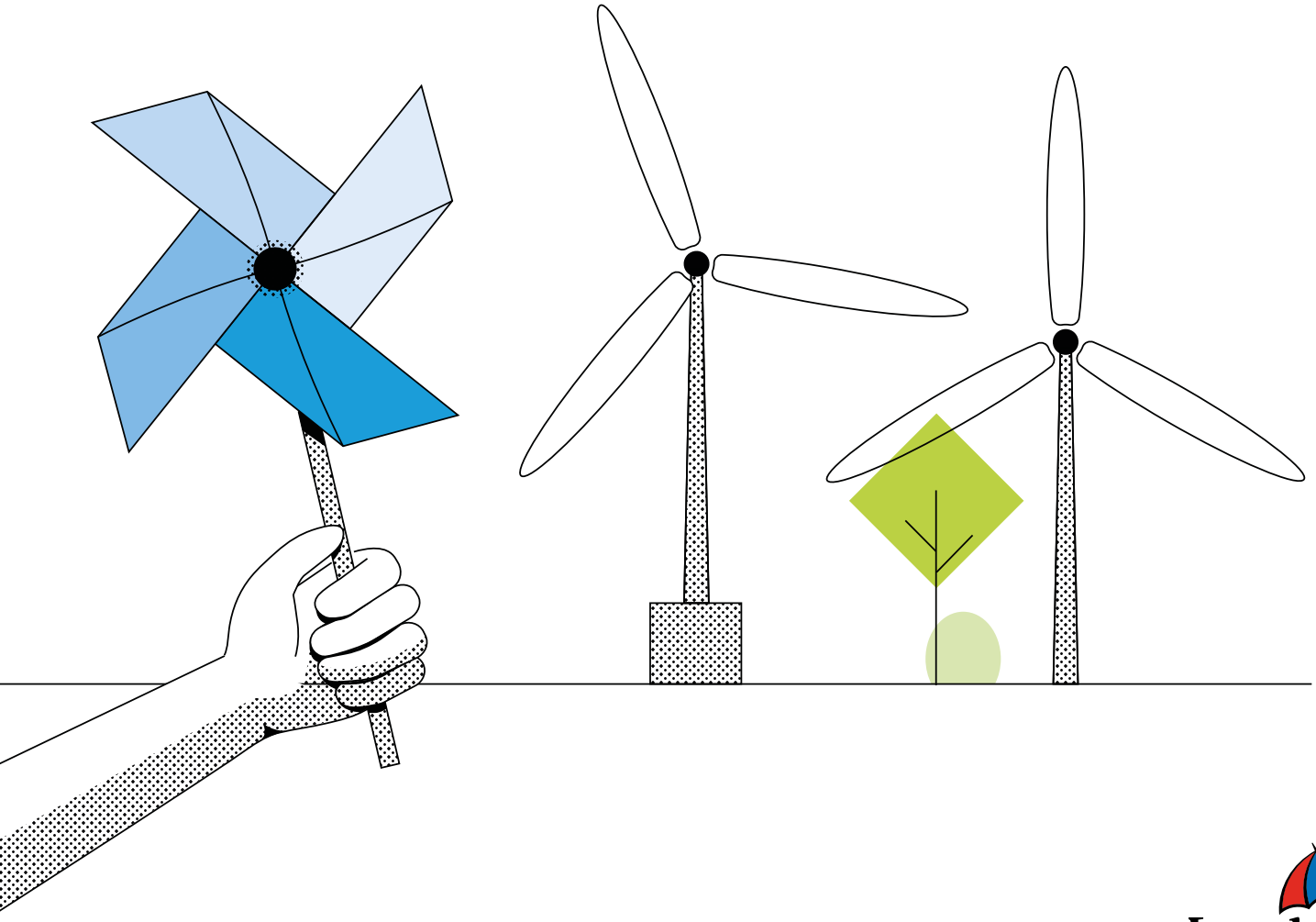
Task Force on Climate-related Financial Disclosures (TCFD) Report 2019



Legal & General

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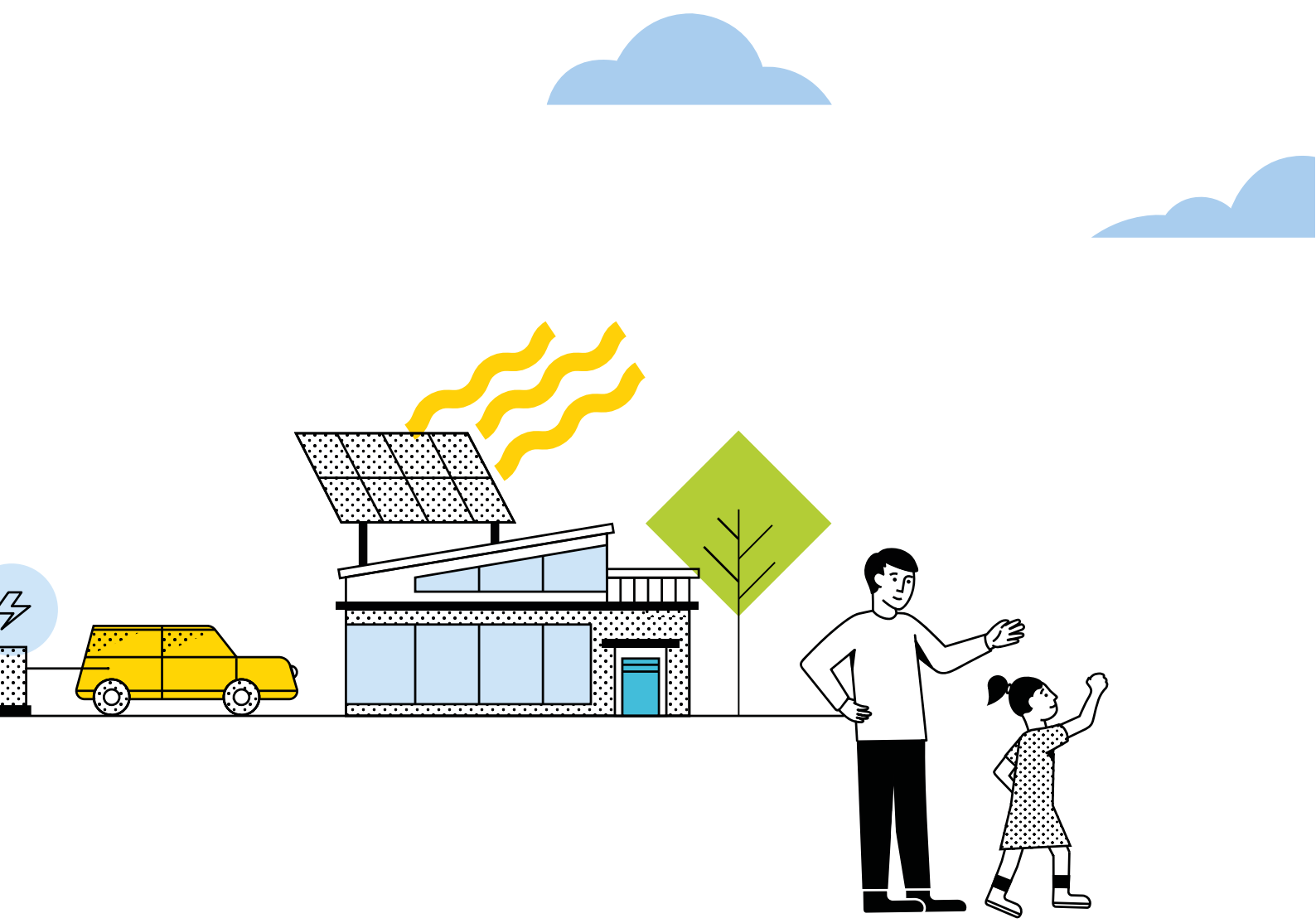


Task Force on Climate-related Financial Disclosures (TCFD) Report 2019

Background

Legal & General Group PLC (L&G) is listed on the London Stock Exchange and is a FTSE 100 constituent with an end year market capitalisation of c£18bn. We are a top 20 global asset manager,[1] the UK's largest provider of individual life assurance products and a leader in the UK and US markets in managing retirement risk for pension schemes. To secure our obligations in connection with these businesses we own c£99.6bn of assets, a portion of which matches the customer liability and a portion comprises our regulatory capital and surplus.

This is our second report describing our climate related financial disclosure in line with the voluntary disclosure recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) As last year, it is based on the TCFD recommended structure, namely 1) Governance, 2) Strategy, 3) Risk Management and 4) Metrics and Targets.[2] This report is also summarised in our Annual Report and Accounts published in March 2020 - link to Annual report 2019

In our 2018 TCFD Report we made a number of commitments to support the aim of the Paris Agreement,[3] set carbon emission intensity targets for our own assets, implement a number of high carbon exclusions in our Investment Management Agreements (IMAs) and we committed that we would use our influence as a large investor to promote a transition to a low carbon economy. Our 2019 TCFD Report now takes us to the next stage and describes in more detail how we have streamlined our governance to get more focus on climate risk, improved our modelling and understanding of energy transition pathways to meet different warming outcomes and widened the range of assets in the carbon emission intensity analysis to give 98% coverage of our £99.6bn of assets.

We believe this constitutes good progress towards our climate policy statements and implementation commitments.

We previously acknowledged a need to improve our understanding of the financial impact of a range of climate warming outcomes using scenario analysis. In the Strategy section of this report (Section 2) we show progress towards that commitment by reporting the following:

1. Portfolio allocations to the high carbon sectors weighted by market value, carbon intensity and equity risk of loss.
2. The portfolio implied temperature alignment.
3. A portfolio climate Value-at-Risk (VAR) analysis that quantifies financial risk in a 'Paris' and Business As Usual (BAU) scenario taking account of both transition and physical risk and opportunities as they evolve over the next 30 years.

1. Investment and Pensions Europe (IPE) as at 31/12/19 LGIM manages c£1.2trn on behalf of a wide range of internal and external clients.
2. See TCFD website at https://www.fsb-tcfd.org/
3. The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change effective 4th November 2016. The Agreement specifies that the increase in average global temperatures should be kept well below 2 degrees above pre-industrial levels'

Foreword

> “We recognise that our scale brings a responsibility to act decisively and we are able to support the fight against the climate catastrophe through both the positioning of our own balance sheet and also through our ownership of one of the largest global institutional investors”

Nigel Wilson
Group CEO

Avoiding climate catastrophe is our greatest global priority. The debate about whether higher concentrations of greenhouse gases (GHG) cause global warming, is long over. The science is clear and we can see the change with our own eyes. The focus now should be on what we do about it.

We recognise that our scale brings a responsibility to act decisively and we are able to support the fight against climate catastrophe through both the positioning of our own balance sheet and also through our ownership of one of the largest global institutional investors. Through Legal & General Investment Management (LGIM), our investment management arm, we engage with companies and governments and push for urgent action.

Within L&G the climate issue has my personal focus and we are committed to delivering our policy statements below. At the end of May last year I wrote to the then Prime Minister (Theresa May) to ask her to act immediately to put into legislation the Committee on Climate Change recommendation for a UK 2050 net zero GHG emissions target and to back that up with a robust set of policy initiatives in the priority areas.[4] I’m very pleased that at the end of June the UK became the first major economy to pass a zero emissions law. We now need to make it happen.

I also chair the Innovation work stream of the PRA/FCA Climate Financial Risk Forum Project, which will report this year. It is clear to me that a timely transition to a net zero economy offers significant economic growth and industrial competitiveness opportunities if supported by a comprehensive policy package. In particular we need to increase the ambition in the Green Finance Strategy to rapidly grow private capital flows into green infrastructure. The offshore wind sector is a good example of what can be achieved by combining private capital with clear government policies and supportive pricing mechanisms.

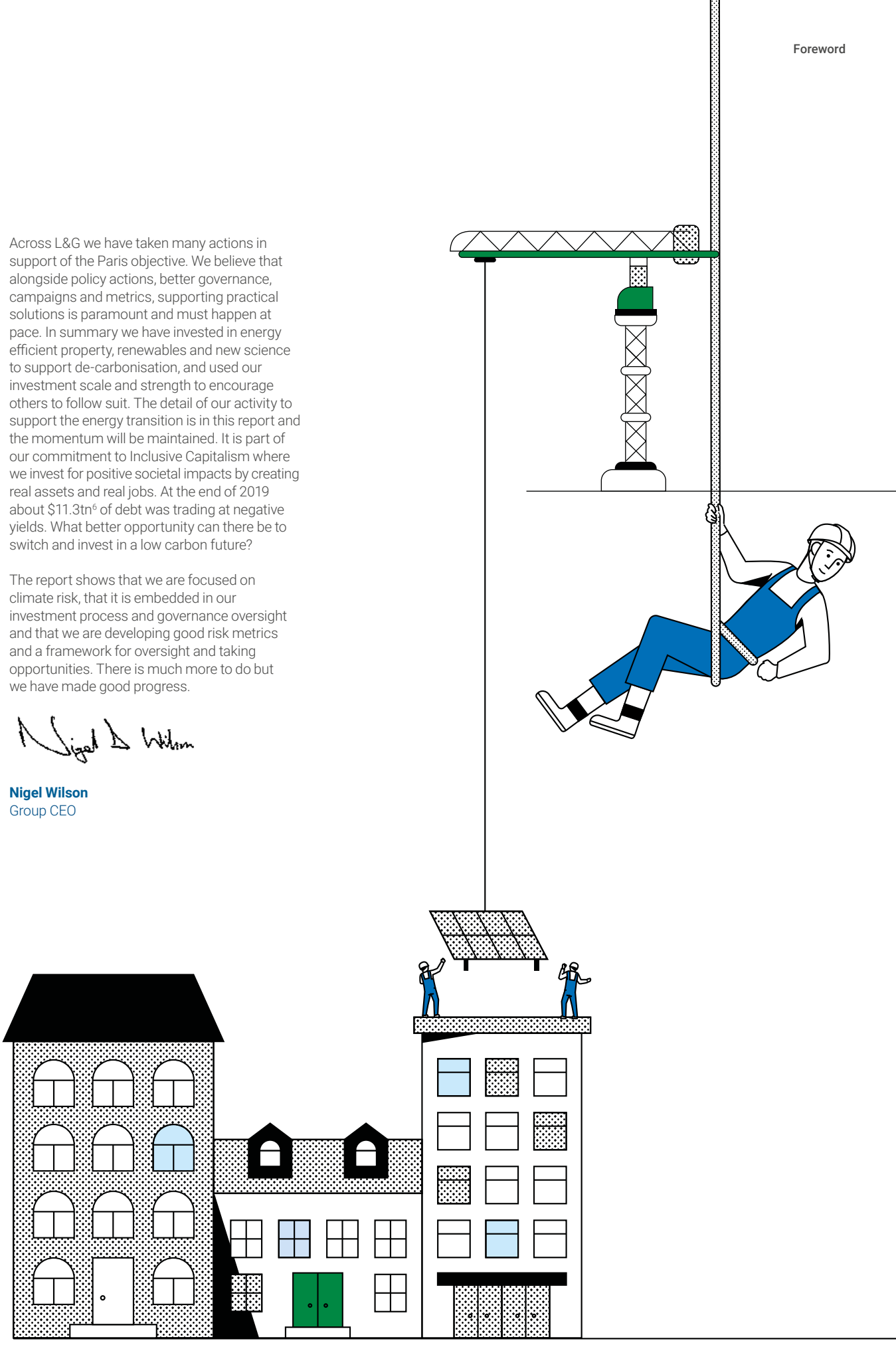
I see a real opportunity for the UK. In doing the right thing for our planet and securing our future, we can, with the right policies, see the number of ‘green collar jobs’ grow to 2 million and the value of exports from the low carbon economy grow to £170 billion a year by 2030.[5] We have made climate risk and the opportunities arising from the necessary energy transition a key growth driver of our business.

4. https://www.legalandgeneralgroup.com/media-centre/in-the-news/climate-change-legal-general-issue-letter-to-theresa-may/
5. Gov UK 27 June 2019

Across L&G we have taken many actions in support of the Paris objective. We believe that alongside policy actions, better governance, campaigns and metrics, supporting practical solutions is paramount and must happen at pace. In summary we have invested in energy efficient property, renewables and new science to support de-carbonisation, and used our investment scale and strength to encourage others to follow suit. The detail of our activity to support the energy transition is in this report and the momentum will be maintained. It is part of our commitment to Inclusive Capitalism where we invest for positive societal impacts by creating real assets and real jobs. At the end of 2019 about $11.3tn[6] of debt was trading at negative yields. What better opportunity can there be to switch and invest in a low carbon future?

The report shows that we are focused on climate risk, that it is embedded in our investment process and governance oversight and that we are developing good risk metrics and a framework for oversight and taking opportunities. There is much more to do but we have made good progress.

Nigel Wilson
Group CEO



6. Bloomberg based on proportion trading on negative yields within the Barclays Global Aggregate Index.

Reading this report

The TCFD is an evolving reporting structure and remains a 'best endeavours' analysis. We have made progress in our understanding and quantification of climate risk this year but we are still at an early stage in this conversation. It is not yet clear where the financial sector will eventually align in terms of metrics and calculation methodology, time frame and scenario definition. TCFD reporting is still voluntary though the UK Government in its Green Finance Strategy has proposed mandatory disclosures by 2022. It is our view that the sooner we move to mandatory climate reporting the better.

To support alignment and comparability we have been transparent in the energy transition pathways we have assumed (Section 2) and focused on two key warming scenarios, 'Paris' and a Business As Usual scenario (BAU). In terms of warming outcomes our chosen scenarios approximately map to respectively RCP 2.6 and IEA SDS (aggressive mitigation) and between RCP 6 and RPC 8.5 (some mitigation), which are all well known reference scenarios.

The point of TCFD reporting is to give investors and other stakeholders a better understanding of our business exposure to climate risk and strategic resilience. To help with context in this regard we think the following observations are important.

1. This is a *Group* TCFD which means it covers c98% of the £99.6bn of assets that L&G directly owns to back our insurance and pensions business. For these assets we have control over investment strategy. It is important to distinguish these assets from assets that our investment manager (LGIM) manages as agent on behalf of external clients. In the latter case the investment strategy is subject to the agreed mandate and any client restrictions. We can only directly control what we own. Where L&G don't have control, but rather have a fiduciary duty through LGIM, we can and do provide appropriate low carbon products and as a matter of course provide ESG assessments and engagement with investee companies.[7]
2. The risk metrics we show in Section 2 ('Strategy') are forward looking and projected over 30 years. This is a much longer timeframe than the normal horizon for scenario analysis. Given uncertainty around the global energy transition,[8] the associated warming path, weather outcomes, carbon prices and technological developments, the numbers should be treated as having a wide margin of uncertainty.
3. Scenario analysis is agnostic as to outcomes. The scenarios we show are not 'forecasts' or 'predictions' nor are we saying they are equally likely or that they are desirable. Clearly some aren't. We are showing a possible portfolio impact under a given scenario. The commitment to the 'Paris' warming target, the implied emission targets we set for ourselves and the objectives of LGIM engagement on our behalf are however *normative* – they are intended to deliver a *desired* outcome. We think this is an important difference; the impact of higher warming outcomes is basically the cost of failure.
4. The Paris objective is achievable but the door is closing. As time passes and nations fall short of their ambitions to curb emissions it will become increasingly difficult to make up the difference and delivery of 'Paris' gets less plausible. In models such as ours this can be 'accommodated' with a growing reliance on negative emissions to meet the carbon budget. Generally as an industry we need to be very careful using this as a default option. At this point in time we believe our assumption of negative global emissions of 2 gigatonnes Bio-energy with Carbon Capture and Storage (BECCS) and 4 gigatonnes Carbon Capture and Storage (CCS) by the year 2050 is credible.
5. The focus of the TCFD Report is on reporting resilience to climate risk. This is clearly important but the analysis will also inform investment strategy. We believe there should be an equal emphasis on capital allocation plans to recognise the growth opportunities afforded by tackling climate change. Ultimately the successful positioning of Group assets to support 'Paris', both mitigates the associated transition risk and takes opportunities in the energy transition. This is what is important for our shareholders, customers and employees.

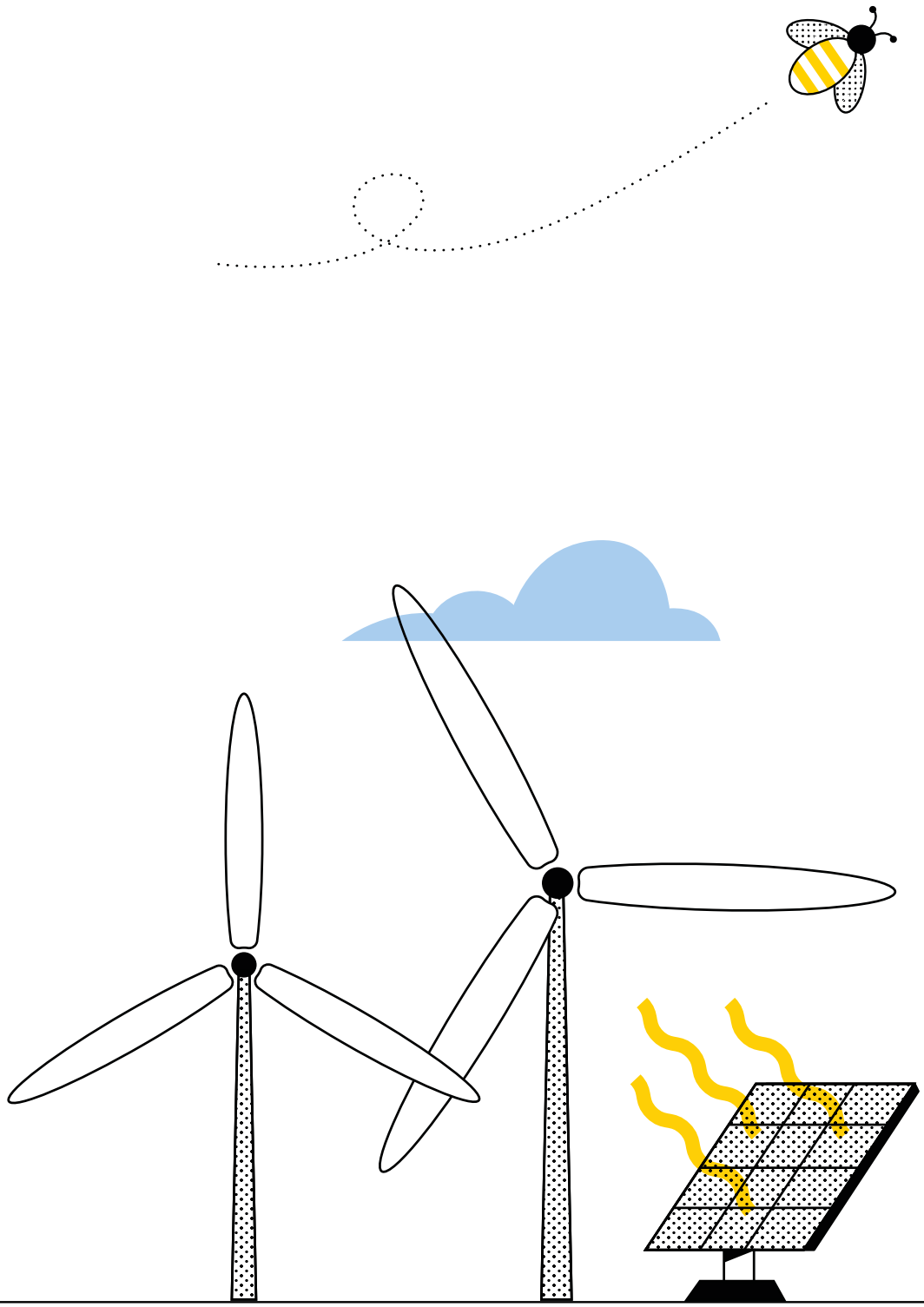
7. Details of LGIM governance and product range can be found at https://documentlibrary.lgim.com/documentlibrary/literature.html?cid=12642&lib=55458 (LGIM climate change policy) and http://update.lgim.com/futureworldfund (LGIM Future World product range)
8. There is an important distinction between scenario *outcomes* and scenario *pathways*. There are many energy transitions that deliver a particular carbon budget and associated level of warming.

L&G Climate Risk Policy Statements

1. We will decarbonise the assets on our balance sheet to align with the Paris objective. We interpret the Paris objective as targeting 1.5 degrees Celsius of warming.[9]
2. We advocate for urgent action to mitigate the climate emergency from both governments and the companies we are invested in.
3. We will use our influence as a large investor to promote a transition to a low carbon economy.
4. We support the UK Government legislation to achieve carbon neutrality by 2050.

Policy implementation (actions taken to deliver our policy statements)

1. We have set carbon intensity targets to monitor alignment with the Paris objective.
2. We have exclusions for thermal coal[10] and the LGIM Climate Impact Pledge stocks[11] written into the Investment Management Agreements (IMAs) for all relevant asset classes managed by LGIM.
3. We have implemented additional governance and control around the acquisition of high carbon investments. This includes controls to comply with PPCA[12] guidelines that apply to the funding of new coal facilities.
4. We will develop energy efficient commercial properties in our urban regeneration business and set Science Based Targets (SBT) that are aligned with the Paris objective.
5. As a large UK housebuilder we will enable all new homes we build from 2030 to operate with net zero carbon emissions.
6. We will fund the development and roll out of key technologies with the potential to accelerate the transition to carbon neutrality.

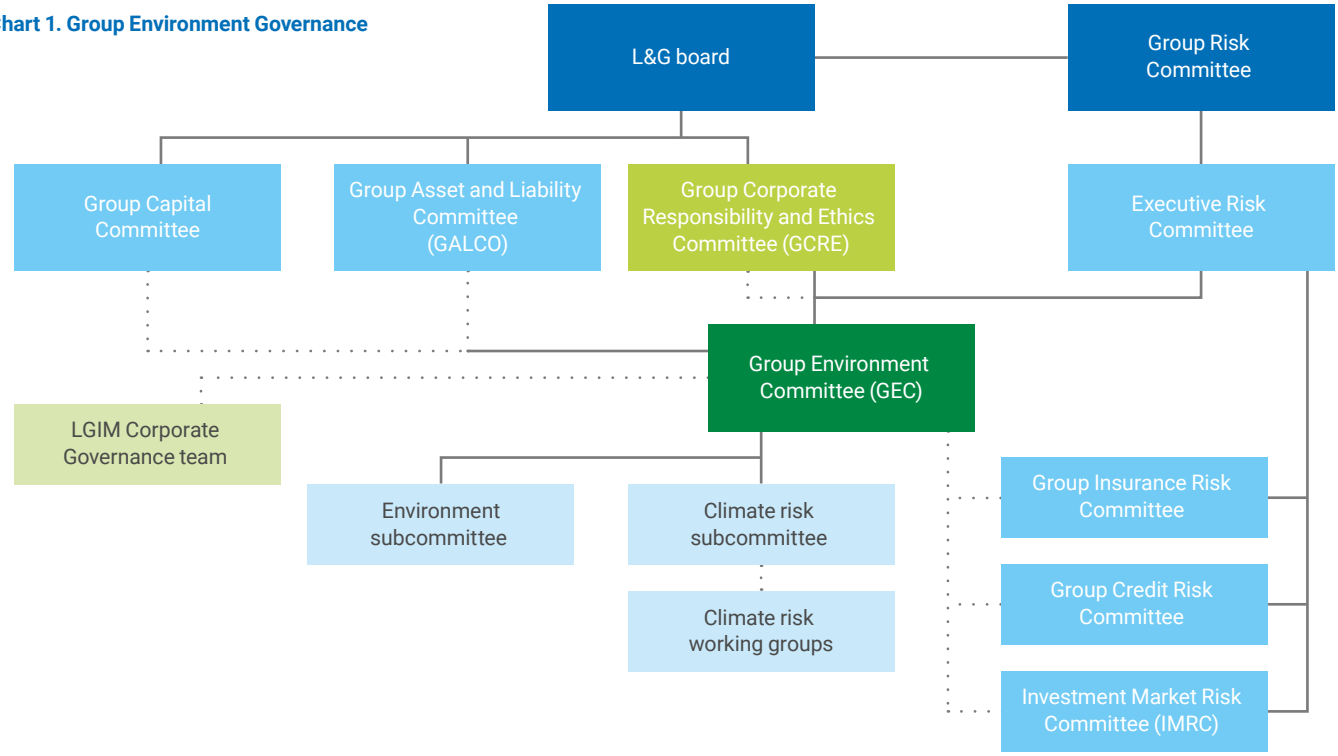


9. Over the last 18 months, and particularly since the IPCC Special Report on Global Warming of 1.5 degrees (SR 15) published in October 2018, the interpretation of 'Paris' and what needs to be achieved to deliver no more than 2 degrees of warming, has tightened significantly. The report highlighted the huge benefit of limiting warming to 1.5 degrees compared to 2 degrees and to achieve that, global human CO_2 emissions need to fall to net zero by 2050.
10. These are stocks where thermal coal is more than 30% of revenues applied to both mining companies and power generating utilities.
11. These are stocks that have fallen below the minimum thresholds LGIM applies on behalf of the Future World Range of Funds in the assessment of a wide range of climate risk mitigation policies. For the list of current exclusions see https://www.lgim.com/uk/en/insights/our-thinking/market-insights/climate-impact-pledge-tackling-the-climate-emergency.html
12. The Powering Past Coal Alliance is a coalition of countries, states and businesses working towards the global phase-out of unabated coal power, see https://poweringpastcoal.org/

Governance

Our governance around climate related risks and opportunities

Chart 1. Group Environment Governance



During 2019 L&G Group redefined the governance framework as set out above to ensure that our exposures to the financial risks from climate change are understood, identified, assessed, measured and controlled within the Group's overall risk appetite.

Group Board oversight

Nigel Wilson, Group CEO, has spearheaded the Group's engagement on a range of climate change and environmental initiatives. Nigel is actively engaged and takes responsibility for the Group's strategic direction and progress on this important topic.

We also consider market risk connected to our investments (including risks arising from climate change). The Group CFO, who is also a Board member, is responsible for how these risks are identified, considered and managed.

The Group CRO is responsible for ensuring that an appropriate strategy is in place to understand, identify, measure, monitor, control and report risks from climate change in line with the risk strategy and risk appetite parameters set by the Group Board, and support business managers in the development of appropriate processes to monitor and report exposures to the risks from climate change.

The Group Corporate Responsibility and Ethics Committee (GCRE) has been established by the Board. It is responsible for ensuring compliance with the principles of good corporate governance. Its purpose is to develop and review the Group strategy and policies in relation to Group wide ESG risks and opportunities, including climate change.

The chairman of the GCRE (the Group Corporate Affairs Director) reports to the Group Board on any significant issue or corrective action. The Committee's membership includes the heads of key businesses driving the group investment strategy along with heads of Investment Stewardship Sustainability, HR and Community Involvement.

The Corporate Social Responsibility (CSR) strategy is presented to the Board on an annual basis giving the Board's executive and non-executive directors the chance to formally engage with the CSR programme at least once a year. The GCRE is then responsible for monitoring and delivering against forward looking targets.

The Group Board, through the Executive Risk Committee (ERC) and Group Risk Committees (GRC) has delegated oversight of the management of the risks associated with climate change to the Group Environment Committee (GEC).

The GEC membership is made up of senior executives, demonstrating the importance of responding to climate risk for the Group. The committee is chaired by the Group CRO and its members include the Group CFO, LGIM CIO, the Group HR Director, the Group Corporate Affairs Director, LGRI CEO, and the LGIM Investment Stewardship team. This enables us to ensure that there is a single forum to provide oversight and encourage debate on this topic.

The Group CRO has senior management responsibility for climate risk identification and management for L&G Group and the role of the Group HR Director and the Group Corporate Affairs Director is to make sure that the management of climate risk is consistent with the broader Group Corporate and Social Responsibility policy.
www.legalandgeneralgroup.com/csr/

GEC has clearly defined relationships with Group risk oversight committees and the Group Corporate Responsibility and Ethics Committee to ensure that the management of the financial risks from climate change is integrated across the Group's system of governance and embedded into the existing risk management framework. The Committee also interacts with Group ALCo which is a committee responsible for managing all market risks on the Group balance sheet. These regular interactions will ensure a consistent Group wide approach.

The GEC is responsible for providing strategic direction for the management of environmental impact, with a particular focus on the Group's management of the financial risks from climate change. This includes:

- Setting the Group strategy for managing environmental impact with a focus on climate; including setting targets: monitoring and reporting on performance.
- Providing central oversight of the Group's management of climate impact to ensure that climate change informs strategic planning and decision-making across all Group activities (including investments).
- Overseeing the management practices that ensure these exposures are controlled in line with the Group's Risk Appetite and environment strategy.
- Promoting internal awareness and understanding of climate related threats and opportunities.
- Ensuring that the Group's actions and responses to climate are proportionate.
- Considering both the transitional and physical risks associated with climate change and their impact on listed and direct investment assets, equities and bonds, assets and liabilities, in both the short and long term.

The GEC is supported by subcommittees to review and challenge performance against tolerances and targets, one for climate risk and one for other environmental aspects; and by working groups to focus on specific additional regulatory requirements on the management of climate-related financial risks.

Strategy

The actual and potential impacts of climate related risks and opportunities on our business strategy and financial planning

Patient capital

The concept of 'patient capital' is firmly embedded in our investment approach and corporate culture. It is the long-term views we have on structural issues like climate change, demographics, future cities and changes in technology that are the key drivers of Group investment strategy.

We believe that this approach not only makes sense from an investment perspective but also has broader benefits for society. We invest for a positive economic and social impact and try to generate positive benefits to society in what we do.

We believe that climate change has not yet been fully priced in by the market, and as such L&G considers this an area of both additional risk and investment opportunity.

While we acknowledge the full set of climate risks and opportunities across our balance sheet, our broad approach is to focus on the **assets** and **transition** risk.

Focus on assets

We believe that the key source of climate risk to our business is through the shareholder owned assets, a portion of which (largely Matching Assets) supports our payments to insurance, savings and retirement customers and a portion of which (Shareholder Funds) comprises the Regulatory Solvency Capital Requirement (SCR) and surplus.

We are however also exposed to liability impacts, in particular changes in mortality outcomes in LGR, our pension annuities business and in LGI our protection business in the US. In our annuity business our pricing and liability matching strategy is applied given our mortality assumptions. Mortality outcomes different to those assumptions will have a future economic impact, which can be positive or negative. Given the geographies we operate in, our early assessment is that the impact of temperature changes depends on time horizon, but are likely to be relatively small and uncertain as to direction out to 2050. We describe our initial thinking about liability climate risk in Section 3 ('Risk management').

We sold our General Insurance business to Allianz at the end of 2019 so the assets and liabilities associated with home contents and building insurance are no longer part of our TCFD reporting.

Table 1. Total Group investments
Group Assets (Dec 2019)
Analysed by investment class:

	LGR investments 2019 £m	Other non profit insurance investments 2019 £m	LGC[a] investments 2019 £m	Other shareholder investments 2019 £m	Total 2019 £m	Total 2018 £m
Equities[a]	**203**	**14**	**2,843**	**71**	**3,131**	2,785
Bonds	**70,061**	**2,065**	**2,933**	**83**	**75,142**	63,096
Derivative assets[b]	**11,448**	**–**	**108**	**–**	**11,556**	4,411
Property	**3,798**	**–**	**159**	**–**	**3,957**	3,055
Cash, cash equivalents and loans[c]	**1,769**	**579**	**1,489**	**438**	**4,275**	4,894
Financial investments	**87,279**	**2,658**	**7,532**	**592**	**98,061**	78,241
Other assets[d]	**90**	**–**	**1,458**	**–**	**1,548**	1,208
Total investments	**87,369**	**2,658**	**8,990**	**592**	**99,609**	79,449

a. Equity investments include a total of £324m (31 December 2018: £259m) in respect of associates and joint ventures.
b. Derivative assets are shown gross of derivative liabilities of £11.5bn (31 December 2018: £3.3bn). Exposures arise from use of derivatives for efficient portfolio management, especially the use of interest rate swaps, inflation swaps, credit default swaps and foreign exchange forward contracts for asset and liability management.
c. Loans include reverse repurchase agreements of £1,261m (31 December 2018 £857m).
d. Other assets includes the consolidated net asset value of the group's investments in CALA Homes and other housing businesses.

As of 31 December 2019, the Group's balance sheet comprises £99.6bn of investment assets to which shareholders are directly exposed.

We invest in the full spectrum of asset classes including equity, corporate and government bonds, commercial and residential property and a range of other 'alternative' assets such as infrastructure.

These assets support the following core businesses:

Legal & General Retirement (LGR) offers both institutional 'pension risk transfer' products to pension scheme trustees (through Legal & General Retirement Institutional 'LGRI') and retail products to customers to help them manage their finances in retirement (through Legal & General Retirement Retail 'LGRR'). These are largely 'annuity' products that give people a guaranteed income, either through life or for a fixed term.

- As seen in Table 1, LGR holds c88% of Group assets, the vast majority of which (£70.0bn) relate to both listed and unlisted bond investments.
- Listed bond investments are generally split between government and corporate bonds, split across multiple sectors.
- Direct investments include the Lifetime Mortgage business (£4.7bn), Commercial Real Estate Loans (£3.6bn) and Infrastructure Loans (£10.8bn).
- While Sterling bonds make up most of LGR's assets, a US Dollar portfolio covers both a portion of the UK annuity products and annuities sold in the USA.
- A further breakdown of the bond portfolio, by sector and region, is given in the annual accounts.
- Property assets in this business (£3.8bn) are Commercial Properties.

Legal & General Capital (LGC) manages shareholder assets which are not directly required to meet contractual obligations to policyholders. Its focus is investing in Future Cities, including urban regeneration, clean energy and digital infrastructure, housing and SME finance.

- The associated financial investments of Future Cities and SME Finance are included alongside listed investments in the table above.
- Housing investment is through the funding of the Housing Operating businesses (including CALA) and is reflected in the 'Other Assets' line in the table above.

Legal & General Insurance (LGI) helps individuals protect themselves and their families from the effects of death, critical illness and long-term ill health, both in the UK and in the US.

- The assets in this business are generally held to cover the business sold in the US so are mostly US-denominated bond investments.

Focus on transition risk

Climate-related risks are broadly categorised as physical or transition risks. Physical risks include those to supply chains and physical assets from severe weather events and from chronic, climate-related strain on resources. Transition risks are those that are brought about by the shifts in the political, technological, social, and economic landscape that are likely to occur during the transition to a low carbon economy. Clearly the two risks are interrelated: continued emissions will lead to rising temperatures that increase physical risks, but limiting these impacts requires substantial emissions reductions that increase transition risks.

We focus on transition risk because successful delivery of the Paris Agreement implies a fundamental change in the global economy over the next 10 years. We think this is the key near-term issue and source of risk for our business – specifically our investment portfolio.

This doesn't mean that physical risks are unimportant. Physical risks are present in the real assets and businesses we invest in now and are included in our 30-year scenario analysis. Some physical risks are projected to 2100 to get a sense of the impact beyond our 2050 model horizon. Physical risk is also measured in our forward looking flood risk mapping for directly owned commercial property.

However, the concentration of greenhouse gases already present in the atmosphere means that warming trends are not expected to significantly diverge until around 2040/50. Physical risk impacts are therefore largely locked-in over coming decades, making the emission scenarios we are applying less relevant. For physical risk quantification in our analysis we think it makes sense to focus on the 'BAU' 3.75 degree pathway.

Our strategic response

We support the Paris Agreement. This means we will manage our business to align with the mitigation of climate change defined in the Agreement. We will plan our businesses on the basis that climate change is successfully constrained while managing the risk that it is not.

The world's energy system is directly responsible for around two-thirds of global CO_2e emissions[13] and there are many possible energy pathway solutions that deliver a 'Paris' outcome. LGIM has modelled what we believe is the most plausible in a purpose built bespoke energy model 'Destination'. This pathway defines the carbon price that informs our understanding of transition risk.

A key assumption in our strategy is that the world's energy system needs to change very quickly compared to history. A 'Paris' transition requires unprecedented economic restructuring, behavioural change and technological development that have significant implications for investment portfolios.

Below (LGIM 'Destination' model) we describe our approach to modelling the energy transition. We then show (the Destination@Risk model) how this informs our understanding of financial impacts, bringing together transitional risk and physical risk in the defined scenarios.

Modelling climate risk

LGIM 'Destination' model

In 2018, LGIM entered into a strategic partnership with Baringa Partners, to construct a bespoke model that we could use to analyse scenarios depicting how the energy system is likely to evolve over the next 30 years and what the implications are for investors (see press release March 2018).[14]

Together we have developed 'Destination', a dynamic flexible model that we can use to analyse the energy transition. We have built a dataset using around 100 different public and proprietary sources and around two million variables and assumptions.

We have used 'Destination' to model two pathways.

The first is the energy system we will have in a world where we take early, definitive, joined-up policy and investment actions to move onto a well-below 2 degree scenario by the end of the century. We define this scenario as 'Paris'. Companies and consumers align their behaviour with a carbon neutral economy gradually in this scenario. Financial markets price in the transition in an orderly fashion and take advantage of the opportunities the transition provides. Whilst there are significant structural changes and winners and losers, the economic impacts are manageable. Our policy commitment is to support the delivery of this outcome.

The second is a business as usual 'BAU' scenario where the warming outcome is expected to be 3.75 degrees which is the likely outcome if we fail to act to make the necessary changes to address climate change. This is still a technologically optimistic view of the world, with many green and low carbon technologies becoming cheaper than legacy choices over time but there is no aggressive coordinated international response. The bulk of scientific and economic research has confirmed that the consequences of this are significantly negative, potentially catastrophic.

In terms of warming outcomes our chosen scenarios can be mapped to well- known reference scenarios that are likely to be used in many TCFD reports which will help comparability and alignment over time.

The contrast between our 'Paris' and 'BAU' scenarios is stark with dramatic macro economic consequences. In our 'Paris' transition the energy mix changes very rapidly. Disruption is widespread; both coal and oil lose roughly 50% of their share of the mix in only 35 years, with much of that disruption occurring in the middle years of the forecast period rather than the later years. Similarly the electricity system is rapidly decarbonised. Around three-quarters of all electricity is generated from low-carbon sources by 2050. In our 'BAU' scenario, we forecast an energy mix that remains remarkably stable. In particular, coal, oil and gas all hold onto roughly constant shares. Nuclear should see modest growth, mostly in Asian markets. Renewables grow modestly in the 'BAU' scenarios but very rapidly in the 'Paris ' scenario. Solar becomes especially valuable to the system, as costs continue to decline throughout the forecasting period.

When looked at in the context of history, the 'Paris' aligned energy system changes at somewhere between two and three times the pace of 'normal' change. It is significantly more capital intensive than our 'BAU' scenario leading in our analysis to a cumulative additional capital investment of about $29 trillion. Such a change is bound to have significant implications for investors both positive and negative.

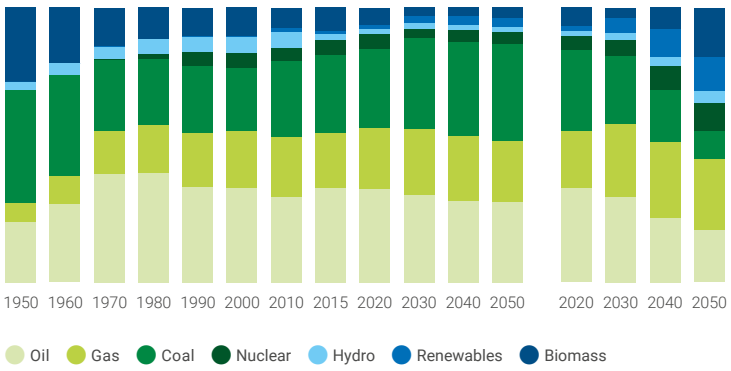
As an example of the business implications, in our 'BAU' scenario around 50% of all cars driven globally remain powered by petrol or diesel in 2050. In contrast in our 'Paris' scenario, around 90% of the fleet is electric.

The modelled transition for both scenarios is shown in chart 2 'Destination' primary energy mix at the bottom of the page.

The bars 1950 -2015 show the energy mix historically, the left hand bars represent 'BAU'; the bars on the right represent our 'Paris' scenario.

Chart 2.

'Destination' primary energy mix (%)



13. Carbon dioxide is the most significant contributor to global GHG emissions (these consist also of methane, nitrous oxide and fluorinated gases). In order to align all emissions under the same metric all corporate GHG emissions are measured in CO_2e which is carbon dioxide equivalent measured in tonnes. This measures the equivalent warming impact of GHG emissions. Non energy emissions represent roughly one third of emissions.
14. https://www.insurancebusinessmag.com/uk/news/energy/legal-and-general-unit-reveals-new-model-for-energy-transition-risk-164814.aspx

Key assumptions

1. Almost all transition scenarios utilise Carbon Capture and Storage (CCS) to some extent. One form of CCS is a technology called Bio Energy with Carbon Capture and Storage (BECCS) which aims to capture CO_2 from the atmosphere using 'natural' processes (planting trees) and then capturing that CO_2 when it is burnt to produce energy. In our 'Paris' scenario we have assumed offsetting negative global emissions of 2 gigatonnes BECCS and 4 gigatonnes CCS by 2050 which we believe is in the mid-range of academic and industry scenarios sized to reflect constraints on land usage.[15]
2. Another key assumption is that in our 'Paris' scenario we have assumed a rate of improvement in non-energy emissions derived from research from the International Energy Agency (IEA).

The Destination@Risk model

Our approach to asset risk modelling brings the energy model (above) together with a physical risk model, company impacts model (including earnings, capex and balance sheet effects) and a model that helps us calibrate financial impacts. Collectively this is our framework for understanding 30-year transition and physical risk financial impacts for our chosen scenarios, which we refer to as our 'Destination@Risk' model. The model has been developed in collaboration with Baringa Partners.

Our start point is to use the energy model 'Destination' to define the chosen transition pathway for the modelled scenarios. That pathway, and the associated carbon price, drives a number of macro and sector/regional outputs (prices and quantities) that impact company earnings in the high carbon sectors. They will face new costs in proportion to the emissions generated by their operations and power usage. Suppliers will also face cost increases which will also increase input costs and customer prices will rise to offset these pressures. Demand adjusts given the elasticity assumptions we have made. We then translate sector level outputs into company level impacts. We have applied a granular bottom up approach to our earnings analysis of stocks in the Power Generation and Energy sectors.

For physical risk we use an analysis that maps corporate facilities and commercial property locations at a granular level to forward looking weather outcomes in terms of a change in frequency (hazard heat maps). We use annual business interruption as a proxy for disruption costs to model the impact on companies. For real assets like commercial property we can think of this as a reduction in yield connected to an increase in insurance costs.

We then aggregate the transition and physical risk impacts at the company level and model the impact on the financial assets we hold. Given the uncertainties, we've taken a simple approach to this – changes in earnings flow proportionately straight through to price for equity, whereas for bonds a <1 sensitivity is applied to reflect the credit rating and lower risk nature of the asset class.

We assume that the nominal size and composition of the balance sheet doesn't change but the companies we hold in the Energy and Power Generating sectors do adapt and reposition over the scenario period.

Whilst these risk models are consistently applied in the two scenarios it is worth emphasising that given the uncertainties and the assumption of a static balance sheet we should treat the numbers as being indicative.

The next stage in our model development will be to build in more company specific information on the location of operating assets, mitigating actions taken and forward looking product and market characteristics that indicate more or less resilience to climate risk. Our initial focus is to introduce a granular approach to the Transport sector.

15. See https://data.ene.iiasa.ac.at/iamc-1.5c-explorer/)

Chart 3.

GICS sector by valuation %

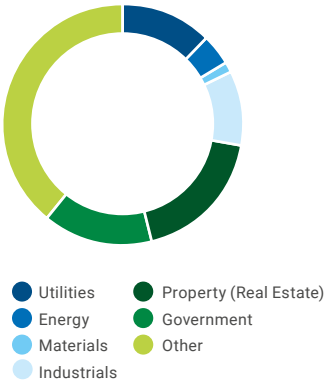


Chart 4.

GICS sector by CO_2e intensity %

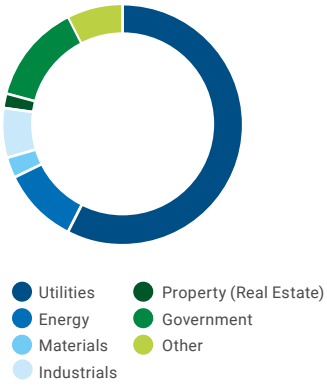
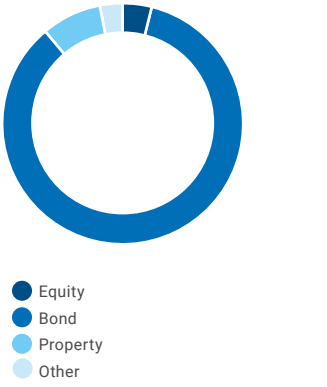


Chart 5.

Asset type by valuation %



Group assets £84bn[16]

Risk analysis results

Exposure to transition risk

The pie charts to the left show Dec 2019 Group asset exposures based on sector asset values and sector carbon intensity. Chart 3 shows that weighted by value roughly 46% of the portfolio is exposed to the highest carbon sectors, Energy, Utilities, Real Estate, Industrials (including Transport) and Materials.

When weighted by carbon intensity (chart 4) we can see that transition risk is highly concentrated in the same sectors (79%).

Chart 5 shows a breakdown by asset type. The key observation is that bonds comprise 84% of the portfolio analysed. This is an important factor when we show financial risk impacts in our two scenarios.

Temperature alignment of L&G portfolio

Another way of looking at transition risk is to look at the implied warming potential of our portfolio and compare it to well known indices which serve as a proxy for 'the world as it is'. This gives us a sense of where we are compared to both our Paris objective and the world as it currently stands in terms of carbon intensity. We have analysised c£36bn of listed assets (including government bonds) where we have the relevant carbon data.

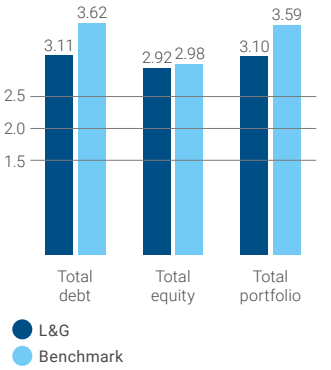
This is the analysis we show in chart 6 above 'portfolio temperature alignment'

The lower the 'implied warming' compared to the chosen benchmarks the better the fund is positioned with respect to transition risk. We have used 'Destination' to calculate the required reduction in carbon intensity for the higher risk sectors to deliver the 'Paris' outcome. This gives us a trajectory against which we can assess the stocks we hold in those sectors. To the extent we own stocks where the expected emission intensity pathway is lower than the sector reference, the implied portfolio warming is lower than the Paris objective and vice versa. We have used up to 10 years' of reported carbon emissions for each stock as the key indicator of alignment (adjusted for where the stock sits with respect to the average in the sector).

Chart 6.

Portfolio Temperature Alignment °C

(c£36bn of listed equity and bonds)



16. Group assets excluding derivatives and cash

For government bonds we use data provided by Climate Action Tracker to map government policies to a warming outcome. We also show our calculation of the implied warming on the chosen indices.

Chart 6 shows that the analysed listed equity and bond assets imply a warming slightly below that derived for two standard indices. In other words on this portion of our assets we are more highly weighted in stocks transitioning more quickly than the average in the relevant sector of the chosen indices. The horizontal lines show what needs to be achieved to deliver the indicated warming paths.

The implied warming is clearly above 'Paris' defined as targetting 1.5 degrees of warming but at this point in the energy transition this isn't a surprising result. 'Paris' is a desired future outcome whereas the current portfolio largely reflects the opportunity set connected to the 'world as it is'. That investment universe does not yet contain all the renewable assets and green technologies required to deliver 'Paris' and not all companies are evidencing a future strategy that is consistent with 'Paris'. We know that to mitigate transition risk our portfolio must align with the fall in carbon emissions required to deliver the 'Paris' objective. The policies and procedures we have in place to drive that change are described in Section 3 ('Risk Management').

Scenario analysis

Results

Given our view that climate risk is not fully discounted in asset pricing, it follows that we can expect some impact on prices as the risk is realised over time. A reduction in value can be expected on the most at-risk stocks and sectors (indicated by high carbon intensity or a high risk location).

Equity impacts

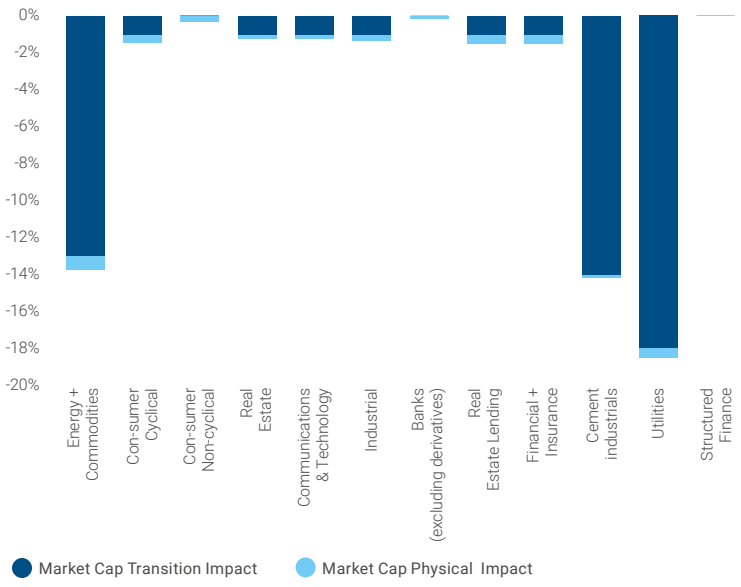
Chart 7 below 'Market cap impacts' gives a good sense of the financial risk connected to a 'Paris' transition. It shows for our diversified equity exposure the approximate average sector combined transitional and physical risk price impact to 2030. We emphasise that this is just the impact on equity, the highest risk broad asset class; we are not here showing total L&G portfolio impacts.

The key observation is that equity price risk strongly maps to the highest carbon sectors we identified in the pie charts earlier. These results show just broad sector impacts, but within the Utility sector for example there are clear winners and losers over different time periods. Looking at the distribution within utilities in the 'Paris' scenario out to 2050, the price range indicates that some companies don't survive whilst a number nearly double in price.

It is interesting to note the relatively low impact of physical risk in this scenario; conceptually we are incurring higher transitional costs to avoid the potential catastrophic impact of much higher warming outcomes.

Chart 7. Market Cap Impacts to 2030.

'Paris' Equity market cap impacts to 2030



L&G portfolio impacts

Table 2 below shows for 'Paris' and our 'BAU' scenarios what the percentage reduction in portfolio value is estimated to be at the 2030 point and the 2050 point split by transition and physical impact. We assume that the balance sheet mix of assets doesn't change. The value of assets in the analysis is c£41bn and focuses on corporate issuers (excludes cash, government bonds, commercial property, and number of non corporate instruments).

Table 2. Total portfolio impacts

	BAU		Paris	
	2030	2050	2030	2050
Physical	-0.2%	-0.8%	-0.1%	-0.3%
Transitional	–	–	-1.0%	-1.7%
Total	**-0.2%**	**-0.8**	**-1.1%**	**-2.0%**

As a comparison, table 3 below shows the impact on the equity only portfolio under the same assumptions. The difference highlights the risk reducing impact of our high bond allocations.

The key observation is that the portfolio impacts are much reduced compared to the equity only impacts. This is the point about asset mix and the high weighting in bonds we alluded to earlier.

Table 3. Equity only impacts

	BAU		Paris	
	2030	2050	2030	2050
Physical	-1.0%	-3.7%	-0.4%	-1.1%
Transitional	–	–	-3.4%	-9.6%
Total	**-1.0%**	**-3.7%**	**-3.8%**	**-10.7%**

L&G portfolio scenario impacts through time

In charts 8 and 9 we show the evolving shape of portfolio impacts to 2050 split by transition risk and physical risk in the two scenarios

We can see that in the 'Paris' scenario to 2050 the physical risk impact looks relatively low in the context of transitional risk. This outcome is very plausible and is in line with our expectations. Similarly, in the 'BAU' world the impacts are exclusively physical. However over the timeframe shown the 'BAU' physical risk impact looks low in the context of the Paris transitional risk impact. The issue here is timeframe: the worst effects of warming in the 'BAU' scenario are more apparent in years 2050-2100 which is outside the model framework.

Chart 8.

'Paris' Full portfolio transition and physical impacts

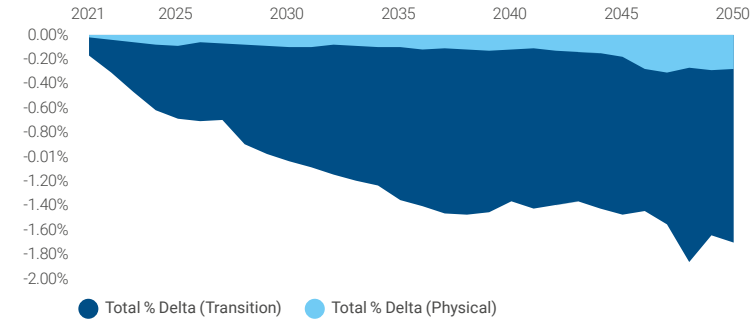
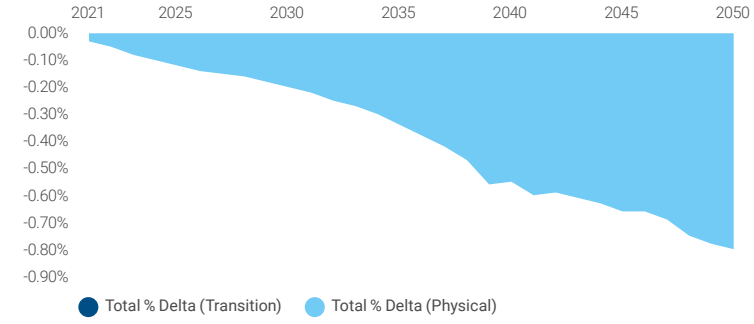


Chart 9.

'BAU' Full portfolio transition and physical impacts

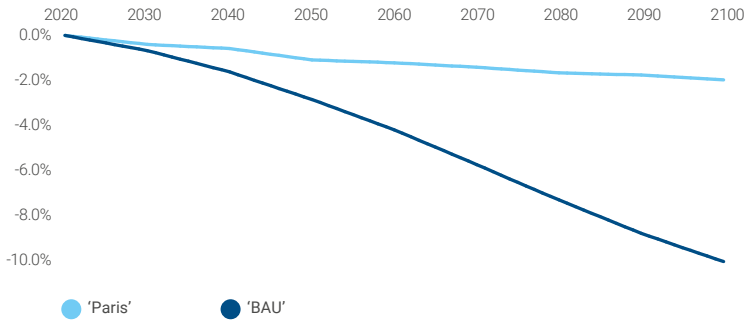


To give a sense of this longer-term trajectory for physical risk, chart 10 extends the analysis of physical risk for the portfolio.

The chart shows a continuing deterioration of physical impacts until the end of the century and this is also likely to be understated because we are only looking at the first order impact of physical risks on the real assets of the corporates. We are not assessing the full financial impacts to the economy from physical risks, which should also include the full human impacts (disease, forced migration due to water and food shortages) and disruption to corporate supply chains. The impacts are likely to be much higher than shown, though difficult to model.

Chart 10.

Physical Impacts Only to 2,100 (Top 2,000 companies)



Does the scenario risk analysis evidence strategic L&G resilience?

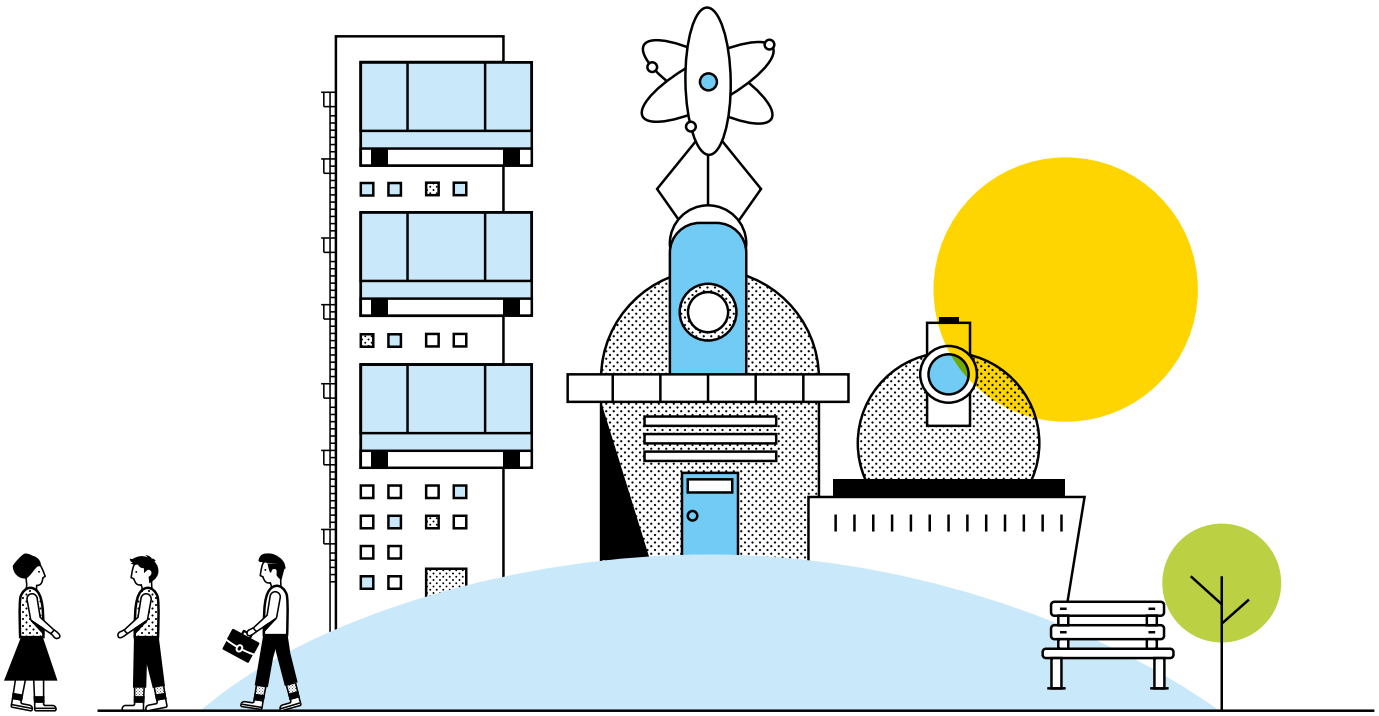
As a broad observation three mitigations follow from the nature of our business and transition risk exposure.

First, given that our exposure is largely through financial assets, many of which are listed, we have significant flexibility to adapt by trading to the desired carbon position. This is the expected outcome in the event that our process of active engagement fails. This gives us more adaptive flexibility than a business that may need to make large changes to its business model and correspondingly restructure its operations and facilities.

Second, given that we hold mainly investment grade bonds, the price risk is substantially lower compared to investors with portfolios holding a larger exposures to equities. The extent of this is clearly seen in the difference between the L&G portfolio impacts and the equity only impacts.

Third, the balance sheet is well diversified across different sectors of the economy and following our initial assessment of implied warming we are not overweight the highest carbon intensity names within the market sectors.

We also believe that our transition strategy and the policies we have in place to mitigate climate risk will also support resilience (Section 3 'Risk Management').



Risk management

The processes used by Legal & General to identify, assess and manage climate-related risks

We have carried out a detailed assessment of how we could expect climate risk to emerge across our business model. We describe what we see are the relevant considerations on the different areas below.

Insurance and shareholder funds

Climate change may impact on credit risk both through movements in credit spreads and through credit rating transitions as a result of changes in either actual or anticipated default rates.

Climate change may impact on equity and property risk. This may be through asset values being exposed to a, potentially sudden, re-pricing to reflect transition risks to a low or carbon neutral economy, or as a result of more frequent and severe weather events and longer-term shifts in climate impacting on asset values. Both of these may be through actual experience or a change in anticipated future experience. Climate change may also present enhanced asset returns, for example increased equity valuation for a firm enabling transition to a low carbon economy.

While we would not expect climate change to pose significant risk to our short-term counterparty exposures, we do have a number of long-term reinsurance arrangements. Reinsurance counterparties would be expected to have a similar exposure to the risks posed by climate change as outlined above, and further exposed to the physical risk from climate change due to their property and casualty (P&C) business. This could change our assessment of the counterparty risk.

L&G seeks to limit loss from the risks from climate change and deploys a range of risk management strategies to mitigate unforeseen loss.

However we cannot completely eliminate the risks associated with climate change through asset allocation, which is why we have focused on developing our governance, our understanding of the risk and the environmental impact of our business decisions.

The processes used to manage transition risks

In Section 2 ('Strategy') we highlighted our focus on climate risk in connection with our investment assets and the required energy transition. Given this focus, the integration of carbon controls into the investment process is the obvious mitigation strategy.

These mitigations and controls fall into the following categories; carbon intensity targets, climate stock exclusions, high carbon escalation, corporate engagement, investing in renewable infrastructure, carbon neutral transportation, green technology and implementing high energy efficiency standards into our directly owned commercial property and housing businesses.

Carbon intensity targets

We calculate carbon emission intensity at both the Group level and the key business units. We are currently in the process of reviewing our reduction targets on our investment assets to align with the 'Paris' objective. We expect to report these trajectories in our next TCFD report. The balance sheet carbon intensity calculation is done 6 monthly and when the full framework is established it will be monitored against the agreed targets. Oversight will be by the Group Environment Committee.

Climate risk IMA exclusions

We have made changes in our Investment Management Agreements (IMAs) with LGIM to exclude investments in companies with more than 30% of revenues connected to thermal coal and also stocks excluded by LGIM from the Future World product range under the Climate Impact Pledge.

Under the Climate Impact Pledge LGIM has been focused on the world's largest companies in sectors which are key to the low-carbon transition. Companies are assessed on over 100 indicators, based on their articulation of risk and opportunities, the level of transparency, the robustness of their governance, the strength of their strategies in pursuing new opportunities, the record of controversial incidents and how they lobby governments on climate regulations. All companies are contacted directly to discuss areas of improvements with constructive feedback based on their current disclosures.

Companies exhibiting best practice will be 'named and famed' publicly, whilst laggards that fall below what LGIM considers its minimum thresholds will be excluded, which will lead to voting against the chair of the board across the entire equity holdings of LGIM and to divestment in our Future World fund range. L&G Group's IMAs will also reflect these exclusions, helping to drive change in the market by backing up LGIM's engagement with the use of the Group's own balance sheet capital.

This list is reviewed in June each year and the IMAs are updated for any changes. The rule we apply to an excluded stock is 'do not buy'. If after 12 months' engagement we still have concerns about the company's strategy the relevant business and the asset manager will agree a course of action.

Escalation process

As part of delivering our carbon reduction commitments we have established a process to escalate through further governance all proposed individual stock investments where the carbon intensity (emissions and/or reserves) is greater than a top quartile threshold across a number of relevant sectors. This gives us an early warning system and a degree of control over the accumulation of carbon risk through time.

The escalation process is not a rubber stamping and has had a real impact. Large proposed transactions have been declined on the basis of greenhouse gas (GHG) concerns or concerns about physical risk.

Engagement

An important part of our strategy to limit the impact of climate change is to engage with regulators and investee companies in support of increased climate action. This benefits not just L&G stakeholders but the wider market and society as well. This activity is actively pursued by LGIM on our behalf.

To maximise our influence LGIM works alongside other large investors and specialist advisory groups to promote better standards of corporate governance and stewardship in general but also a number of forums to support collaboration on climate change.

LGIM makes use of a number of collaborative initiatives and industry associations to enhance its leverage on climate-related topics. It is a long-standing member of the Institutional Investor Group on Climate Change and a member of Climate Action 100+, an investor initiative engaging with some of the world's largest companies on their management of climate-related risks. As part of the work with CA100+, LGIM co-filed a shareholder resolution at BP in 2019, calling on the company to set Paris-aligned operational emissions targets, and to demonstrate the viability of its capex spend under a low-carbon trajectory.

L&G is a member of the Aldersgate Group – an alliance of leaders from business, politics and civil society that drives action for a sustainable economy. We use this forum to engage with policymakers both in the EU and the UK, with Aldersgate Group being one of the key actors encouraging the adoption of net-zero legislation in the UK, which was passed in 2019.

LGIM is also an active members of the Principles for Responsible Investment, which coordinates investor action on issues such as climate-related corporate lobbying and deforestation. It isalso a member of FAIRR, an investor initiative focused on the ESG and climate-related risks associated with livestock farming.

Additionally, LGIM's CEO sits on the board of directors of the Investment Association (IA), while members of LGIM's Investment Stewardship team sit on the IA's Sustainability & Responsible Investment Committee.

LGIM is also directly engaging with regulators and policy-makers globally on the issue, including the UK Department for Work and Pensions, Financial Conduct Authority and the Prudential Regulation Authority, the US Securities and Exchange Commission, and the European Commission.

Direct company engagement is another key toolkit to mitigate portfolio climate risk. The targeted approach in LGIM's flagship climate engagement programme – the Climate Impact Pledge, which uses voting and investment decisions to motivate companies to step up climate action – has led to notable improvements in companies – for example, two energy companies that had been excluded from certain funds in 2017 have since made sufficient improvements to be reinstated in the funds.

LGIM does not simply follow proxy advisers, but rather uses its voting power as a shareholder to encourage better climate governance and hold company boards to account on their management of climate-related risks. As part of the Climate Impact Pledge, LGIM votes against chairs where they believe the company's strategic approach to climate change is insufficient and falling behind its peers. They also vote against chairs of companies on the Future World Protection List, which includes those that have violated international environmental norms.[17]

Observing that more than half of surveyed fund managers 'had no climate change-related voting policies or guidelines', the UK Minister for Pensions and Financial Inclusion remarked that a 'notable exception' is 'Legal and General's Future World Fund which withdraws investment in companies who don't engage with climate change, forcing those firms to act fast in the hope of being reinstated.

The Climate Impact Pledge engagements and research are conducted within LGIM's Investment Stewardship team, which led to a target list of circa. 80 large-cap companies. However, the other investment teams within LGIM also conduct a significant number of engagements with thousands of global companies.

That is why, in 2019, LGIM's CIO established a Global Sector Research Framework to bring together the best sector expertise across LGIM to identify the challenges and opportunities which will determine the resiliency of sectors and the companies within them. This collaboration will unify engagement efforts, allowing us to communicate with one voice and escalate concerns.

> "The pricing mechanism in markets is not discounting all ESG-related risks fairly, particularly those stemming from climate change, as investors lack the information necessary to do so. The output from the platform strengthens and streamlines our engagement activities across investments and stewardship, to enable us to collectively set goals and targets at a company level with one voice, whilst supporting and guiding our investment decisions across the capital structure"
>
> Sonja Laud
> LGIM CIO

17. LGIM executes votes on behalf of L&G's internally managed assets – LGIM's voting records are publically available, and disclosed on a monthly, regional basis: https://documentlibrary.lgim.com/documentlibrary/library_55458.html

Support for mainstream low-carbon funds and client education

L&G Group has demonstrated strong support for LGIM Future World Fund Range by investing c£789.8m of our own capital.[18] We believe this brings resilience to our own assets but also gives LGIM the scale and credibility to attract external capital to bring more power and authority to our engagement process. One of the key ways L&G can have a positive impact is by helping clients, the owners and ultimate beneficiaries of the assets we manage, to take action on climate change.

LGIM seeks to achieve this through an assessment of the implications of climate change for our clients' assets. This is done to help our clients better understand which impacts and risks may be sitting in an average portfolio. We regularly publish thought pieces and blogs on climate-related topics, for example:

- A blog on climate and longevity risk: https://futureworldblog.lgim.com/categories/themes/could-green-investments-help-hedge-longevity-risk/
- Scope 3 emissions and climate liability: https://futureworldblog.lgim.com/categories/themes/when-red-herrings-turn-green/?cid=linkedin
- Climate investment options for Local Government Pension Schemes: https://www.lgim.com/files/_document-library/knowledge/thought-leadership-content/lgps-intelligence/lgps-intelligence-nov-2019-final.pdf
- Legal & General's CEO also regularly publishes articles on climate-related topics, for example:
  - On the role of markets in driving climate solutions: https://www.forbes.com/sites/nigelwilson/2019/07/28/markets-and-technology-may-hold-out-the-real-green-new-deal-part-ii/ (building regulation)
  - 6 approaches to increasing corporate sustainability: https://www.forbes.com/sites/nigelwilson/2019/12/09/esg-notebook-6-practical-approaches-to-increasing-corporate-sustainability/
- LGIM regularly hosts educational sessions for trustees and clients. In early 2019, senior LGIM staff were joined by world-renowned climate economist Lord Nicholas Stern at the London Stock Exchange for a client webinar to discuss climate integration into investments – a recording is available here: https://youtu.be/3ldIlweafvY
- To make climate information more accessible, carbon metrics (e.g. reductions in fossil fuel exposure relative to a benchmark, or carbon emissions intensity) have now been incorporated into fund factsheets, where applicable to funds in LGIM's Future World range.

Group training and culture

An important part of our strategy to mitigate climate risk is to develop internal communications with the objective of generating a culture that is climate risk aware and encourages the engagement of staff. To this end our Senior Leadership Conference in November 2019 focussed on developing concrete workable ideas for responding to the climate emergency and developing a sense of ownership and personal responsibility amongst all staff. As a firm we collectively committed to making this issue a top priority and will follow up the practical ideas generated. We will also develop an internal communications programme to ensure a minimum level of understanding among employees and galvanise individual and corporate action, by promoting conversation about this issue among employees.

In late 2019, LGIM's Director of Investment Stewardship presented to the L&G Board and senior leadership teams about LGIM's ongoing work to incorporate climate risk into investments, company engagement and client education. He discussed the growing financial materiality of climate change – coming under increased focus from regulators as well as end pension fund clients. On an almost weekly basis, many of LGIM's clients are asking increasingly sophisticated questions around the climate risks within their portfolios. Issues around the lack of consistent, standardised climate information were also discussed, while noting the remarkable progress in climate analytics seen in the market.

Investing in renewable infrastructure and green technology

Part of building portfolio resilience is to invest in low carbon assets and technologies that support a speedy transition. We would expect to see a positive return on these assets[19] if a Paris consistent economy is achieved which will mitigate the transition and physical risks that arise elsewhere in the portfolio.

Onshore and off-shore wind

In many markets onshore wind is the lowest cost way to generate renewable power and therefore L&G has invested to both fund and support the development, construction and operation of this global leading renewable technology.

LGC has a 25% share in NTR Asset Management Europe a clean energy asset manager, and we seeded NTR funds with c£180m in equity commitments. Over 2018-2019, NTR funds powered c.140,000 homes and offset c.120,000 tonnes of CO_2.

In addition, whilst direct investment in the construction of new renewable energy assets can take a while to establish we have invested c£177m in closed end listed funds focused on operating wind and solar power production.

Further, our retirement business (LGR) has provided £773m of debt financing into off-shore wind infrastructure. This includes the Hornsea Project One offshore wind farm, Dudgeon Offshore Wind Ltd and Walney Extension offshore wind farm. These three wind farms combined have the capacity to provide enough power to service over 2,000,000 homes.

Solar Photovoltaic (PV)

Solar PV is becoming one of the lowest cost renewable energy sources.
Oxford PV is a UK-headquartered solar perovskite technology company that develops breakthrough, high-efficiency solar PV products which can produce substantially more power than a typical silicon PV module of the same size.

In 2019 LGC continued to support the development of this technology with a further investment as part of the company's total £65m Series D fund raise.

In addition LGR has provided c£130m of solar debt.

Tokamak Energy

Tokamak Energy is striving to harness the significant potential of fusion power to deliver an abundant, safe and cost-effective source of clean energy on a global scale.

LGC has invested in the business since 2016 to help finance the research, development and engineering of the technology being led by a team based in Oxford, UK.

In 2019 LGC made a further investment in the business to support its continuing progress.

18. For the LGIM managed funds on behalf of external clients all risks associated with these funds are borne by the client holders of these assets. The ultimate decision to choose a specific mandate or portfolio lies with the client. As a result LGIM may be directed to invest in portfolios that include companies on the Future World Fund Range exclusions list.
19. For corporate bonds we can think of the positive impact as being reflected in the default probability and credit rating

Upside Energy

LGC recognises that there are many challenges to be addressed as the energy system transitions towards more clean and renewable sources of energy. For example, as more renewable power is delivered to power grid systems, there is a need to use this power in the most effective way and match the variable nature of the generation, with the profile of consumption.

We have invested in Upside Energy, a company that has developed a digital software platform that uses advanced algorithms and artificial intelligence to match energy demand with the available supply. This helps the electricity grid deal with fluctuations and times of peak usage. Supporting the grid in this way reduces energy costs and carbon emissions and helps to create a more sustainable and efficient power network.

Pod Point

It is our view that the majority of new vehicles sold a decade from now will be electric vehicles (EVs) which are expected to reach cost-parity with the internal combustion engine within five years. It is also our view that petrol and diesel cars will increasingly be seen as socially unacceptable in the coming decade and, once a certain level of EV uptake is reached, the internal combustion engine will be seen as obsolete technology, accelerating the switch.

Pod Point provides EV charging units and management software to households as well as to companies wanting to provide EV charging capability for their customers, visitors or employees. In our view this strategy also aligns well with the activities of our wider businesses, specifically the residential, retail, leisure, commercial and industrial property portfolios.

The capital provided by LGC has enabled Pod Point to scale up its business in 2019 to support the uptake of electric vehicles and decarbonisation of the transport sector.

The built environment (housing and commercial property)

The built environment (domestic and commercial) contributes around 40% of the UK's total carbon footprint. Almost half of this is from energy used in buildings and infrastructure.[20]

An important part of our strategy to mitigate transition risk therefore is to improve energy efficiency in the assets we build (whether to sell or hold) and switch to low carbon heat sources where we are responsible for energy procurement.

Housing

Our commitment to deliver low carbon, energy efficient homes

As a large UK house builder we recognise that we have an important role to play, through our fast growing diversified housing platform, in delivering carbon reductions from the nation's housing stock. Therefore, in line with the definitions within the UK Green Building Council (UKGBC) framework, from 2030 all new L&G homes will be capable of operating with net zero carbon emissions. We will achieve this by:

- addressing the operational energy in our new homes, both the amount used and the primary energy source;
- ensuring that building fabric thermal performance is in line with industry best practice (to Future Homes Standard and above);
- establishing designs to reduce unwanted heat losses;
- implementing environmental control systems which seek to utilise low- and zero-carbon (LZC) technologies; and
- employing a programme of on-site monitoring of Legal & General Capital developments, helping to bridge the performance gap between design and operation, and ensuring that data is captured accurately.

We have already started on our journey. Within L&G's modular housing business, for instance, our homes perform ahead of current standards by up to 8%, with new products being designed to achieve EPC Standard A.

We've also been using LZC technologies in a range of our homes. For example, CALA currently utilises LZC technologies in 40% of its homes, including hybrid air-source heat pumps and photovoltaics, and can achieve a 20% performance improvement over current standards.

Commercial property

Managing transition risk

Environmental sustainability and social impact are central considerations in our property investment decision making. A key focus of our sustainability strategy is the reduction of carbon emissions from our commercial property.

We have built an extensive framework to address carbon emissions and the emerging climate-related risks associated with our commercial properties since 2008, and continue to evolve it.

- An Asset Sustainability Plan (ASP) is produced for each property under management. In 2019 we introduced an Asset Operational Plan for managed assets, which will define key operational actions to improve performance over the next 12 months, including sustainability and carbon reduction measures. This will be rolled out across assets during 2020.
- During 2019 a new system of energy and carbon monitoring, analysis and reporting was put in place for real estate properties, working with specialist partner Evora. This will provide improved energy and sustainability data quality and support regular asset, fund and corporate reporting.
- Sustainability related KPI's continue to be included in employees' appraisal targets and property supplier contracts.
- 100% of service charge properties have IS0 14001 accreditation – an Environmental Management System (EMS) which looks at managing any environmental risks at a site level.
- 100% of electricity for our managed properties is purchased from certified 'natural' Renewable Electricity Generation, meaning only wind, solar or hydro sources are used. The electricity is certified under the Ofgem administered Renewable Energy Guarantees of Origin (REGO) scheme.

20. UK GBC

- Energy Performance Certificates (EPCs) are obtained for all relevant properties.
- All of our standard new leases have included where possible 'green' clauses since 2011.
- During 2019 Real Assets signed up to the Better Buildings Partnership Climate Change Commitment for our real estate portfolio. This commits us to achieving net zero carbon by 2050, with a pathway to achieve it to be in place by the end of 2020. We are currently defining new Science Based energy and carbon reduction targets for real estate, to cover the next 10 years. These will be used to help us to reach our net zero carbon goal and will be put in place in 2020.
- During 2019 work started on a joint project between LGIM Real Assets (new developments) and LGC (Urban Regeneration) to develop net zero carbon briefs for new developments. This will be broadened to include refurbishment works in 2020. Currently all new developments, and where possible major refurbishments, are required to achieve a BREEAM rating of 'excellent'. BREEAM (Building Research Establishment Environmental Assessment Method) is a sustainability assessment method. In all of our acquisitions, we specify best practice standards in terms of sustainability and have a robust due diligence process to ensure the assets we purchase have high sustainability credentials.

Physical risk

Flood risk profiling

During 2019 we started work to ensure that we maintain an updated view of any emerging physical risks associated with flooding.

An assessment of flooding risk is included in the due diligence process of all real asset property acquisitions. This enables the flood risk to each to be categorised and zoned. Our policy is to reject properties in high risk zones, unless a specific review confirms no risk to structure or operation and that flood defences will be constructed and maintained. Properties in medium risk zones are investigated in detail for resilience.

During 2019 we mapped the location of all of our real asset commercial properties against flood risk zones. This illustrated that 82% are located in very low and low risk zones. This was a first filter review which enabled us to confirm the prioritised properties located in medium and high risk zones.

An increasing body of published scientific research indicates that climate change is linked to an increased risk of flooding in the UK, along with rising costs to deal with the damage caused. This is driving the need for increased scrutiny of flood risk through regular review and reassessment.

During 2020 we will move to the next step to enable us to confirm the flood risk today and the future risk under our chosen scenarios. This information will be used as a basis for adaptation measures and to inform acquisition and disposal strategy. Finally, we will put in place an annual flood risk review, in order to identify any changes in flood risk profiles during the year.

In addition to flooding, we have also carried out sample modelling of the risks to our properties associated with windstorms. This will be built upon as more robust and accurate data and modelling becomes available.

Liabilities (mortality/longevity risk)

Our initial modelling work has concentrated on the link between temperature and mortality as this is an area with good availability of historical data and significant academic study.

We have applied this model to the same scenarios chosen for the assets.

What's the link between temperature and mortality?

Extreme cold and extreme heat both increase mortality rates, particularly amongst the most frail in society. Currently, weather in the United Kingdom largely falls within a zone that's relatively simple to adapt to – we do not have many extreme weather events. Therefore, in isolation, an increase in average temperatures of a couple of degrees Celsius in the United Kingdom would on average be beneficial for mortality rates. However, climate change will lead to more changes than just an increase in the average temperature. It is expected that the distribution of temperatures, not just the average will change.

This change in the distribution of temperature is expected to lead to prolonged heatwaves, but also a higher volatility in weather patterns. Therefore the overall temperature effect, in isolation of other environmental changes, is a balancing act between:

- Reduced winter deaths from a higher average temperature
- Increased summer deaths caused by higher temperature and prolonged heatwaves
- Increased deaths caused by more extreme winters as a result of higher temperature volatility

The overall impact of these competing effects is sensitive to the assumptions we make in our modelling. It's possible to produce different sets of plausible assumptions that lead to opposite conclusions in relation to the longevity impact. Also, this modelling does not explicitly take account of a wide range of other factors such as:

- Higher average temperatures impacting air pollution levels
- Higher average temperatures allowing vector borne diseases to thrive in a broader range of latitudes
- Society adapting to the changing environment with different levels of success depending on socio-economic class or age.

When holistically considering these unmodelled impacts as well as the direct temperature relationship with mortality rates, we believe the effects to 2050 are likely to be small and uncertain as to direction.

Uncertainty

The relationship between climate and mortality is an inherently difficult one to model, as there are a large number of moving parts that interact with each other. In particular it's not possible to accurately know how society will respond to climate change – and our ability to adapt to the new normal that would be seen under the scenarios we've looked at could offset the mortality impact of the changing climate. It's feasible that a rapid adoption of new technology could counteract the health impacts of prolonged heatwaves or deeper cold snaps in the winter. Societal changes such as a change in diet or an increase in zero emission cars could lead to health benefits.

Future liability work

We recognise that our climate vs mortality modelling is at an early stage. We have begun by building a pragmatic model that captures the key interaction between temperature and mortality rates. This is just one facet of how climate change could affect mortality rates. The relationship between climate change and longevity risk is one of competing factors, some that serve to increase life expectancy tempered by other factors that increase mortality rates. These factors relate not just to the physical environment but also our response and adaptability to that changing environment. This makes it difficult to project the impact of climate risk on our longevity risk.

The aim of future iterations of our climate-longevity modelling will be to capture additional impacts of climate change (over and above the direct temperature effects we have focused on to date) whilst recognising the uncertainty in how many of these elements will play out in different scenarios. We will also expand the work geographically to look at other regions where our largest longevity liabilities are held. Inevitably we will need to be pragmatic, but will refine our approach based on what we consider to be plausible scenarios.

Carbon metrics and setting targets

The metrics and targets used to assess and manage relevant climate-related risks and opportunities

Methodology for calculating carbon emission intensity

Carbon dioxide is the most significant contributor to anthropogenic global GHG emissions (these consist also of methane, nitrous oxide and fluorinated gases). In order to align all emissions under the same metric all corporate GHG emissions are measured in CO_2e which is carbon dioxide equivalent measured in tonnes. This measures the equivalent warming impact of GHG emissions.

In the analysis below we distinguish between our own 'operational' footprint, which is the scope 1 and scope 2 emissions intensity directly connected with our own business operations, and the much larger estimate of scope 3 emissions, which includes the carbon emissions from the companies that we invest in. In other words the companies that comprise our investment portfolio report their scope 1 and 2 emissions and we calculate total portfolio emission intensity and disclose as part of our scope 3.

Portfolio carbon intensity

The simplest carbon measure is total carbon emissions (scope 1 and 2) expressed in tonnes of CO_2e but this figure is an absolute and not normalised for the size of the company or investor. It is therefore reflective of the portfolio or company size rather than a genuine measure of carbon intensity. It does not allow for comparisons across companies, portfolios or against a benchmark (which we want to do).

To measure our scope 3 footprint we have therefore normalised individual stock emission data. We have chosen to show three sets of figures that reflect the different normalisation approaches.

- The first is to divide total company emissions by equity capitalisation which was the basis on which we reported our end 2018 carbon intensity.
- The second is to shown the figure where total capital (enterprise value) is the divisor
- Thirdly we have normalised by revenues.

We've done this because it is not yet clear where the industry will converge to in terms of reported metrics.

We then consider the portion of carbon footprint we 'own' given the size of the investment we have in the company. Our preferred metric is tonnes of CO_2e/£1m investment which can be applied to the company, sector or portfolio level for comparative purposes. It attributes the carbon emissions of the issuer to the investor based on its ownership, normalised for the size of the investment and the company market size. We have applied the emission data equally to equity and bond assets; the rationale for this is that all capital raised by corporates both equity and debt is used to fund the operations and assets of the business.

To determine total portfolio emissions simply multiply the preferred metric by the portfolio size (in £m).

Our key input is the TruCost carbon dataset that covers c15,000 companies. Where there is no TruCost coverage we have applied the methodology described below.

Equity and corporate bonds

1. a suitable stock proxy in the TruCost database
2. a TruCost sector average (smaller holdings)

Real Assets

The carbon analysis of our property portfolio is based upon a number of sources.

Where we are responsible for the utility procurement, operation and management of our properties, through our managing agents, we can obtain energy and environmental data directly from site utility meters or from utility suppliers. Where we do not manage our properties, we generally rely upon our occupiers to provide utility data. Alternatively we use benchmark data based upon property type and floor area. Data sources are:

1. Global Real Estate Sustainability Benchmarking (GRESB) – occupier data collection. As part of our occupier liaison processes, we currently receive operational data from approximately 30% of our occupiers. This data, an indication of the emissions within our property portfolio.
2. Industry standard benchmarks: Chartered Institute of Building Services Engineers (CIBSE) and Better Buildings Partnership's Real Estate Environmental Benchmarks (REEB). Energy (and carbon) benchmarks for various types of property have been published in the UK for over 20 years, originating from the government funded Energy Efficiency Best Practice programme (EEBPP). The most recent update to these benchmarks was undertaken by CIBSE and can be found in their Technical Memorandum 46 (TM46): Energy Benchmarks 2008.
3. In addition, the Better Buildings Partnership, a voluntary group comprising 34 of the major commercial property owners in the UK, has established more recent benchmarks for particular types of commercial buildings, predominantly offices and shopping centres (http://www.betterbuildingspartnership.co.uk/node/129). REEB 2019 office benchmark was used for this analysis.

By using a combination of these benchmarks we establish an estimate of the carbon emissions associated with all of our direct property investments and also identify which property sectors are on average most intensive in terms of carbon emissions.

For commercial property, our operational footprint (scope 1 and 2) includes assets that are owned and managed in connection with our businesses. This includes all assets we occupy where we procure energy but also includes assets owned and managed by us, i.e. where we procure energy on behalf of external occupiers. The Group scope 3 calculation additionally brings in the emissions associated with occupier energy use.

Our methodology for house building is to source energy usage connected with the construction process from the utility provider. At a later stage we will also include embodied carbon in materials used in the construction process.

Government bonds

For government and quasi government bonds we apply the total outstanding debt owned by L&G to total country emissions intensity sourced from EDGAR – the Emissions Database for Global Atmospheric Research – European Commission. The intensity measure is based on country GDP.

Lifetime mortgages (LTM)

Conceptually our approach to LTM is based on an analysis of the lending by purpose and we then map each purpose to an asset category with a known carbon footprint. For example we assume a portion of the lending is allocated to travel and within that air travel. We therefore ascribe the carbon intensity connected to the air industry to that portion of outstanding loans.

Other assets

We have assumed that no emissions apply to the cash and derivative exposures.

Portfolio carbon intensity metrics and Group/ business targets

Table 4 shows that on a like for like basis at Dec 2019 the carbon emission intensity of the balance sheet was 243 tonnes CO_2e/£1m invested (down 22% from the previous year). When applied to the £84 billion of assets in this analysis this gives a carbon footprint of 20.4m[21] tonnes of CO_2 emissions, down (6%) from 21.6m[22] tonnes last year. In the table we have separately identified LGR, our largest business, because we have set targets for a desired trajectory at this level. The intention is to set targets for a number of Group businesses in the next TCFD (see Next steps).

The carbon intensity number can be volatile over short periods. It is the medium term annualised trend that matters. In any one year the metric is impacted by 1) changes in reported emissions from the companies we invest in 2) changes in the denominator which is market cap (equity markets have been strong which reduces carbon intensity on this metric) and 3) investment activity.

Our initial attribution work shows that all three of the above were a factor in the reduction seen over 2019.

Targets

When our reduction trajectory targets were first proposed the consensus was that aggregate global carbon emissions need to come down by c50% by 2040 to meet the less than 2 degree pathway.[23]

We have now moved on from this. Since the IPCC Special Report on Global Warming of 1.5 degrees (SR 15) published in October 2018, the interpretation of 'Paris' and what needs to be achieved to deliver no more than 2 degrees of warming, has tightened significantly. The report highlighted the huge benefit of limiting warming to 1.5 degrees compared to 2 degrees and that to achieve that, global human CO_2 emissions need to fall to net zero by 2050. It is clear that this implies severe emission reductions over the next decade and net zero in the medium and long term.

Table 4. Portfolio Carbon intensity metrics
Tonnes CO_2e/£1m invested

		Tonnes CO_2e / £m				
Entity		**Dec '18**	**June '19**	**Dec '19**	**Dec 19 Target**	**Dec 20 Target**
Group	CO_2e / £m market cap	313[22]	301	243	Paris Alignment	Paris Alignment
	CO_2e / £m revenues	n/a	354	350	Paris Alignment	Paris Alignment
	CO_2e / £m Enterprise Value	n/a	184	150	Paris Alignment	Paris Alignment
LGR	CO_2e / £m market cap	348	333	260	327	316
	CO_2e / £m revenues	n/a	390	376	–	–
	CO_2e / £m Enterprise Value	n/a	200	159	–	–

21. The Dec 2019 analysis includes CALA and other housing businesses within LGC which were excluded from the Dec 2018 total emissions calculation.
22. Note also refers to Dec '18 carbon intensity in table 4. Respectively these numbers were reported as 26m tonnes and 370 CO_2e/£1m last year. The change is due to a more accurate calculation method.
23. The International Energy Agency (IEA) for example showed that a 45.6% reduction was needed to deliver 'Paris'.

Carbon metrics and setting targets
continued

As a firm we are going through a process of defining a target carbon intensity trajectory for each of our core businesses. The intention is that the Group aggregate of those trajectories is consistent with delivering 'Paris', interpreted as a 1.5 degree outcome.

Setting Science Based Targets (SBT) for commercial properties

Having successfully met the target (set in 2012) to cut carbon emissions from Real Asset commercial property by 20% compared to 2010 levels, work was started during 2019 to develop new targets for the next ten years and beyond. L&G has committed to adopting a 'science-based' approach to target setting which links targets to the aim of limiting global warming to 1.5 degrees. The Real Assets team has been working with a specialist consultancy during 2019 to arrive at a target and this will be confirmed in Q1 2020. It is intended that this will establish milestones reduction targets to 2030, helping to plot our course to net zero carbon.

Group operational strategy and targets

Operational footprint

In table 5 below it can be seen that during 2019 the carbon associated with the direct operations of our businesses decreased by 5%, from 48,744 tonnes CO_2e in 2018 to 46,164 tonnes CO_2e. These reductions were met both through our UK operational offices, which delivered a 13% reduction, and through our portfolio of commercial properties, which delivered a 14% reduction. In contrast, our house building businesses' carbon footprint continued to grow. A more detailed breakdown of our operational carbon data will be provided in our CSR report (published in May 2020).

We will continue to manage and reduce the carbon from our operational footprint through identifying efficiencies and improvements in technology; increasing the consumption of onsite and offsite renewable energy; designing and building energy efficient homes and buildings; and seeking to better understand and manage our need to travel for business. We have set a target for our operational footprint (occupied offices and business travel) to operate with net zero carbon emissions from 2030. This is supported by the targets stated earlier in this report, i.e. that from 2030 we will create homes that can be operated at net zero carbon emissions, we will set Science Based Targets in our Real Assets business and we will seek to understand, monitor and report the embodied carbon associated with the construction of our homes. All of this together will enable us to move towards operational net zero carbon.

Table 5. Group operational footprint

Emissions source (tCO_2e)	Jan–Dec 2019	Jan–Dec 2018
Total CO_2e (scope 1, 2, 3)*	46,164	48,744
Scope 1 – fuel	15,226	12,447
Scope 2 – all electricity (amount from a renewable source)	23,716 (20,922.71)	28,982 (24,428.85)
Scope 3 – business travel including grey fleet	7,223	7,316

We have used the GHG reporting protocol for calculating our GHG emissions and applied the emission factors from UK Government's GHG Conversion Factors for Company Reporting 2018

Summary and next steps

As our CEO Nigel Wilson says in his introductory comments, we are focussed on climate risk, it is embedded in our investment process and governance oversight and we are developing good climate risk metrics and a framework for oversight and taking opportunities. We believe that this report shows that this is the case. There is much more to do but we have made good progress.

Next steps

Targets

- Revisit the implied carbon reduction trajectory for 'Paris' now defined as targeting 1.5 degrees of warming
- Set carbon emission targets for more Group businesses
- Set SBT for real assets to 2030 that is consistent with the net zero target by 2050

Risk metrics

- Use the Destination@Risk model to set climate VAR tolerances for Group assets and integrate them into the Group planning process.

Risk model development

- Incorporate more company specific information on the location of operating assets and our forward looking views on company resiliance.
- A granular approach to companies in the Transport sector.
- Assess credit risk in terms of the impact of climate risk on credit ratings and the probability of downgrading rather than price or spread risk.
- Bring in longer dated weather outcomes 2050–2100.
- Build functionality to run a disorderly transition scenario.
- Widen the range of balance sheet assets in the risk analysis to include lifetime mortgages (and other mortgage securities) and government bonds.
- Forward looking flood risk mapping for all property assets including lifetime mortgages

Liabilities

Further progress our understanding of the impact of climate change on mortality rates.