looking into CO_2 emissions standards for light vehicles, as part of new measures to meet the nation's 2030 climate targets.[6] In February 2016, the Vehicle Emissions Ministerial Forum released a Discussion Paper on proposed new measures for road vehicles. This includes canvassing tougher standards for new vehicles, fuel efficiency measures for new light vehicles, testing and reporting arrangements among other measures. The working group will report by 31 March 2017 to the Ministerial Forum on a draft implementation plan.[7]

[3] Moody's (September 20, 2016). "Automotive sector faces rising credit risks from carbon transition."

[4] Ceres (2016). "USA automakers reduce risk and suppliers win under MPG standards."

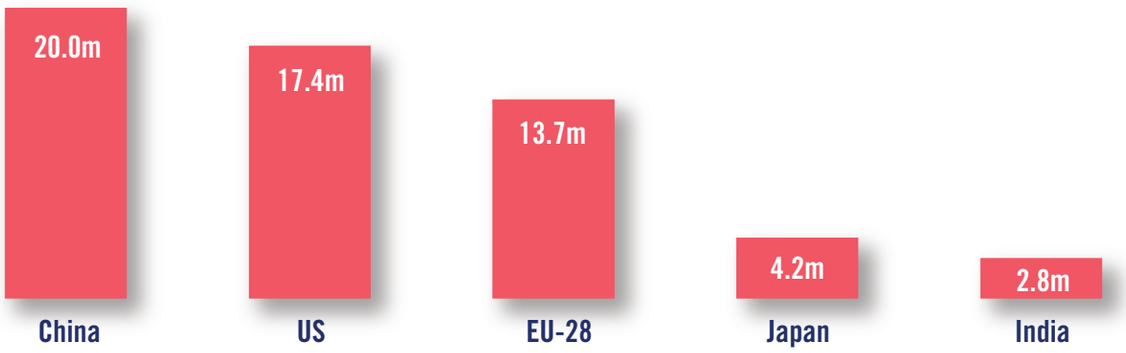
[5] http://www.goldmansachs.com/our-thinking/technology-driving-innovation/cars-2025/

[6] https://www.environment.gov.au/minister/frydenberg/media-releases/mr20160829.html

[7] The Vehicle Emissions Discussion Paper http://minister.infrastructure.gov.au/pf/releases/2016/february/pf018_2016.aspx. The Terms of Reference for the Ministerial Forum on Vehicle Emissions https://infrastructure.gov.au/roads/environment/forum/tor.aspx

The world's five largest car markets

(based on new vehicle registrations between January and December 2015)[8]



- **Brazil:** By 2020, over 80 percent of the Brazilian automobile fleet should be capable of running on pure ethanol, a jump from the current 20 percent, displacing gasoline even further.[9]
- **China:** Phase III of China's LDV fuel consumption regulations include its first-ever standards for fleet average fuel usage, which will reduce fuel consumption to 7 L/100km by 2015, a 13 percent improvement for new fleet vehicles between 2008 and 2015. Phase IV standards are under development. For heavy duty vehicles, China is in the process of developing Phase 1 standards, expected for 2015–2020.[10]
- **The European Union** has introduced new CO_2 emission targets to be achieved in 2021. Under the New European Driving Cycle (NEDC) test regime, LDVs are thereafter allowed to emit no more than 95 grams of CO_2 per km (the target for 2015 had been set at 130g/km which implies a further reduction of more than 25%). Whilst the targets have been introduced, the International Council on Clean Transportation (ICCT) has reported an increasing gap between real-world emission levels from cars and the officially reported levels, a gap which has widened from 8% in 2001 to 38% in 2014.[11]

  Given the sector's general reputation regarding the gap between emissions testing and real time vehicle performance on the road, investors believe that actual enforcement of emission targets and fuel performance is likely both to tighten and become more stringently enforced. This will, in part, be the case already with the introduction of the Worldwide Harmonised Light Vehicles Test Procedures (WLTP).[12]
- **India:** India's Bureau of Energy Efficiency (BEE) has put forward a proposal mandating a 15 percent reduction in fuel usage by 2020 for LDVs, which would result in an average fuel consumption of 20 km/L for the new vehicle fleet. This standard would open the door to energy-efficiency standards for two- and three-wheelers as well as heavy-duty vehicles (HDVs), which currently account for a greater proportion of fuel consumption in India than passenger vehicles.[13] Vehicle emission standards have aided progress over the last decade as India implemented Euro IV equivalent standards in 13 major cities and Euro III standards in the rest of the country in 2010. But the nation still lags in terms of clean vehicle and fuels policies, and much remains to be done to mitigate the harmful effects of vehicular air pollution.
- **Japan:** In 2003 the Ministry of Environment finalized very stringent 2005 emission standards for both light and heavy vehicles. At the time they came to power, the 2005 heavy-duty emission standards (NO_x = 2 g/kWh, PM = 0.027 g/kWh) were the most stringent diesel emission regulation in the world.

[8] https://www.statista.com/statistics/269872/largest-automobile-markets-worldwide-based-on-new-car-registrations/

[9] http://www.unep.org/transport/gfei/autotool/case_studies/samerica/brazil/BRAZIL%20CASE%20STUDY.pdf

[10] http://www.theicct.org/china

[11] ICCT (2015). From laboratory to road: A 2015 update of official and "real-world" fuel consumption and CO_2 values for passenger cars in Europe. Available at: http://www.theicct.org/sites/default/files/publications/ICCT_LaboratoryToRoad_2015_Report_English.pdf

[12] ICCT. (2016): Reducing CO_2 emissions from road transport in the European Union: An evaluation of policy options.

[13] http://www.theicct.org/india

The 2016 limits are comparable in stringency to the US 2010 and Euro VI standards. Vehicle owners have two ways to comply with a 9-12 year compliance period from initial registration: replace old vehicles with newer, cleaner models or retrofit old vehicles with approved NO_x and PM control devices.

Most categories of on road vehicles are also subject to mandatory fuel efficiency targets. The Japanese fuel efficiency requirements for heavy trucks and buses were the world's first fuel economy regulation for heavy vehicles from 1985.[14]

- **Korea:** The 2020 standards, with implementation from 2016 require a 30.7 percent reduction in the fleet average GHG emission for passenger vehicles from 2015 standards and 31.1 percent from the 2013 fleet average emissions level. Light trucks are required to reduce their CO_2 emissions by 15.2 percent from 2013 to 2020.[15] Korea follows the US and EU emissions standards depending on the application for specific vehicle types.[16]
- **USA Greenhouse Gas Emissions and Fuel Economy Standards:** In the United States, National Program standards for LDV are projected to result in an average industry fleet-wide emissions level of 175 grams/mile of CO_2 in model year 2025[17]. Federal agencies, in coordination with the state of California, are currently conducting a Midterm Evaluation (MTE) of standards set under the National Program, to assess whether model year 2022-25 standards should be retained, strengthened, or weakened. As part of this process, the agencies released a draft Technical Assessment Report (TAR) in June 2016 which showed manufacturers are adopting fuel economy technologies at unprecedented rates, and that the standards can be met while also generating substantial fuel savings for consumers.[18] A Proposed Determination is due out in June 2017, and a Final Determination in 2018. In addition, the USA recently adopted medium and heavy duty truck standards[19] (these vehicles are responsible for 23% of GHG emissions from the USA transportation sector). These will extend through 2027, and will serve to reinforce American leadership in the development of advanced truck and engine technologies.

  Federal and state regulations will continue to become more stringent. Post 2025, National Program standards will need to ensure an additional 77% reduction by 2050 in order to meet the U.S. Paris commitments. In addition, a recent law requiring state-wide GHG emissions in California be reduced 40% below 1990 levels by 2030 will also lead to stronger LDV GHG emissions standards and Zero Emission Vehicle mandates in California as well as in those other states that choose to adopt California's standards.

Clean air regulations

While not directly contributing to climate change, other auto emissions such as Nitrogen Oxide (NO_x) and Sulphur Dioxide (SO_2) have more immediate impacts on air quality which can in turn motivate governments to take action to regulate all emissions. Fuels used for transport, first and foremost diesel, generate more than half the NO_x emitted globally, which can trigger respiratory problems and the formation of other hazardous particles and pollutants, including ozone. In 2014, the USA adopted Tier 3 standards, which will be phased in between 2017-2025. These rules require vehicle manufacturers to improve emission control technologies that reduce a range of pollutants, including NO_x, SO_2, and particulate matter (PM) from medium-duty and light duty vehicles. America's Tier 3 standards are significantly more stringent that EU standards, while compliance and enforcement mechanisms in the USA and California are more rigorous as well.[20] (This became especially apparent as a result of the VW scandal, when in-use testing revealed VW's failure to comply with these rules and – in response – the EU is now working to strengthen its own testing procedures.)

[14] https://www.dieselnet.com/standards/jp/

[15] http://www.theicct.org/south-korea-FE-and-GHG-standards-new-ldvs-2016-2020

[16] https://www.dieselnet.com/standards/kr/

[17] https://www3.epa.gov/otaq/climate/documents/mte/420d16901.pdf

[18] https://www3.epa.gov/otaq/climate/mte.htm

[19] https://www3.epa.gov/otaq/climate/regs-heavy-duty.htm

[20] http://www.theicct.org/sites/default/files/ICCT_comparison%20Euro%20v%20US.pdf

National electric vehicles incentives

Widespread electrification of the global vehicle fleet will be necessary to meet climate commitments and goals set out in the Paris Agreement. There are currently approximately 1.5 million electric vehicles globally, and IEA estimates that we will need 100 million EVs by 2030 to meet the Paris commitments and 140 million EVs by 2030 to meet a 2°C Scenario.[21] Evidence so far suggests the widespread adoption and acceptance of advanced vehicles is likely to depend initially on the incentives provided by the state to switch from combustion engine-propelled vehicles to electric cars. For example, as a result of strong EV policies and incentives, in addition to technological advances, Norway's EV and PHEV share is 40 times the global average (compared to almost zero deployment 5 years ago.)[22]

IEA estimates that we will need 100 million EVs by 2030 to meet the Paris commitments and 140 million EVs by 2030 to meet a 2°C Scenario

To incentivise people to buy electric vehicles, policy makers have several tools at their disposal: The most direct means comprise **monetary incentives** in the form of tax breaks or purchase subsidies (as recently introduced in Germany[23], Korea[24] and, Hong Kong and which have been present for a couple of years in the USA[25, 26]); or the provision of funding for home and business charging infrastructure. Japan has employed a range of electric vehicle incentives since 2009 and now has more electric power charging stations than petrol stations as a result, many of which are private facilities.[27] In January 2013, the Indian government announced a new plan to provide subsidies for hybrid and electric vehicles up to the value of 150,000 rupees (about $2,200) for cars and 50,000 rupees for two wheelers. India aims to have seven million electric vehicles on the road by 2020. A similar policy exists in Taiwan where emissions by scooters and motorcycles comprises 20% of all particulate matter, so a new electric scooter in 2016 will receive state-level subsidy of NTD2,000~4,000 (US$62~125) as well as additional city-level subsidy.

Several non-monetary incentives also exist, such as **preferential access to motorways and roads** (electric vehicle lanes or the right to use bus lanes), **preferential parking or access to low-emission zones**.[28] In order to successfully penetrate the market with electric cars it is crucial that necessary infrastructure is provided (see section below on technology dynamics): Incentives will only be effective if there are, for example, enough charging points. An analysis carried out by the ICCT which focused on Europe reveals that Norway and the Netherlands provide a reasonable mix of state-level incentives and charging points, even though there are particular cities in these nations that are outstanding, such as Oslo and Amsterdam (see Figure 1)[29] suggesting incentive schemes for electric cars can be effective city-wide rather than simply state-wide. In addition, the state of California has instituted a Zero Emissions Vehicle (ZEV) mandate, which has been adopted by nine additional US states (these ten states together comprise 25% of the US vehicle market) which will help drive the US market.

[21] **https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf**

[22] Goldman Sachs EV report – **http://www.goldmansachs.com/our-thinking/pages/new-energy-landscape-folder/report-the-low-carbon-economy/report.pdf**

[23] ICCT (2016): Germany, sleeping giant of electric vehicles, awakes. Available at: **http://www.theicct.org/blogs/staff/germany-sleeping-giant-electric-vehicles-awakes**

[24] **http://www.theicct.org/blogs/staff/promoting-electric-vehicles-in-korea**

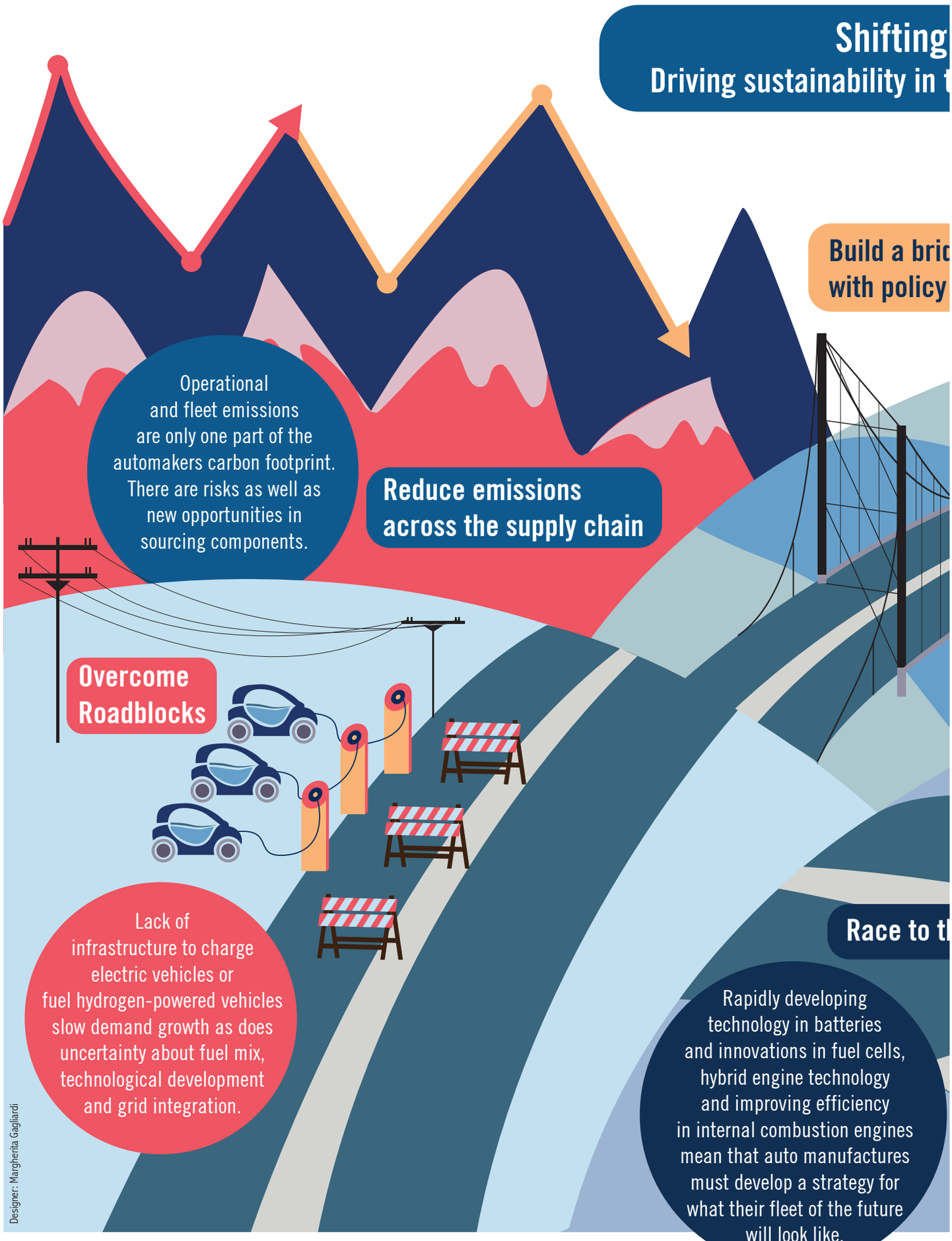
[25] ICCT (2014). Evaluation of state-level USA electric vehicles incentives.

[26] ibid.

[27] **https://www.theguardian.com/world/2016/may/10/japan-electric-car-charge-points-petrol-stations**

[28] For a more extensive list of possible state-level incentives, see ICCT (2016). Comparison of leading electric vehicle policy and deployment in Europe.

[29] ICCT (2016). Comparison of leading electric vehicle policy and deployment in Europe.


Shifting
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with policy
Operational
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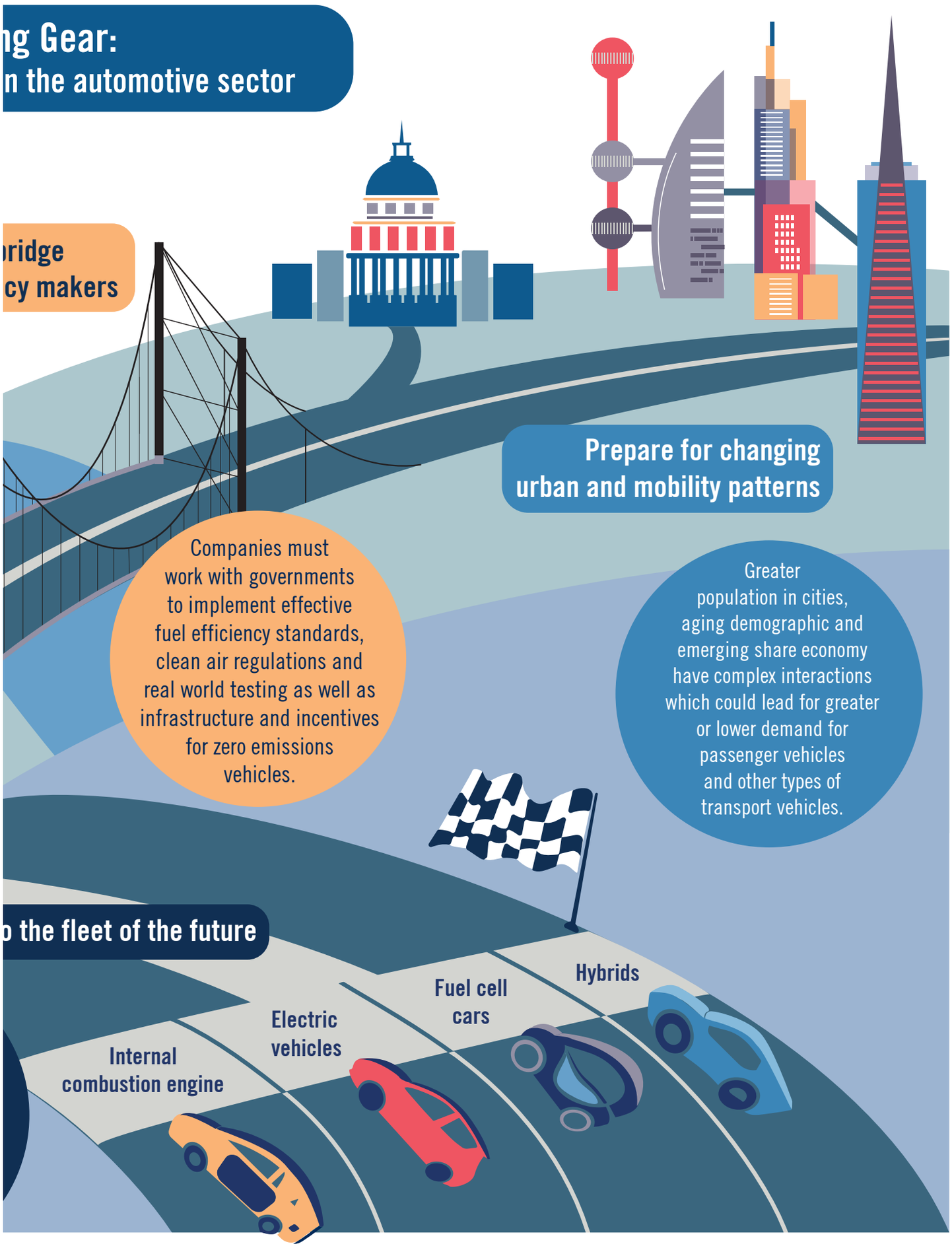
are only one part of the
automakers carbon footprint.
There are risks as well as
new opportunities in
sourcing components.
Reduce emissions
across the supply chain
Overcome
Roadblocks
Lack of
infrastructure to charge
electric vehicles or
fuel hydrogen-powered vehicles
slow demand growth as does
uncertainty about fuel mix,
technological development
and grid integration.
Race to t
Rapidly developing
technology in batteries
and innovations in fuel cells,
hybrid engine technology
and improving efficiency
in internal combustion engines
mean that auto manufactures
must develop a strategy for
what their fleet of the future
will look like.
Designer: Margherita Gagliardi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n the automotive sector
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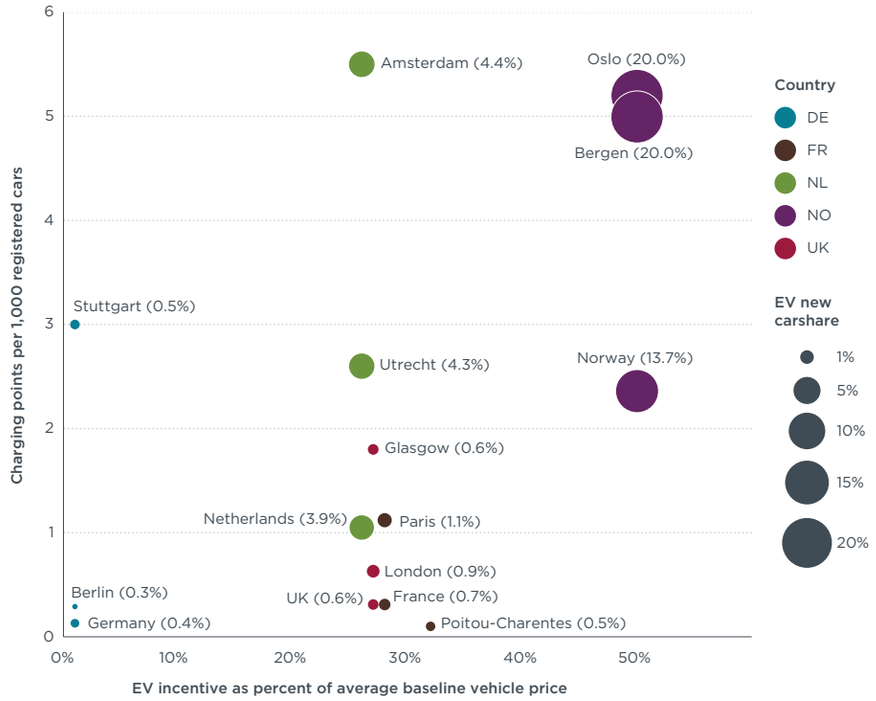
Prepare for changing urban and mobility patterns
Companies must work with governments to implement effective fuel efficiency standards, clean air regulations and real world testing as well as infrastructure and incentives for zero emissions vehicles.
Greater population in cities, aging demographic and emerging share economy have complex interactions which could lead for greater or lower demand for passenger vehicles and other types of transport vehicles.
o the fleet of the future
Internal combustion engine
Electric vehicles
Fuel cell cars
Hybrids

Figure 1 Comparison of leading electric vehicle policy and deployment in Europe



Source: ICCT 2016, incentive schemes for EV's in Europe have been effective at national and city-wide levels

Implications arising from incentives for automotive companies

The recent introduction of state-level electric vehicle incentives shows that regulators are keen to reform the existing automotive sector. If such incentives were to be introduced across various markets, they could lead to a real push in the demand for advanced vehicles. In order to do so, the relevant infrastructure must be put in place (see below) to penetrate the market with the various kinds of alternative driving technologies. If the incentives are properly designed and introduced in all major markets, automotive companies will in turn be given a clear incentive to develop advanced vehicles.

Technology Dynamics: Race to the fleet of the future

Several technological advancements will help drive the development of more fuel-efficient cars, sustainable vehicle technology, and changing demand or supply patterns. Current technology dynamics have the potential to transform the entire automotive industry.

Advanced vehicles: At the forefront will be the development and advancement of advanced vehicles that rely on more sustainable power train engineering, such as Battery Electric Vehicles (BEV), Plug-in Hybrid Electric Vehicles (PHEV), and Fuel Cell Vehicles (FCV). It is predicted that BEVs, PHEVs, and FCVs will significantly contribute to reduce the car manufacturer's fleet emissions (in the interim, significant advances in Internal Combustion Engine technologies driven by strong regulations will also decrease fleet emissions).[30] Also, it is expected that BEV and FCV developments will complement rather than compete with each other.[31] For hydrogen-powered engines, the outlook is more mixed because the energy sources for hydrogen-powered cars mainly stem mostly from fossil fuels – giving rise to the question whether such vehicles will actually help cut overall CO_2 emissions from automotives.[32] Currently the cheapest source of hydrogen is from fossil fuels, but even if the fuel comes from natural gas, (one of the dirtiest sources of hydrogen) fuel cell vehicles can cut emissions by over 30%[33] when compared with vehicles with ICE.

[30] CDP (2016): Emission impossible – Which car makers are driving into trouble?

[31] Goldman Sachs Equity Research: Cars 2025: Vol. 2 Solving CO_2: Engines, Batteries, and Fuel Cells

[32] ibid.

[33] http://www.ucsusa.org/clean-vehicles/electric-vehicles/how-clean-are-hydrogen-fuel-cell-vehicles#.V-7AaZMrLOQ

Overcome roadblocks

The automotive industry is expected to move further towards more sustainable vehicles technology and subsequently move away from combustion engines, especially because of new competitive pressures on car manufacturers from high tech companies. A key challenge for the sector in the years to come will be further reducing battery costs (which have come down significantly already) and enhancing the range of advanced vehicles. At the end of the day, these developments will also spark innovation by suppliers of crucial car parts, implying that these expectations can also apply to their business models.

Strategy: For vehicle manufacturers to stay ahead of the curve it is important they acknowledge the move towards a low-carbon economy, including upcoming tighter environmental regulation. Consequently, product pipelines need to reflect this move by re-focusing towards becoming holistic mobility service providers and producers of advanced vehicles which ultimately will not rely anymore on combustion engines and fossil fuels.

Innovation: Sparking innovation regarding advanced vehicles is key for the long-run viability of vehicle manufacturers. To successfully re-focus their strategy, it will be key that automotive companies become more innovative regarding alternative driving technologies through reasonable capital expenditures on research and development of new technologies, more fuel efficient engines (during the transition period), better batteries, and the use of ever lighter materials. Closer cooperation with suppliers might be necessary to accomplish this goal, but vehicle manufacturers must be aware of potentially increased competition for significant production factors likely to influence the efficiency of cars.

Infrastructure: For the various kinds of advanced vehicles to enter the mainstream, a significant roadblock must be overcome, namely the lack of a sufficient charging and fuelling stations in almost all major markets. The diverse mix of advanced drivetrains will require significant infrastructure investments into relevant charging and fuelling technology. The success of advanced vehicles will therefore partly depend on policy makers' decision making with regards to building up (investing in) the necessary infrastructure. Vehicle makers should engage proactively with policy makers and utilities on this issue. A successful example is Japan where, according to the World Economic Forum, there are already more electric charging points than petrol stations.[34]

The grid: The growing usage of advanced vehicles, especially PHEVs and BEVs will eventually also have consequences for energy demand and for the grid.[35] These vehicles may become an important source of revenue for utilities because while overall energy use could decline it will be possible to manage the grid more effectively and increase the use of renewable energy by using electric vehicles for storage. Public policy engagement by investors and automotive companies could help persuade legislators to make investments in the infrastructure necessary for advanced vehicles more attractive.

LDV vs. HDV: The development of advanced vehicles will go well beyond passenger cars. There are significant opportunities to develop cleaner heavy duty vehicles; the U.S. Department of Energy's SuperTruck program has already resulted in model trucks with a 115% increase in fuel efficiency through use of lightweight materials, low resistance tyres, aerodynamic surfaces and more advanced combustion engines.[36] Another opportunity for automotive companies to make a difference is to further develop electrification technology for HDV such as trucks and buses (which seem to be particularly well suited for this drive technology). While already viable for shorter trips, a key challenge here will be to develop this technology to allow heavy duty trucks to cover long distances, often across different countries (some argue for simply switching the battery out at intervals). In the USA suppliers of fuel-efficient technology for trucks and buses are growing – a recent CalSTART report identified 255 suppliers of low-carbon tech for heavy duty vehicles in the country.[37]

[34] World Economic Forum (2016): Japan now has more electric charging points than petrol stations. Retrieved from the World Wide Web on August, 10: https://www.weforum.org/agenda/2016/05/japan-now-has-more-electric-charging-points-than-petrol-stations/

[35] See World Economic Forum (2015): "How will electric cars affect the energy grid?": https://www.weforum.org/agenda/2015/02/how-will-electric-cars-affect-the-energy-grid/

[36] http://energy.gov/articles/infographic-how-supertruck-making-heavy-duty-vehicles-more-efficient

[37] http://www.calstart.org/Homepage.aspx

Autonomous vehicles: Most automobile manufacturers are incorporating some form of autonomous driving (or self-driving) technology into their latest models, and many have plans to eventually move to fully autonomous vehicles. For example, BMW has announced specific targets for the development of driverless cars, and aims to produce them by the beginning of the 2020's.[38] The implications of moving to autonomous vehicles for the sector's carbon footprint will depend on how they are used; a recent study found that autonomous vehicles could halve or double GHG emissions; critical factors include whether the vehicles are electric, and whether they result in an overall increase or decrease in vehicle miles travelled (VMT).[39] Furthermore, there are several additional roadblocks to overcome in order to accelerate the adoption and wider societal acceptance of autonomous vehicles – most notably safety, reliability and cybersecurity as well as the existence of relevant technological infrastructure. The World Economic Forum summarises the barriers facing advanced vehicles as follows: "The widespread commercial realisation of autonomous in the immediate future is hindered by legislative wariness, infrastructure barriers, unpredictable consumer acceptance and cost of development. Consequently, the production of AVs will require a full transformation of the automotive operation and its support ecosystem."[40] Investors and companies alike must be aware of the inherent risks and opportunities arising out of this transformation.

Digitalisation and big data: Technological advancements carry with them additional challenges for automotive companies related to cyber security and wider digitalisation issues. High technology companies are at the forefront of developing necessary software for advanced and autonomous vehicles. This exposes automotive manufacturers to significant new competitive pressures from companies setting out to manufacture driverless cars at some point in the future. Equally, there are plenty of opportunities for car makers to pursue, and joint ventures or other collaborations with certain high-tech companies may provide some automotive companies with considerable first-mover advantage.

[38] See Financial Times, July 1, 2016: https://www.ft.com/content/cfbdc326-3fa2-11e6-8716-a4a71e8140b0 (Retrieved August 10, 2016).

[39] http://www.sciencedirect.com/science/article/pii/S0965856415002694

[40] The World Economic Forum (2016): The driverless car revolution. Retrieved August, 10, from the World Wide Web: http://reports.weforum.org/digital-transformation-of-industries/the-driverless-car-revolution/

Demand Dynamics: Prepare for changing urban, population and mobility trends

The demand for autos will change in the years to come as a direct consequence of several global trends which affect various aspects of the global economy:

- **Changing mobility patterns due to increased urbanisation:** The United Nations estimates that by 2050, 66% of the population will reside in urban areas, as compared to 30% in 1950.[41] This shift implies increased demand for urban mobility services from a more concentrated population alongside potentially rising demand for transportation from and to rural areas. Electric vehicles will need to be able cover longer distances sufficient to provide access to remotely located rural areas.
- **Continued overall population growth**, especially in emerging markets, might open up new markets for automotive companies, either through vehicles or mobility services. The United Nations project that the populations of Africa and Asia in particular will rise until 2100, growing three fold in Africa to reach c. 4.4 billion people while the population in Asia increases to c. 4.9 billion.[42] These markets could prove important demand drivers for the automotive sector.
- **Demographics:** An ageing population will also have significant implications for the future demand for vehicles and mobility services. The World Economic Forum estimates that the average global life expectancy is almost 80 years currently.[43] Higher life expectancy combined with higher urbanisation levels will increase demand for mobility services of almost every kind to serve the needs of the elderly. Automotive companies could benefit if they adapt their business models so as to move away from merely providing vehicles towards the provision of all-encompassing mobility services for cities and in more rural areas.
- **Sharing economy:** The trend towards a sharing economy also has the potential to cut demand for new cars. Several commentators, however, argue that car sales will not necessarily be affected by this trend, because most car sharers will not want to give up their car ownership.[44] Also, the potentially lost demand capacity from increased car sharing might be offset by larger fleets from car sharing service providers. Equally, car sharing is likely to lead to more efficient vehicle usage, thereby driving down overall vehicle demand. Automotive companies can already prepare for this trend by opening up their product pipeline to car sharing and mobility services in both urban and rural areas, tailored to the needs of different generations.
- **Power grid integration:** If plug-in hybrid electric vehicles (PHEV) and electric vehicles (EV) really start to take off they will become an integral part of the energy system.[45] Their batteries can help the grid operator to balance the grid (see above) and might constitute a business opportunity for car owners or manufactures (in case of leasing) that brings down total cost of ownership.

[41] United Nations (2014). 2014 Revision – World urbanisation prospects.

[42] World Population Prospects: Key findings and advance tables (2015 Revision), by the United Nations: https://esa.un.org/unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf

[43] World Economic Forum (2016). A field guide to the future of mobility.

[44] The Boston Consulting Group (2016). What's ahead for car sharing? The new mobility and its impact on vehicle sales.

[45] UBS (2014) "Global Utilities, Autos & Chemicals: Will solar, batteries and electric cars re-shape the electricity system?"

Investor expectations of automotive companies

Five Investor Expectations of Automative Companies

1	2	3	4	5
Governance	Strategy implementation	Emissions management	Public policy	Transparency and disclosure

Given the aforementioned key sector trends and effects from climate change on the automotive sector, the Global Investor Coalition on Climate Change have developed a set of five investor expectations. These expectations should inform the engagement process by institutional investors and should help them to have a constructive and effective dialogue with automotive companies on their long-term viability of their business model and the corresponding effects that climate change might have for them. The expectations address the five key areas, governance, strategy, emissions management, public policy, transparency and disclosure.

1 Governance

Expectation

- **Clearly define board and executive management responsibilities and capabilities for managing climate change risks and opportunities in relation to the sector dynamics outlined above, in order to set a sustainable, long-term strategy which encompasses a product pipeline that can reflect the move to a low-carbon economy and an orientation towards advanced vehicle development.**

Questions

- Board composition: **Who on your board has expertise in the automotive industry and is familiar with alternative and sustainable vehicles technology? How is the board/executive management involved in the process of setting and achieving environmental goals or milestone related to pollution reduction and specifically greenhouse gas emissions? Who on the board has expertise in the technologies required to build advanced and/or autonomous cars? Who on your board is familiar with the role of transportation sector in climate change?**
- Board-level responsibility for climate change and pollution: **Who on your board is responsible for managing the environmental externalities caused by the company's manufacturing facilities and by the vehicles that are sold? Who on the board is in charge of measuring the environmental impact of the vehicles manufactured and for developing a sound greenhouse gas reduction plan for both company operations and products with meaningful KPIs and metrics (encompassing scope 1, 2 and 3 emissions)?**
- Executive remuneration: **To what extent does the company's existing remuneration policy take into account the long-term strategic implications stemming from climate change and disruptive technologies? Does the remuneration policy feature a KPI which is related to the significant reduction in both fleet and manufacturing greenhouse gas emissions? To what extent is remuneration linked to a strategy which re-focuses the business on the development of advanced vehicles and driverless cars? How does the remuneration policy incentivise executives to foster innovation regarding sustainable vehicle technologies?**

2 Strategy implementation

Expectation

- Develop a long-term strategy resilient to regulatory shifts (with respect to climate change and stricter emission testing regulations); which incorporates key industry trends such as sustainable and/or autonomous vehicles; and which features a clear decarbonisation strategy. Build a stringent R&D and capital expenditures strategy that can underpin the companies' move towards becoming holistic mobility service providers whilst at the same time maintaining a competitive edge over peers. Co-operate with key suppliers on the development of powertrain technologies.

Questions

- Strategy and product development: How does your long-term strategy reflect the ongoing move towards a low-carbon economy and how is this reflected in your product pipeline? Which ratio of ICE vs. other advanced vehicles (ZEV, EV, hydrogen, biofuel, etc.) do you want to achieve over the next five to 20 years? Which alternative mobility services do you envisage developing in the future? What is your positioning regarding batteries; would you favour a value integration within the company, or would you favour the outsourcing of battery production? What role do you envision mobility services playing in your future?
- Forecast/outlook for future of fuels: How do you plan and forecast future demand for internal combustion engines? To what extent do you undertake scenario analyses to model the future demand curve for diesel and petrol engines and advanced vehicles? To what extent do you take into account clean fuels policies such as Low Carbon Fuels Standards, which promote electrification?
- R&D and capital expenditures: What is the trajectory for the company's future R&D costs and capital expenditures that is to be used to develop advanced vehicles and alternative fuel technology? How much of the overall R&D budget will be spent on developing wider mobility services? What is the planning horizon of your capital expenditure plan regarding the development of advanced vehicles?
- Supply chain: How are you working with/to incentivise your component suppliers to advance the long-term fleet decarbonisation strategy? Which influence do suppliers have on the development of advanced vehicles? How much innovation on their end do you need in order to develop more advanced vehicle models? To what extent will you co-operate with high technology companies to advance the evolution of driverless cars? Are you planning to develop advanced vehicles in-house or do you plan to outsource the development of key components such as software, battery technology, etc.?

3 Emissions management

Expectation

- Ensure that a robust greenhouse gas emission reduction plan is in place for the fleet and assembly operations which is sufficient to close the gap between real world and laboratory testing conditions. Make sure that a plan is in place which outlines how the company wants to reduce both fleet and operational carbon intensity, including meaningful targets and metrics.

Questions

- Emissions reductions targets: To what extent have you set ambitious but realistic long-term carbon emissions reduction targets? How do these distribute across the entire supply chain? Do you have reduction plans in place which treat Scope 1, Scope 2, and Scope 3 emissions separately? Which opportunities do you see emerging from better emissions management? Which key stakeholder groups do you involve in the design of your emission reduction plans? What are the main obstacles to achieving your targets, and how do you intend to overcome them?
- Fleet emissions: What does your carbon emission reduction plan for your fleet look like? How do you want to reduce the carbon footprint of your fleet over the next 5 years, and by how much? Which meaningful metrics do you draw on to measure progress to curb fleet emission levels? Which targets do you have in place in order to meet various emissions limits in different jurisdictions? How do you see these costs evolving incrementally? Will you be using super-credit in 2020? How much gCO_2 reduction do you forecast will be achieved through the sales of EV or PHEV and what are your estimates? Which compliance procedures do you have in place regarding fleet emission levels? How does your plan align with science based 2°C Scenario emission reduction goals? Do you track lifecycle emissions of the fleet?
- Manufacturing emissions: What does your carbon emissions reduction plan for the manufacturing and assembly plants look like? Which meaningful metrics do you draw on to measure progress on reducing manufacturing emission levels? Which interim targets do you specify? What is the horizon for your emission reduction plans?
- Supply chain: What does your emissions reduction strategy for your supply chain look like? How do you engage with your direct suppliers on carbon emission reduction plans? How do you make sure that also Tier 2 and Tier 3 suppliers have emission reduction plans in place? How do you track how the emissions stemming from your supply chain evolve over the next 5 to 10 years? Is there any process to track the life-cycle emissions of vehicles?

4 Public policy

Expectation

- Engage pro-actively with public policy makers in partnership with other stakeholders to accelerate the transition to a low-carbon economy in line with a 2°C scenario. Specifically, engage in support of stricter emissions testing regulation, tighter fuel efficiency standards, stronger EV purchase and use incentives, cleaner fuel standards, more investment in charging infrastructure and the introduction of a carbon price in manufacturing. Ensure that there is oversight and transparency about the company's lobbying activities on the aforementioned topics.

Questions

- Policy positions: **What are your positions in relation to climate and energy policy and to what extent do these relate to the company's strategy? What is your position on incentivising people to switch from usual combustion engine-propelled vehicles to ZEVs? What is your position regarding emissions testing procedures and the introduction of stricter emission level limits? What is your position on the fuel efficiency/GHG standards, EV policies (including ZEV mandates) and incentives, and clean fuel standards?**
- Policy engagement activity: **To what extent are you engaging with regulators, NGOs, public policy makers and utility companies on climate change and renewable energy issues (including GHG standards and ZEV mandates)? Do you engage with them on how to better incentivise people to adopt advanced vehicles? If your CEO supported the World Economic Forum's Climate Leadership for Automotive[46] how is your organisation working with governments to advance the goals of stable long-term policies and global standardisation of testing procedures?**
- Lobbying: **How do you and/or your representative industry association, engage and lobby public policy makers on regulations regarding emission levels, fuel performance statistics, EVs, clean fuel standards transition periods and emission testing procedures? Do statements issued by your trade association align with your own public statements and policies on these issues?**

5 Transparency and disclosure

Expectation

- **Disclose in annual reports and financial filings the company's position regarding the questions set out in this document, and be transparent about fleet and manufacturing emissions related to your company. Report on how the company's strategy is encompassing the different dynamics discussed in this document and how they translate into operational targets and decisions. Use pro-actively other means, such as CDP and through dialogue with investors, to publicise your position on climate change and the company's greenhouse gas emission levels.**

Questions

- Governance: **Which framework have you put in place to govern the disclosure process of climate change related information?**
- Transparency: **To what extent are you communicating how the outlined sector dynamics and future challenges set out in this document relate to your business model? How do you disclose the greenhouse gas emissions of both your fleet and manufacturing operations? How do you report on fuel consumption? Is the reported fuel consumption verified and audited? How do you report on the sector dynamics set out above in relation to your internal strategy? Which costs do you expect to arise from complying with new emission testing regimes and fuel performance standards?**
- Disclosure: **To what extent do you publish information on your long-term strategy in relation to climate change in your financial filings? Are you participating in the CDP reporting framework on climate change and water? If not, why not? Which information are you disclosing with respect to the company's preparedness for stricter emission regulation, climate change policy and policymaker engagement.**

[46] World Economic Forum (year.) "CEO Climate Leadership for Automotive" signed by CEOs of GM, Ford, Renault-Nissan, Volvo, Fiat-Chrysler and several other component manufacturers. Available for download at: http://www3.weforum.org/docs/Media/WEFUSA_CEOClimateLeadershipforAutomotiveDeclaration.pdf

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