GLOBAL WEALTH

Investing in a Time of Climate Change

The Sequel 2019 — Executive Summary

MAKE TOMORROW, TODAY MERCER

Investing in a Time of Climate Change — The Sequel ("the Sequel") is Mercer's latest climate scenario research and modeling for institutional investors with diversified portfolios to assess the "climate impact on investment return." For more information, see the full report.[i]

[i] Mercer. *Investing in a Time of Climate Change — The Sequel*, available at https://www.mercer.com/our-thinking/wealth/responsible-investment.html.

Why Is Climate Change Important to Investors?

It Needs to Be Addressed Now, Not Later

We have already experienced around 1°C of average warming above preindustrial levels,[1] and extraordinary weather events with significant financial and human consequences are increasing in frequency.[2] Humans have never lived in a world much warmer than today; yet the current trajectory of at least 3°C above the preindustrial average by 2100 could put us beyond the realm of human experience sometime in the next 30 years.[3]

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) released a new report highlighting the difference between a 1.5°C and a 2°C scenario to illustrate the additional impact that 0.5°C is expected to have.[4] This report reinforces why the Paris Agreement ambition agreed upon by the world's governments is for "well below" 2°C, and we have less than 12 years before the window of opportunity to achieve that ambition closes.

Business leaders are also acknowledging the risks posed by climate change, as reflected in the 2019 World Economic Forum *Global Risks Report,*[5] which displays the heightened focus on environmental and social risks over time.

The Risks of Physical Damages and the Transition to a Low-Carbon Economy

There are three scenarios modeled in the Sequel — 2°C, 3°C and 4°C. The following table summarizes the key milestones and assumptions in the Mercer scenarios and compares these to the current situation. This summary highlights the different degrees of physical damages risks and the changes required to transition to a low-carbon economy and reduce fossil fuel emissions, consistent with each temperature outcome.

The Sequel Scenarios in Summary

(carbon emissions — $GtCO_2$ — fossil fuel and industrial only)

	Transition milestones and commentary	Physical damage milestones and commentary
Current	• 2017 emissions reached 37 $GtCO_2$.[6] • Fossil fuels are 80% of the energy mix. • 80% of emissions are not covered by carbon pricing. • 59% of 2017 energy supply investment went to fossil fuels. • 3.3 million electric vehicles were on the road in 2017.[7]	• Temperature has increased 1.1°C relative to preindustrial levels. • CO_2 concentration is over 400 ppm (last occurred three million years ago).[8] • Sea-level rise is at 22 cm.[9] • Half of the Great Barrier Reef has bleached to death since 2016,[10] which has significant biodiversity and flood protection implications.[11]
2°C	Aggressive* climate action: • Emissions peak in 2020. • Emissions fall to 16 $GtCO_2$ by 2050 (57% decrease versus 2017). • Net-zero emissions are reached by 2080–2100. By 2050 (relative to 2015): • Total energy demand is down by 12%. • Aggressive phase-out of coal is completed. • Electrification of the energy sector is completed. • Power generation increases by 60% (with 55% of generation from renewables and 8% nuclear). • Oil and gas supply is down by 10% (oil demand down by 33%; gas supply up by 20%). • New vehicle sales are 50% electric vehicles (EV) and 25% liquefied petroleum gas (LPG).	• There is a 50% chance of keeping temperature increase below 2°C. • By 2050, temperature rises 1.7°C. Physical damage examples at 2°C of warming include[12]: • Average sea level rises around 50 cm. • Annual maximum daily temperature is 2.6°C higher; the number of hot days increases by 25%. • Frequency of rainfall extremes over land increases by 36%. • Average drought length increases by four months. • Suitability of drylands for malaria transmission goes up 27%. • Average crop yields for maize and wheat decrease by 9% and 4%, respectively.

** "Drastic" action would be required to stay below 1.5 °C of warming relative to preindustrial levels.*

	Transition milestones and commentary	Physical damage milestones and commentary
3°C	Some climate action but not transformative, and we fail to achieve a 2°C outcome: • Global emissions are essentially flat to 2050 and rise slighter after. • Emissions reach 41 $GtCO_2$ in 2050. By 2050 (relative to 2015): • Total energy demand is up 18%. • Fossil fuels represent 80% of primary energy. • Coal use is down but only by 7%. • Power generation increases by 85% (with 27% of generation from renewables and 3% nuclear). • New vehicle sales are 37% EV and 35% LPG.	• In 2050: Temperature increases by 1.9°C. • By 2100: Temperature increases by 3.2°C. By 2100, example physical damages are largely considered irreversible (permanent loss of arctic sea ice) and include: • Sea levels rise approximately 58 cm on average.[13] • Average drought length increases by four months. • There is 30% less water availability. • Heat waves and forest fires are greater than recent years. • Risk to marine fisheries and negative aggregate impact on agriculture and food production increases chance of famine.
4°C	Business as usual pathway: • Global annual emissions increase by 49% by 2050 relative to 2015. • Emissions reach 91 $GtCO_2$ by 2100. By 2050 (relative to 2015): • Total primary energy is up by 28%. • Fossil fuels represent 84% of primary energy at 2050. • Power generation is 25% renewable (plus 5% nuclear).	• In 2050: Temperature increases by 2.0°C. • By 2100: Temperature increases by 3.9°C (heading higher). By 2100, example physical damages are largely considered irreversible (permanent loss of arctic sea ice) and include: • Sea level rise of approximately 70 cm on average. • There is 50% less water availability. • The strongest Northern Atlantic cyclones increase by 80%. • Heat wave and forest fire risk is very high and compromises normal outdoor activities. • Risk to marine fisheries and ecosystems and medium-to-high risk of decline in fish stocks, plus negative aggregate impact on agriculture and food production, increases chance of famine and reductions in food supplies and employment.

Source: Mercer

It's a Fiduciary Issue

For many years, Mercer has held the investment belief that climate change is a "systemic risk," and investors are therefore encouraged to "consider the potential financial impacts of both the associated transition to a low-carbon economy and the physical impacts under different climate outcomes."[14] Financial regulators, particularly for pension funds, are also increasingly asking investors to consider the materiality of climate-related risks and manage them accordingly, consistent with their fiduciary duties.[15]

There has been recent pension-fund guidance and legislation, particularly in Europe[16] but also across the Atlantic, with the provincial government in Ontario, Canada, requiring pensions to disclose in their statements of investment policies and procedures whether environmental, social and governance (ESG) factors are considered and, if so, how[17] and the insurance regulator in California requiring insurers to disclose their fossil-fuel-related holdings.[18] These requirements recognize at least the potential for financial materiality and require climate change to be considered in investment decision-making processes, consistent with the timeframes of beneficiaries.

Laws and litigation related to climate change also continue to develop.[19] Litigation is primarily aimed at companies failing to mitigate, adapt or disclose, but there are examples of litigation against governments[20] and, most recently, pension funds.[21] As signals from regulators become stronger and/or more investors take action, those that fail to consider, manage and disclose their potential portfolio-specific risks may be at risk of attracting legal challenges in the future.

In this context, investors with multidecade time horizons and exposure across the global economy are considering how to develop climate resilience in their portfolios with heightened urgency.

How Can Climate Scenario Modeling Help Investors?

Climate Change Scenarios and Risk Factors

Investors often use scenario analysis to support strategic asset allocation and portfolio construction decisions, as it helps to test portfolio resilience under multiple potential future outcomes. Climate scenario analysis was a key element of the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD)[22] recommendations released in 2017.

Mercer believes it is valuable to ensure climate change considerations are integrated into every stage of the investment process, including setting strategic asset allocation and portfolio construction decisions, which then inform mandate creation and, ultimately, exposures. Understanding the relative implications for different asset classes and sub-asset classes under different scenarios helps to identify priority risks and opportunities as part of strategic decision-making. This top-down, portfolio-wide scenario analysis can then be combined with further insights from bottom-up analytical tools that assess climate exposures of sectors and companies.

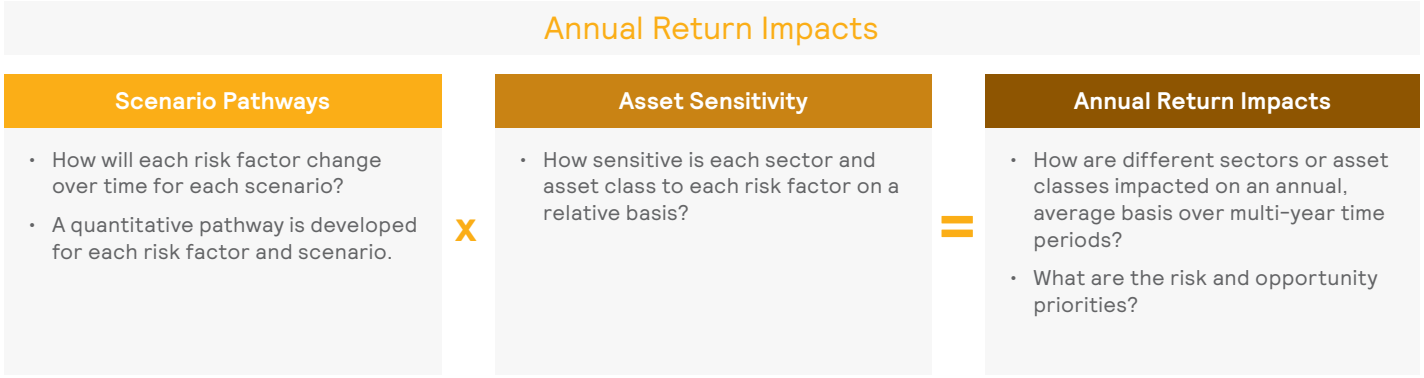
The Sequel models three climate change scenarios, a 2°C, 3°C and 4°C average warming increase on preindustrial levels, over three timeframes — 2030, 2050 and 2100. For each scenario, we assess the relative asset class and industry sector sensitivities to climate risk factors over this timeframe.

The following two modeling approaches are used to calculate an additional climate impact on return, which we don't believe is currently captured in return expectations relying primarily on historical data.

Modeling Approach 1: Long-Term Return Impact Analysis

Portfolio implications are generated by calculating the average annual climate impact on return for different asset classes and industry sectors across the three scenarios over different time periods (for example, to 2030, 2050 and 2100).

Figure 1. Annual Return Impact Analysis Inputs and Outputs



Source: Mercer

Modeling Approach 2: Short-Term Stress-Testing Analysis

Many clients requested that we consider how longer-term return impacts could manifest as shorter-term climate-related market repricing events (for example, reflecting short-term changes in how the market prices climate change risks and opportunities, including changing views on the probabilities of different climate scenarios).

As a result, we have developed a climate stress-testing addition to the model, which immediately capitalizes expected future impacts in present-value terms using a dividend discount modeling (DDM) approach, driven by a change in view on scenario probabilities, market awareness and/or physical damages.

Figure 2. Stress Test Inputs and Outputs

Source: Mercer

What Does the Sequel Modeling Tell Investors?

The modeling results have evolved from the 2015 *Investing in a Time of Climate Change* report ("the 2015 Report") given there have been many environmental, scientific, political and technological developments that continue to evolve both our understanding and the climate change modeling data. However, the headline messages remain consistent, reinforce the recommendations made at that time and support greater urgency for action to achieve a well-below 2°C scenario. The relative impacts across asset classes and sectors convey a number of key signals for investors to consider in portfolio construction and asset allocation decisions. The new stress-test modeling is also beneficial to demonstrate the potential magnitude of return impacts in the short term if changes in policy, market awareness or physical damages are greater than currently anticipated.

A key conclusion is that investing for a 2°C scenario is both an imperative and an opportunity:

- An imperative, since, for nearly all asset classes, regions and timeframes, a 2°C scenario leads to enhanced projected returns versus 3°C or 4°C and therefore a better outcome for investors
- An opportunity, since, although incumbent industries can suffer losses in a 2°C scenario, there are many notable investment opportunities enabled in a low-carbon transition

The Sequel's highlights include the following[ii]:

1. **The results emphasize the physical damages risks and why a below 2°C scenario is most beneficial**, and the 4°C and 3°C scenarios are to be avoided, from a long-term investor perspective.

2. **Transition opportunities emerge from a 2°C scenario, with transition now expected to be a benefit from a macroeconomic perspective**,[23] including the potential to capture a "low-carbon transition (LCT) premium."[24] Although a 2°C scenario definitely still presents transition risk (especially for portfolios aligned to a 3°C or 4°C+ world), opportunistic investors can target investment in the many mitigation and adaptation solutions required for a transformative transition. In the two sample portfolios, the sustainability-themed version is nearly 0.20% p.a. better off to 2030.

3. **Expected annual return impacts remain most visible at an industry-sector level, with significant variations by scenario, particularly for energy, utilities, consumer staples and telecoms.** Asset class returns can also vary significantly by scenario, with infrastructure, property and equities being the most notable. Variations in results between asset classes and across regions, cumulative impacts, and the emphasis on sustainable opportunities provide multiple portfolio construction possibilities for investors.

4. **In reality, sudden changes in return impacts are more likely than neat, annual averages, so stress testing is an important tool in preparing for this eventuality.** Stress testing portfolios for changes in view on scenario probability, market awareness and physical damages can help investors to consider how longer-term return impacts that may appear small on an annual basis could emerge as more-meaningful shorter-term market repricing events. Testing an increased probability of a 2°C scenario with increased market awareness can result in sector-level returns where renewables increase by more than 100% and coal decreases by nearly 50%. Positive asset class impacts include infrastructure at almost 23% and sustainable equity at more than 5%. Testing an increased probability of a 2°C scenario or a 4°C scenario with greater market awareness, even for the modeled diversified portfolios, results in +3% to -3% return impacts in less than a year.

[ii] In the Sequel, two sample asset allocations were used to illustrate the key findings: 1) the same diversified growth asset allocation introduced in the 2015 Report and 2) a 2019 portfolio that is equivalent to the 2015 portfolio but with explicit allocations to sustainability-themed investments in multiple asset classes. Current limitations in data and methodology available for modeling physical damages, together with the myriad of factors not yet captured and multidecade timeframes, mean the resulting magnitudes are likely to be significantly underestimated and invariably relatively small in absolute terms. The Sequel outlines more on these additional considerations when assessing quantitative results.

Figure 3. Annualized Total Portfolio Results

Source: Mercer

How Can Investors Apply the Sequel?

The Sequel provides investors with a clear framework and tools to start actively supporting the transition to a 2°C scenario — as "Future Makers."[25] Fiduciaries, motivated by the economic and social interests of their beneficiaries and clients, have the opportunity — and, arguably, the obligation — to use their portfolios and their influence to help guide us toward this more economically secure outcome.

The Sequel provides investors with recommendations to help integrate climate change when setting investment beliefs, policies and processes, and when constructing and managing portfolios. Mercer's *Responsible Investment Pathway* shows you how.

Mercer is actively working to ensure that climate scenarios are integrated within the standard stress tests for all Mercer clients undertaking strategy reviews. Mercer's global consulting team can also help apply Mercer's climate scenario model to conduct more-detailed, tailored analysis for clients at a total portfolio, asset class and sector level, including comparing different asset allocations and undertaking stress tests, to then support recommended actions and implementation.

We look forward to the opportunity to support investors in incorporating climate change throughout the investment process and to build climate-resilient portfolios.

1	2	3	4
Beliefs	Policy	Process	Portfolio

Integration

Include ESG factors in investment decisions, with an explicit approach to climate change transition and physical risks, which are portfolio-wide.

AIM:
Financial objectives
+ risk management improvement

Stewardship

Exercise active ownership/stewardship through voting and engagement with underlying companies and by engaging with policymakers.

AIM:
Financial objectives
+ financial system improvement

Investment

Allocate to sustainability themes or impact investments for new opportunities — for example, renewable energy, water and social housing.

AIM:
Financial objectives
+ positive social and environmental impact

Screening

Screen out sectors or companies deemed to be irresponsible or not acceptable to profit from.

AIM:
Alignment with values/reputation/risk management or longer-term financial expectations

Source: Mercer

Contacts

For the complete report, *Investing in a Time of Climate Change — The Sequel,* and for more information and related content, please visit: https://www.mercer.com/our-thinking/wealth/responsible-investment.html.

Alternatively, you can connect directly with your local Mercer consultant or Mercer Responsible Investment specialists:

Global

Helga Birgden
Melbourne
helga.birgden@mercer.com

Asia Pacific

Jillian Reid
Sydney
jillian.reid@mercer.com

Alexis Cheang
Sydney
alexis.cheang@mercer.com

UK and Europe

Kate Brett
London
kate.brett@mercer.com

Tomi Nummela
London
tomi.nummela@mercer.com

North America

Alex Bernhardt
Seattle
alex.bernhardt@mercer.com

Karen Lockridge
Toronto
karen.lockridge@mercer.com

End Notes

[1] For the purposes of this report, "preindustrial levels" refer to the period 1850–1900. Example resources include: NASA data and charts, available at https://data.giss.nasa.gov/gistemp/maps; Ed Hawkins' *Climate Lab Book,* available at https://www.climate-lab-book.ac.uk/2018/warming-stripes/; and Resource Watch, available at https://resourcewatch.org/topics/climate.

[2] Centre for Research on the Epidemiology of Disasters. "EM-DAT: The International Disaster Database," available at https://emdat.be/.

[3] Homo sapiens evolved from the genus Homo about 200,000 years ago. The penultimate interglacial period (the Eemian) likely reached temperatures 1.5ºC–2.0ºC warmer than preindustrial levels about 125,000 years ago. Source: National Centers for Environmental Information. "Penultimate Interglacial Period — About 125,000 Years Ago," available at https://www.ncdc.noaa.gov/global-warming/penultimate-interglacial-period. Mercer's 3ºC scenario has warming reaching 1.9ºC by 2050.

[4] The Intergovernmental Panel on Climate Change. *Global Warming of 1.5ºC,* 2018, http://www.ipcc.ch/report/sr15/.

[5] World Economic Forum. *Global Risks Report 2019,* available at https://www.weforum.org/reports/the-global-risks-report-2019. Rooted in a survey that tapped into approximately 900 experts from across the world over ten years, the report has adjusted the list of global risks and moved risks between categories. The depiction here assigns a consistent category for risks.

[6] Global Carbon Project. "Global Carbon Budget," 2018, available at https://www.globalcarbonproject.org/carbonbudget.

[7] By the end of 2018, the global fleet of light vehicle plug-ins was 5.4 million plus another 600,000 in medium and heavy commercial. Source: Irle R. "Global EV Sales for 2018 — Final Results," EV-Volumes.com, available at http://www.ev-volumes.com/country/total-world-plug-in-vehicle-volumes/.

[8] Further, if greenhouse gas concentrations were stabilized at their current level, existing concentrations would commit the world to at least an additional 0.6ºC of warming over this century. Source: US Global Change Research Program. "Climate Models, Scenarios, and Projections" in *Climate Science Special Report,* 2017, available at https://science2017.globalchange.gov/downloads/CSSR_Ch4_Climate_Models_Scenarios_Projections.pdf.

[9] NASA. "Global Cimate Change: Vital Signs of the Planet," available at https://climate.nasa.gov/vital-signs/sea-level/.

[10] James LE. "Half of the Great Barrier Reef Is Dead," *National Geographic* (August 2018), available at https://www.nationalgeographic.com/magazine/2018/08/explore-atlas-great-barrier-reef-coral-bleaching-map-climate-change/.

[11] Beck MW, Losada IJ et al. "The Global Flood Protection Savings Provided by Coral Reefs," *Nature Communications,* Volume 9, Article Number 2186 (2018), available at https://www.nature.com/articles/s41467-018-04568-z.

[12] Carbon Brief. "The Impacts of Climate Change at 1.5C, 2C and Beyond," available at https://www.carbonbrief.org/the-impacts-of-climate-change-at-1-point-5-2c-and-beyond.

[13] Rasmussen DJ, Bittermann et al. "Extreme Sea Level Implications of 1.5 ºC, 2.0 ºC, and 2.5ºC Temperature Stabilization Targets in the 21st and 22nd Centuries," *Environmental Research Letters,* Volume 13, Number 3 (2018), pp. 034040, available at http://iopscience.iop.org/article/10.1088/1748-9326/aaac87

[14] Mercer. *Mercer Investments Beliefs,* 2018, available at https://www.mercer.com/our-thinking/wealth/mercer-investments-beliefs.html.

[15] Official Journal of the European Union. *Directive (EU) 2016/2341 of the European Parliament and of the Council of 14 December 2016 on the Activities and Supervision of Institutions for Occupational Retirement Provision (IORPs),* available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L2341&rid=9.

[16] Ibid.

[17] Government of Ontario. *Pension Benefits Act, R.S.O. 1990, c. P.8,* Regulation 909, Section 78(3), available at https://www.ontario.ca/laws/regulation/900909: "The statement of investment policies and procedures shall include information as to whether environmental, social and governance factors are incorporated into the plan's investment policies and procedures and, if so, how those factors are incorporated."

[18] California Department of Insurance. "Climate Risk Carbon Initiative," available at http://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ci/.

[19] The London School of Economics and Political Science's Grantham Institute on Climate Change and the Environment has partnered with the Columbia Law School's Sabin Center for Climate Change Law to create a database tracking "Climate Change Laws of the World" and "Climate Change Litigation of the World," available at http://www.lse.ac.uk/GranthamInstitute/climate-change-laws-of-the-world/.

[20] Urgenda. "The Urgenda Climate Case Against the Dutch Government," available at http://www.urgenda.nl/en/themas/climate-case/.

[21] Mather J. "REST Fights Claim It Failed to Consider Climate Change," *The Australian Financial Review* (2018), available at https://www.afr.com/personal-finance/superannuation-and-smsfs/rest-fights-claim-it-failed-to-consider-climate-change-20181003-h165w1.

[22] Task Force on Climate-related Financial Disclosures (TCFD), available at https://www.fsb-tcfd.org/about/

[23] In addition to this research, see the following for further support regarding the likely stimulative benefits of a low-carbon transition: Organisation for Economic Co-operation and Development. *Investing in Climate, Investing in Growth,* 2017, available at http://www.oecd.org/environment/cc/g20-climate/synthesis-investing-in-climate-investing-in-growth.pdf.

[24] For more details on this sustainable investment thesis, refer to the following report: Mercer. *Assessing the Prospective Investment Impacts of a Low Carbon Economic Transition,* 2017, available at https://www.mercer.com/our-thinking/assessing-the-prospective-investment-impacts-of-a-low-carbon-economic-transition.html.

[25] BRINK. "The Future Makers: Long Term Investors as Climate Change 'Cops,'" December 4, 2015, available at http://www.brinknews.com/the-future-makers-long-term-investors-as-climate-change-cops/.

Important Notices

References to Mercer shall be construed to include Mercer LLC and/or its associated companies.

The findings, interpretations, views and conclusions expressed herein are those of the authors and do not necessarily reflect the views of the individuals listed as Advisors on the Acknowledgements page.

This contains confidential and proprietary information of Mercer and is intended for the exclusive use of the parties to whom it was provided by Mercer. Its content may not be modified, sold or otherwise provided, in whole or in part, to any other person or entity without Mercer's prior written permission.

Information contained herein may have been obtained from a range of third-party sources. Although the information is believed to be reliable, Mercer has not sought to verify it independently. As such, Mercer makes no representations or warranties as to the accuracy of the information presented and takes no responsibility or liability (including for indirect, consequential or incidental damages) for any error, omission or inaccuracy in the data supplied by any third party.

The findings and opinions are subject to change without notice and are not intended to convey any guarantees as to the future performance of any investment products, asset classes or capital markets covered by this report. Past performance does not guarantee future results.

This report does not contain investment advice relating to your particular circumstances. No investment decision should be made based on this information without first obtaining appropriate professional advice and considering your circumstances.

Mercer does not provide tax or legal advice. You should contact your tax advisor, accountant and/or attorney before making any decisions with tax or legal implications.

This does not constitute an offer to purchase or sell any securities.

For Mercer's conflict of interest disclosures, contact your Mercer representative or see www.mercer.com/conflictsofinterest.

Not all services mentioned are available in all jurisdictions. Please contact your Mercer representative for more information.

Investment management and advisory services for US clients are provided by Mercer Investment Management, Inc. (MIM), and Mercer Investment Consulting LLC (MIC). MIM and MIC are federally registered investment advisers under the Investment Advisers Act of 1940, as amended. Registration as an investment adviser does not imply a certain level of skill or training. The oral and written communications of an adviser provide you with information about which you determine to hire or retain an adviser. MIM's and MIC's Forms ADV Parts 2A and 2B can be obtained by written request directed to: Compliance Department, Mercer Investments, 701 Market Street, Suite 1100, St. Louis, MO 63101.

Certain regulated services in Europe are provided by Mercer Global Investments Europe Limited, Mercer (Ireland) Limited and Mercer Limited. Mercer Global Investments Europe Limited and Mercer (Ireland) Limited are regulated by the Central Bank of Ireland. Mercer Limited is authorized and regulated by the Financial Conduct Authority. Registered in England and Wales No. 984275. Registered Office: 1 Tower Place West, Tower Place, London EC3R 5BU.

MARSH & McLENNAN COMPANIES

6009156b-WE