Common Investment Meeting (NYCERS)

Schedule	Thursday, January 25, 2018, 09:00 AM — 03:00 PM EST
Venue	Office of the New York City Comptroller, 1 Centre Street, 10th Floor (Room 1005) - Northside, New York, NY 10007
Organizer	Kim Boston

Public Agenda

PUBLIC SESSION:

Mercer (Climate Change Investment Risk):
Mercer Climate Change Strategy Report
Mercer Climate Change Risk Assessment Report

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CLIMATE CHANGE RISK MANAGEMENT STRATEGY

New York City Retirement Systems

JANUARY 15, 2018

MARSH & McLENNAN COMPANIES

CONTENTS

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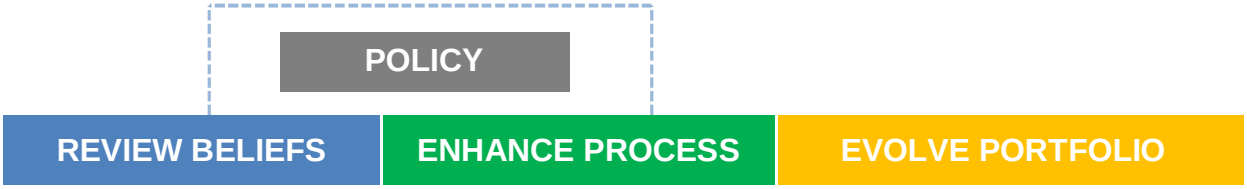
Executive Summary

The New York City Employees Retirement System (NYCERS), New York City Police Pension Fund, New York City Fire Pension Fund and Board of Education Retirement System (collectively referred to in this document as the "New York City Retirement Systems", "NYCRS" or the "Systems") have engaged Mercer to support the development of a climate change strategy. This document sets forth our recommendations for the steps NYCRS should take to achieve this aim.

To support this, we utilize a simple framework called Mercer's Framework for Sustainable Growth. This includes three steps, as outlined below, towards developing an approach to environmental, social and governance (ESG) issues, including climate change.

Figure 1: Mercer's Framework for Sustainable Growth as Foundation for Climate Change Risk Management



- This step includes undertaking education for board and investment staff about climate change, and developing a specific set of investment beliefs which will underpin the future approach.

- Investment policy documents are the backbone of good governance, and should reflect the Systems' approach to climate change.
- Developing a stand-alone climate change strategy would meet the needs of stakeholders and provide an overarching view on a complex topic.

- Climate considerations can lead to portfolio decarbonization as well as thematic investment opportunities.
- New methods for monitoring and reporting on risk – such as carbon footprinting – can be adopted across the fund and embedded into individual manager contracts.
- Engagement with managers, companies and policy-makers is an important climate risk management tool.

The following table sets forth the full range of our recommendations, which have been developed with the Systems' fiduciary duty in mind. The related category – beliefs, process, and portfolio – is shown on the left hand side.

Figure 2: Mercer Recommendations to NYCRS

Beliefs	Mercer recommends that each Board develop one or more investment beliefs on climate change.
Process	Mercer recommends, once each Board gains agreement on its investment beliefs on climate change, that their respective approach to climate change risk management be reflected in the IPS.
	Mercer recommends that the Systems' corporate governance expectations related to climate change be updated to clarify expected alignment with the Paris Agreement and/or that disclosure of climate change risks should be in line with the recommendations of the Financial Stability Board Task Force on Climate Related Financial Disclosures (TCFD)[1].
	Mercer recommends that the Systems document their policy on advocating for reasonable climate related policies and regulations across jurisdictions.
	Mercer recommends that each System (or the Systems collectively to the extent that there is consensus on key beliefs and strategy), develop a climate change strategy document which can outline expectations for Bureau of Asset Management ("BAM") staff, external managers, advisors and other stakeholders.
	Mercer recommends that NYCRS adopt reference to climate related risks in its overall risk management framework and enhance risk management processes to focus more specifically on the management of transition and physical risks.
	Mercer recommends that NYCRS conduct a climate risk review of their external managers to understand what the managers' perspectives are on climate change and how they identify and manage climate-related investment risks and opportunities.
	Mercer recommends, once the Systems develop a climate change strategy, that BAM reflects any new expectations of managers in all stages of the due diligence process (including the due diligence questionnaires) and that the weightings given to climate change (and/or ESG) questions be reviewed and increased, as appropriate.
	Mercer recommends that NYCERS (as the only NYCRS signatory to the PRI) voluntarily report under the new climate-related indicators for the 2018 reporting cycle to support the development and implementation of the System's climate change policy and implementation of emerging industry best practice.
	Mercer recommends that NYCRS provide annual updates against the climate change strategy as another element of reporting and stakeholder engagement.

[1] The TCFD Recommendations are covered in more detail in Section 6 – Disclosure.

Portfolio	Mercer recommends that the Systems review their divestment approaches and consider excluding high-cost, high-carbon reserve owners and thermal coal power utilities if an investment belief is adopted which acknowledges that the continued transition to a low-carbon economy is likely to strand these assets.
	Mercer recommends that NYCRS move some of its existing market-cap-weighted passive equity towards an ESG or low-carbon alternative (whether customized or using an existing index).
	Mercer recommends targeting an aggregate allocation of 1% to sustainability-themed investments (across all asset classes), to be deployed between 2018 and 2020, provided that investment opportunities are available in line with the Systems' investment objectives and risk/return tolerance.
	Mercer recommends the Systems re-examine its existing limitations on private equity investments to provide some allowance for smaller managers, emerging markets and lower fund size thresholds. This would allow better access to sustainability-themed investments given the nascent and global nature of the sustainable investment opportunity set in this asset class.

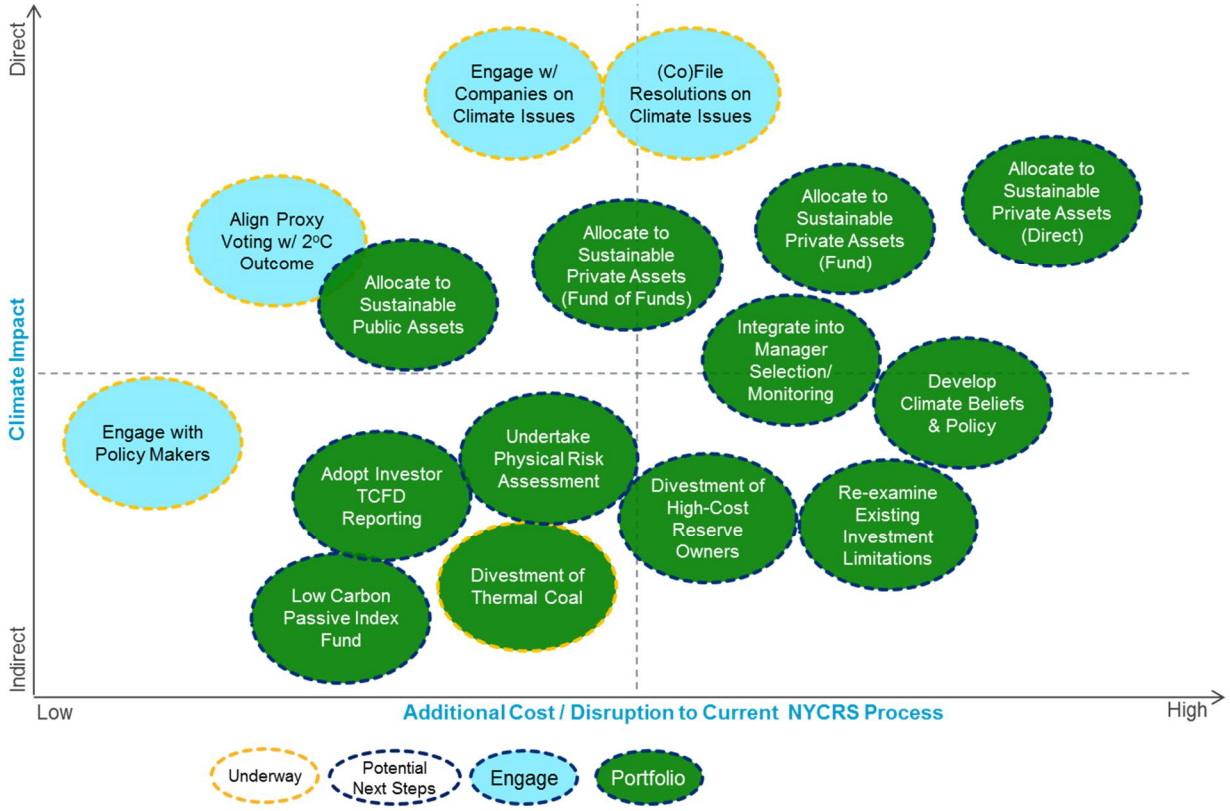
The above list categorizes specific action points within the beliefs, process and portfolio spectrum for NYCRS. As shown in the following chart, we can also display how these actions relate to two other criteria.

- On the **horizontal axis**, we consider the additional cost or disruption that taking the action would have on NYCRS or BAM.
- On the **vertical axis**, we consider the impact that the action would have on the climate – either direct (for example, in contributing to a reduction in GHG emissions by a company or building climate resilience through climate adaptation), or indirect (for example, through supporting climate policy)[2].

As is clear, the range of portfolio risk management options include all types of activities – those with high and low operational impact, and those with direct and indirect climate impact. The placements of the various bubbles are meant to be indicative (as opposed to precise) on the potential climate impact and operational impact continuums.

[2] The distinction being made here between direct and indirect impacts relates primarily to the level at which an action is taking place. Engagements with company management or ownership of a large share in a private company will, relatively speaking, have a more direct impact on company behavior and real economy outcomes than buying or divesting of shares in a public company.

Figure 3: Portfolio Risk Management Options – Climate and Operational Impact



Source: Mercer

As the chart shows, the recommended steps cover a range of actions with varying degrees of complexity from an implementation perspective, delivering both direct and indirect impacts on real world climate outcomes. These actions can be integrated into ongoing work plans and areas of responsibility for BAM staff with climate becoming a more regular agenda item for trustees. In this way, climate risk management will become normalized with the Systems addressing it in an integrated and rigorous manner, as it would with any other significant, forward-looking investment risk. The first and foremost objective of the recommendations set out in this report is to help trustees and their agents to address this emerging risk in a manner which optimizes investment outcomes for NYCRS.

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Introduction

Responsible investment and climate risk strategies continue to take hold within the global investment community. Launched in 2006, the Principles for Responsible Investment (PRI) now have more than 1,700 signatories from 50 countries representing ~US$68 trillion of assets[3]. This growth has been accompanied by a changing approach to RI implementation – moving from the more traditional screening of investment portfolios (to exclude specific sectors) towards the integration of environmental, social and governance (ESG) considerations into investment decisions.

A key focus of this integration has been on the 'E', and more specifically, on climate change, which is also the focus of NYCRS's current review. A flagship industry initiative related to climate was the June 2017 launch of the recommendations from the Financial Stability Board's Task Force on Climate Related Financial Disclosure (TCFD). These recommendations apply to companies and investors globally, setting forth a four part framework – Governance, Strategy, Risk Management and Metrics/Targets – for them to utilize in assessing and reporting on the management of climate related risks and opportunities.

The purpose of this report is to support NYCRS in evolving its approach to climate risk management in a comprehensive way. It is structured as follows.

- **Chapter 3** outlines how climate considerations can be incorporated into Investment Beliefs, Policy and Process
- **Chapter 4** discusses current and emerging approaches towards climate Risk Management
- **Chapter 5** reviews the various Investment Strategies that exist to reflect a consideration of climate related risks and opportunities
- **Chapter 6** sets forth options for Manager Selection and Monitoring
- **Chapter 7** provides perspectives on how the Systems should approach Disclosure, and
- **Chapter 8** sets out our Conclusion.

We welcome the opportunity to discuss this report with you at the January Common Investment Meeting.

[3] https://www.unpri.org/about

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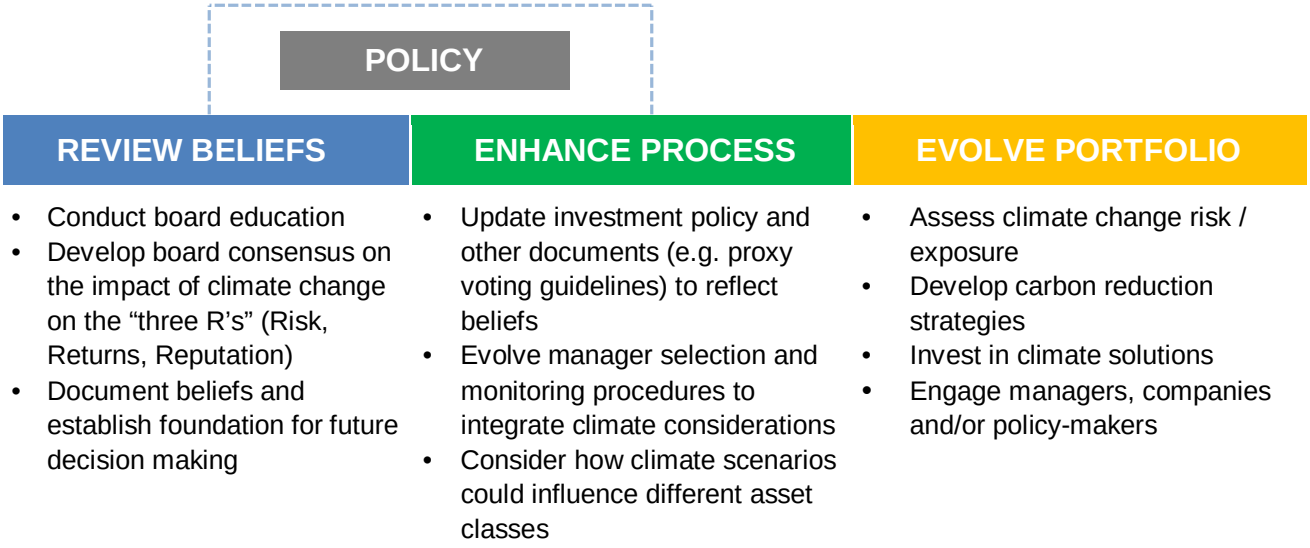
Investment Beliefs, Policy and Process

To support development of an investment governance framework which reflects ESG factors such as climate change, Mercer has created an Investment Framework for Sustainable Growth[4]. This simple framework involves three major steps – Beliefs, Process and Portfolios, illustrated below, which can support NYCRS in evolving its approach.

Figure 4: Mercer's Framework for Sustainable Growth as Foundation for Climate Change Risk Management



Investment Beliefs

Investment beliefs are important as they describe how you think investment markets work, your views on investor duties and how you believe you can create value for your stakeholders.

When developing investment beliefs in non-traditional or evolving areas such as climate change, or ESG more broadly, board education is warranted (such as NYCRS has done through the recent Best Practice Review on Climate Change Strategy). It is Mercer's view that having an explicit statement of investment beliefs is an example of industry best practice that can lead to better investment decision making and even to better investment outcomes. An investment strategy is underpinned by the investment beliefs of the stakeholders who design it. Clearly articulating your beliefs on ESG, and climate change specifically, gives you a broader perspective on risks and opportunities, which should better prepare you as market conditions evolve.

[4] https://www.mercer.com/our-thinking/an-investment-framework-for-sustainable-growth.html

Mercer recommends that each Board develop one or more investment beliefs on climate change.

On the following pages, we have set out a matrix of illustrative belief statements regarding climate change and its connection with financial markets and investor duties. These reflect varying levels of conviction – from limited, to strong. This information can be used to develop:

- An overall view on climate change.
- Any new / enhanced NYCRS investment beliefs.
- The preferred implementation approaches and next steps regarding each area of activity.

Figure 5: Illustrative Belief Statements

		POSSIBLE BELIEF STATEMENTS - STRENGTH OF CONVICTION		
		A – Limited Conviction	B – Some Conviction	C – Strong Conviction
Investor Duties	**Risk** 	Carbon regulation and changing consumption patterns may present risks and opportunities for businesses. This is simply the nature of business.	Climate change is a critical long-term structural trend that will have a material impact on investment risk and returns.	Climate change risks are pervasive and systemic, consisting of a combination of physical impact risk and transition risk which vary by sector and region. As diversified long-term investors, we cannot 'avoid' this risk.
	Fiduciary Duty 	Fiduciary duty requires pension funds to focus exclusively on achieving the best risk-adjusted returns. Focusing on environmental or political issues detracts from our responsibilities.	Investors have a fiduciary obligation to proactively address climate risk, because of the associated long-term financial risks.	Investors risk failing in their fiduciary responsibilities if they do not proactively advocate for and support, through investment policy and strategy, an orderly transition to a low-carbon economy
	Future Taker vs Future Maker 	Advocating for the successful mitigation of climate change poses reputational challenges for the Systems and we do not want to be seen as an overtly political organization.	We believe the future will diverge from the past, and the low-carbon transition will unfold, accompanied by increased incidence of extreme weather events. While we should be cognizant of these changes, and capitalize on them where we can, it is not our role to seek to influence the future.	The financial community has an opportunity to influence economic and political outcomes, and should use this opportunity as it relates to advocating for the successful mitigation of climate change, which is in the Systems' best financial interest (and the economy more broadly).

POSSIBLE BELIEF STATEMENTS - STRENGTH OF CONVICTION				
		A – Limited Conviction	B – Some Conviction	C – Strong Conviction
Investor Actions	**Integration** 	The cost-benefit of fully integrating climate considerations is unlikely to be positive, given the significant changes this would likely necessitate in our processes.	Strategies to integrate climate related risk in the portfolio may have short term costs, but will help us manage risk over the short, medium and longer terms. However, our focus on this topic should be balanced against other priorities.	Climate change risks are pervasive across the economy and affect all parts thereof. We need to develop a comprehensive implementation plan over the next 12-18 months so that NYCRS' portfolio managers are appropriately equipped to manage them.
	Decarbonize 	A negative screening or tilting approach is likely to constrain the process of generating returns for the fund. We don't believe carbon transition risk is material in the near term, and we do not want to take benchmark risk in underweighting carbon. Any changes to the economy will naturally be reflected in market benchmarks, and thus our portfolios over time.	We believe that decarbonising our portfolio has merits, although these must be balanced with a consideration of benchmark risk and implementation cost. We need to undertake sufficient research to inform and justify such an action and understand the potential implications. Underperformance from such a strategy in the near term (even if it is sound longer-term) could also present fiduciary risk to NYCRS.	It is clear that fossil fuel use needs to significantly decline over the coming decades, with a particular reduction in the use of high-carbon and high-cost fuel sources, such as thermal coal and oil sands. It is advantageous to reduce exposure to these high-carbon and high-cost reserves now, in order to avoid the subsequent loss of value to these assets we expect to materialise. Publicly stating our rationale for avoiding high carbon and high cost reserves also sends a signal to policy makers and the marketplace about our prioritisation of this issue, which can help to smooth the transition to a low-carbon economy.
	Invest 	Explicitly investing in climate related themes is not likely to drive additional returns – our managers will capture broader opportunities, regardless of the thematic label.	Long-term growth in the low-carbon economy is likely to surpass broader market growth, and as such, should present attractive investment opportunities for NYCRS to carefully pursue across a range of asset classes.	As a systemic issue, climate change requires the investment of trillions of dollars of assets into the low-carbon future, and will create a huge number of winners and losers across economic sectors. As such, related trends will be sources of new return opportunities which NYCRS should actively pursue.

POSSIBLE BELIEF STATEMENTS - STRENGTH OF CONVICTION				
		A – Limited Conviction	B – Some Conviction	C – Strong Conviction
	Engagement – Capital Market 	Like any long-term trends, climate change will be picked up as markets recognise and respond to the risks and opportunities that emerge. We don't need additional research or focus on the topic.	Climate change is a systemic risk. As a large diversified investor, we have an opportunity to influence policy makers to support the low carbon transition, including through promoting enhanced disclosure across the market.	Climate change is one of the most significant issues of our time, and poses significant financial, economic and social risks. As a large diversified investor, we have an opportunity and obligation to use our influence to work to achieve the swift implementation of the Paris Agreement.
	Engagement – Company[5] 	If shareholders are unhappy with the way a company is being run they can simply "exit" i.e. sell their shares. Allocating resources to voting and engagement is not proven to add financial value and is an additional, unnecessary cost.	Voting and engagement are useful means of communicating with company management, especially for minority shareholders. Given the range of climate related risks and opportunities, it is useful to encourage companies to disclose their approach to this topic – particularly through adopting the recommendations of the FSB TCFD.	Shareholders should engage with companies – directly and in collaboration – to ensure that companies have low-carbon transition plans which will see them preserve / enhance value over time. Where such an engagement leads us to form a view that a company is not aligned for a 2°C outcome (either through transitioning their business plan or by developing a wind-down approach), NYCRS may reconsider if it views an investment in this company as prudent.

Agreed upon investment beliefs on climate change can be incorporated into existing or evolving belief statements for the System(s) overall.

Investment Policy

Each of the four Systems has their own *Investment Policy Statement* ("IPS") with some common elements. In addition, the four Systems have a common set of *Corporate Governance Principles and Proxy Voting Guidelines*[6] (the "Guidelines"). These are addressed in turn below.

Investment Policy Statement

The Investment Policy Statement (and related appendices) for each of the four Systems currently have no direct references to climate change. While the IPS of each System states (under 'Proxy Voting Policy and Shareholder Initiatives') that "*the Proxy Committee seeks to ensure that companies follow sustainable business practices which advance their long-term*

[5] Note that the NYC Comptroller's Office is already actively engaging with listed issuers on climate-related issues, including disclosure and mitigation of climate-related risks.

[6] https://comptroller.nyc.gov/wp-content/uploads/documents/NYCRS-Corporate-Governance-Principles-and-Proxy-Voting-Guidelines_April-2016-Revised-April-2017.pdf

economic value", only the NYCERS IPS has a statement on the potential relevance of ESG to investment analysis and decision making. The reference in the NYCERS IPS to 'ESG' is in Section XIX. The Principles for Responsible Investment[7] and states:

> *The Trustees, acknowledging a duty to act in the best long-term interest of NYCERS' beneficiaries, adopted the UNEP Principles for Responsible Investment on March 28, 2006. It is believed that environmental, social and corporate governance (ESG) issues can affect the performance of investment portfolios over time and that applying these Principles may better align NYCERS' investments with the broader interests of society. As stated in those principles, it is the intent of the Trustees, where consistent with their fiduciary duties, to:*
> - *Incorporate ESG issues into investment analysis and decision-making processes;*
> - *Be active owners and incorporate ESG issues into ownership policies and practices;*
> - *Seek appropriate disclosure on ESG issues by the entities in which NYCERS invests;*
> - *Promote acceptance and implementation of the Principles within the investment industry;*
> - *Work with other adopters of the Principles to enhance the effectiveness of their implementation;*
> - *Share information on our activities and progress towards implementation of the Principles.*

Mercer recommends that, once each Board gains agreement on its investment beliefs on climate change, that their respective approach to climate change risk management be reflected in the IPS.

This IPS addition should articulate how each of the Systems will address climate change in its investment processes and portfolio. Such statements can range from very detailed to very high level. An example of the latter follows:

> *The Trustees acknowledge that climate change is a particularly important ESG issue in terms of the potential for associated risks and opportunities to influence the System's financial performance over the long term. As such, the Trustees have instructed BAM to:*
> - *Consider the management of climate related risks and opportunities in the appointment and review of external fund managers, including how these considerations are reflected by managers in investment decision making as well as the potential for risks and opportunities facing economic sectors or regions more broadly;*
> - *Request climate risk monitoring from external managers (including ongoing reporting of portfolio carbon footprint, and other metrics as/where available), and provide an aggregate overview of this reporting to Trustees on an annual basis;*
> - *Support continued progress across the investment industry in effectively managing risks and opportunities related to this emerging topic.*

Corporate Governance Principles and Proxy Voting Guidelines

NYCRS' current guidelines specifically refer to climate risk: "Climate Change presents regulatory, financial and operational risks to individual companies and to the broader financial markets" and sets out the Systems' position on climate change in the following two areas:

[7] NYCERS is the only System out of the four covered in this report that is a signatory to the PRI and has been since 2006.

1. **Board Oversight of Climate Risk:** The policies set forth expectations that boards include directors with the necessary skills and experience to oversee strategy and risk, including climate-related risks and other environmental challenges.
2. **Responsible Environmental Stewardship**: The policies affirm that the Systems support:
   - Companies that proactively develop policies, initiatives and objectives to mitigate risks related to climate change.
   - Requests for companies to disclose and quantify their exposure to climate-related risks and to assess the potential impact of government regulation on business operations and assets, including GHG emissions and carbon reserves.
   - Reasonable requests for companies to define quantifiable targets to reduce GHG emissions and publicly report on progress.

The Guidelines further state that the Systems generally oppose overly prescriptive proposals that require a company to divest or discontinue its significant business operations or impose specific targets for its emissions reductions, energy efficiency, conservation or renewables.

Mercer recommends that the Systems' corporate governance expectations related to climate change be updated to clarify expected alignment with the Paris Agreement and/or that disclosure of climate change risks should be in line with the TCFD Recommendations[8].

Mercer recommends that the Systems document their policy on advocating for reasonable climate related policies and regulations across jurisdictions, as evidenced by actions to date by the New York City Comptroller's Office (such as becoming a signatory to the Global Investor Statement on Climate Change[9] and the Paris Pledge for Action[10], as outlined in the Postseason Report on Shareholder Initiatives[11]).

Climate Change Strategy

Climate change considerations have implications for all aspects of the Systems' investment framework (beliefs, policy, corporate governance guidelines, and portfolio strategy and implementation). Such considerations are also receiving increasing attention from the Systems' beneficiaries as well as the broader financial sector. In addition to the IPS updates recommended above, NYCRS would benefit from a broader articulation of its climate change position and strategy.

Mercer recommends that each System (or the Systems collectively to the extent that there is consensus on key beliefs and strategy), develop a climate change strategy document which can outline expectations for BAM staff, external managers, advisors and other stakeholders.

[8] The TCFD Recommendations are covered in more detail in Section 6 – Disclosure.

[9] http://investorsonclimatechange.org/statement/

[10] http://www.parispledgeforaction.org

[11] https://comptroller.nyc.gov/reports/shareowner-initiatives

Such a document can take a variety of forms, and can be anywhere from a one page statement[12], to a multi-page strategy document[13]. Regardless of length, a climate change policy or strategy document would include some or all of the following elements:

- **Climate change investment beliefs**
- **Investment objective** (e.g. New Zealand Super states "Our goal is to make the Fund more resilient to climate-related risk.")
- **Strategic pillars** or priorities (e.g. decarbonization, integration of related risks into manager selection and monitoring, investment in solutions, corporate and policy stewardship, participation in collaborative initiatives.)
- **Goals** (e.g. reduce carbon intensity by a certain amount or invest a target amount in climate solutions over a given time period)
- **Expectations** of portfolio companies and/or external mangers (e.g. disclose using the TCFD recommendations)
- **Disclosure** commitment to stakeholders (e.g. that the fund will report annually on its progress and/or will disclose in line with the TCFD recommendations)

Process

Updates to the Systems' investment beliefs, IPS, and corporate governance guidelines – along with the articulation of its climate change strategy – will provide a foundation for enhancements to processes. Three key investment processes relate to:

- Risk management
- Investment strategy, and
- External manager selection and monitoring.

These are each covered in subsequent chapters of this report. Other investment processes that the Boards should consider in the review of its overall approach to climate change are:

- **Education** – given that the landscape related to climate change-related investment risks and opportunities is evolving quickly due to numerous drivers (policy, technology development, peer actions, corporate action, etc.) both the Boards and BAM staff should develop plans for on-going climate change related education leveraging external resources where appropriate[14].
- **Resourcing** – depending on what type of mandate BAM receives from each of the Boards, BAM may wish to structure its resources differently to support integration of climate change into investment analysis and decision-making.
- **Investment consultants**[15] – as noted in Chapter 6, climate related expectations of external providers should be clarified. In addition to setting expectations for external managers, Mercer recommends that the Board clarify their expectations of investment consultants to factor in climate change related risks and opportunities. Other investors are also beginning to set expectations for custodians regarding reporting.

[12] For example, see: https://www.nzsuperfund.co.nz/how-we-invest-balancing-risk-and-return-climate-change/climate-change-strategy

[13] For example, see: EAPF Policy to Address the Impacts of Climate Change (2017)

[14] For example, the PRI recently added a module to its on-line training platform for Trustees on responsible investment, and the existing modules may be appropriate for BAM staff: https://priacademy.org/courses/

[15] The PRI recently published its first review of investment consultants: https://www.unpri.org/news/pri-publishes-investment-consultant-services-review

4

Risk Management

From the perspective of a pension fund trustee, climate change risk can manifest in many ways. The TCFD Recommendations[16] divide climate-related risks into two major categories: (1) risks related to the transition to a lower-carbon economy and (2) risks related to the physical impacts of climate change.

Figure 6: Types of Climate-Related Risks

Transition Risks:	Physical Risks:
• *Policy and Legal Risks*: Increased pricing of GHG emissions; mandates and regulation; exposure to litigation • *Technology Risk*: Substitution of existing products and services with low carbon options; unsuccessful investment in new technology • *Market Risk*: Changing consumer behavior; uncertainty in market signals • *Reputation Risk*: Stigmatization of sector; increased stakeholder concern or negative stakeholder feedback	• *Acute Risk*: extreme event causing direct damage to assets and indirect impacts from supply chain disruption • *Chronic Risk*: direct or indirect impacts from changes in water availability or extreme temperature changes (e.g. food security, employee safety)

The Systems' should consider how or where climate change will be explicitly addressed in its risk management framework, which is led by the BAM Risk Management team. To inform this development, NYCRS has recently undertaken two key climate risk assessment exercises:

- **Mercer's portfolio climate change risk assessment** to assess the potential climate impacts on the portfolios under 3 different climate change scenarios, and
- **A carbon footprinting exercise**, led by Trucost.

Together, these assessments have identified specific areas of the portfolio which are more likely to be impacted (positively or negatively) under different climate change scenarios. This analysis is useful in informing the development of a risk management framework that references climate change, and which can inform specific resulting actions. The next chapter outlines the range of investment approaches that NYCRS can adopt.

The following figure outlines the overview of climate related risks and opportunities undertaken by a Canadian pension plan, the Caisse de dépôt et placement du Québec (CDPQ). They note

[16] It should be noted that the TCFD framework sets out a range of climate related opportunities, alongside the risks.

that they base their climate change strategy on "a rigorous analysis of current and future market risks and opportunities"[17].

Figure 7: Overview of CDPQ's climate change risks and opportunity analysis

Source: CDPQ

Mercer recommends that NYCRS adopt references to climate-related risks in its overall risk management framework and enhance risk management processes to focus more specifically on the management of transition and physical risks.

The risks could be articulated as Transition and Physical risks associated with climate change, to align with the TCFD framework,

- **Transition risks** are more likely to affect private and public market investments in sectors most influenced by the transition to a low carbon economy (namely energy, utilities, materials and transport), whereas;
- **Physical risks** are most likely to impact private market investments in real estate, infrastructure and natural resources and well as public and private equity investments in companies with extensive supply chains in physically vulnerable locations.

The actions BAM can take in relation to **Transition risks**, include the following points. Where particular tools exist to support these activities, they are also noted:

- **Monitoring** sector level exposure to high impact sectors and the relative carbon emissions of companies within each sector. BAM has secured access to tools which enable monitoring and analysis of a range of carbon metrics[18].

[17] https://www.cdpq.com/sites/default/files/medias/pdf/en/investment_strategy_climate_change.pdf

[18] The TCFD Supplemental Guidance for Asset Owners provides detailed commentary on the various carbon metrics that may be relevant for investors: https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Annex-062817.pdf (pages 43 - 44)

- **Identifying preferences or targets** for minimizing exposure to transition risk, which may involve balancing a desire to reduce carbon emissions exposure while maintaining sector diversification and/or setting an acceptable level of tracking error relative to a given benchmark.
- **Requiring external managers** (in investment management agreements) to report on specific carbon metrics (e.g. weighted average carbon intensity, exposure to high carbon assets, and exposure to green revenue).
- **Exploring** how different climate scenarios – including a scenario aligned with successful implementation of the Paris Agreement – could impact portfolio performance. The Systems are undertaking this analysis through the use of Mercer's climate scenario tool.
- **Considering** the extent to which the market has priced for different potential climate scenarios, and how market expectations may unfold in future, driven by various triggers (e.g. new policy announcements, technological breakthroughs, more severe physical events)

The actions BAM can take in relation to **Physical risks**, include:

- **Identifying** a way to assess and monitor the portfolio's exposure to physical climate related risks. Numerous tools and advisory firms exist which can support this analysis.
- **Monitoring and managing accumulations** of exposures in geographies with high vulnerability to physical climate risks.
- **Seeking to minimize, manage or transfer** the aggregate physical risk exposure of the portfolio over time.

NYCRS' overall climate risk management approach could also be visually summarised and included in the Climate Strategy document proposed in the prior chapter and other related documents as appropriate (e.g. each System's IPS and the Corporate Governance Principles and Proxy Voting Guidelines).

5

Investment Strategies

This Chapter outlines a range of portfolio options which exist for NYCRS to address climate related risks and opportunities. These activities – and related objectives – are set out in the figure below, and align with the activity types introduced earlier in the report (Figure 5).

Figure 8: Investor Actions on Climate Change

	PORTFOLIO			ENGAGEMENT	
	Integrate	Decarbonize	Invest	Capital Market	Company
Definition	Integrate a consideration of climate related risks and opportunities into investment analysis, decision making, monitoring and reporting.	Tilt portfolio away from carbon intensive holdings, fossil fuel reserve owners and laggards on climate strategy.	Allocate to climate related sustainability themes (e.g. renewable energy, energy efficiency, water, waste, agriculture, timber).	Engage with regulators, policy makers, and other industry bodies to promote policies and standards which encourage/require disclosure and enable the efficient allocation of capital in the context of climate change.	Exercise voting rights and undertake public and/or private company engagement to promote the effective management of climate related risks and opportunities.
Main Objective	Enhance risk-adjusted returns through broader perspective on investing.	Hedge against impacts of climate policies and regulations (e.g. stranded asset[19] risk).	Improve long-term growth and/or achieve a positive environmental or social impact.	Create more effective capital markets regarding the disclosure, pricing, and management of climate related risks and opportunities.	Protect and enhance value within investee companies (public and private).

Portfolio Actions

Figure 9 outlines the specific actions NYCRS can undertake for each of the Portfolio action areas (Integrate, Decarbonize and Invest). All of these potential portfolio actions are consistent with Mercer's recommendations outlined in this report. Actions shown in green are those which the Systems have already undertaken in whole or in part. Following the table, we provide additional discussion for each of the three areas.

[19] A "stranded asset" in the context of this document can be defined as "those investments which have already been made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return, as a result of changes in the market and regulatory environment brought about by climate policy". Source: IEA World Energy Outlook 2013

Figure 9: Potential Portfolio Actions for NYCRS

PORTFOLIO		
Integrate 	Decarbonize 	Invest 
- Update Investment Beliefs to reflect climate change and/or sustainability - Increase education on climate change for internal BAM staff (to support integration of climate risk into investment analysis and manager engagement) and System Boards - Develop a climate change strategy document - Update the IPS to reflect the System's climate change strategy - Continue to undertake portfolio-level climate risk management assessments on an annual basis (carbon scenario analysis and metrics) - Undertake real asset climate risk assessment (for real estate and infrastructure holdings) - Conduct a climate risk review of current and prospective managers; evolve the manager questionnaire into an annual reporting requirement - Fully integrate climate risk consideration into individual private asset due diligence and active manager selection processes - Incorporate climate change strategy into role descriptions and performance assessment for BAM staff - Report annually on climate change metrics in line with TCFD Recommendations[20]	- For passive equity portfolio(s), reduce exposure to oil companies which have high cost and/or high carbon reserves and coal production/ generation through index enhancements - For active equity portfolios, divest from pure play thermal coal mining - Explore options to develop a time-bound decarbonization target[21] - Extend divestment from thermal coal to additional high-cost, high-carbon reserve owners - For actively managed equity portfolio, give the portfolio managers a carbon budget in line with the System's decarbonization target - Review the infrastructure portfolio for carbon intensive assets that may be at risk of asset stranding - Set guidelines for future infrastructure investments (to either avoid and/or utilize enhanced due diligence for potential high carbon investments)	- Increase allocations to low-carbon infrastructure - Allocate to: o active environmentally thematic public equities o green or climate-aligned bonds o investments in climate solutions in private equity, infrastructure and natural resource asset classes - Explore growing opportunity set of climate-aligned private assets in emerging markets, where multi-lateral and national development banks are providing credit enhancement opportunities for private investors - Explore options to develop a time-bound sustainable investment target[22]

[20] For NYCERS, as a PRI signatory, TCFD related questions will be included in the PRI's 2017 assessment framework. https://www.unpri.org/page/pri-publishes-voluntary-climate-reporting-indicators-based-on-tcfd-recommendations | https://www.unpri.org/download_report/44249

[21] Funds that have done this tend to focus initially on public equity, with decarbonization targets in the 25-50% range. Note: the U.S. pledged to reduce its emissions by 26-28 percent below 2005 levels by 2025 as part of the Paris Agreement (this pledge has now been adopted by the 'America's Pledge' and 'We're Still In' coalitions).

[22] A number of peers have made commitments to invest in climate solutions, which tend to be asset class agnostic and in the range of <1% to 20% of AUM. Christiana Figueres, former Executive Director of the United Nations Framework Convention on Climate Change, recently challenged PRI signatories to invest 1% of their assets in clean technologies and renewable energy by 2020.

PORTFOLIO – INTEGRATE

Climate change risks are present in almost all sectors, regions and across all asset classes, as outlined in the following quote from the Sustainable Accounting Standards Board (SASB)[23].

> "Climate risk is ubiquitous. SASB research demonstrates that 72 out of 79 Sustainable Industry Classification System (SICS™) industries are significantly affected in some way by climate risk. This represents a systematic risk that cannot be diversified away. As a result, investors must employ other strategies to manage climate risk, such as balancing exposures through sector allocation, focusing exposures on best-in-class securities, and actively engaging with portfolio companies on key climate-related factors to encourage improved performance."

From this perspective integration of climate change into top-down investment **governance**, **strategy** and **risk management** processes is warranted. While climate risks manifest in different ways (e.g. transition risk or physical risk) a total fund climate change risk assessment such as conducted by Mercer on behalf of each System helps to identify those risks which are most impactful in the portfolio to support such prioritization. The key three areas for integration have been address in more detail in other chapters of this report:

- Chapter 3: Beliefs, Policy and Process
- Chapter 4: Risk Management
- Chapter 6: Manager Selection and Monitoring

PORTFOLIO – DECARBONISATION

There are various levers that investors can use to reduce the portfolio carbon footprint, and fossil fuel resource exposure, and thereby reduce the carbon risk exposure of the own portfolio, as well as encourage and support investee companies / holdings to reduce their own carbon intensity.

Portfolio decarbonization refers to systematic efforts by investors to align their investment portfolios with the goals of a low-carbon economy. It includes, but is not limited to, efforts to reduce the carbon footprint of investment portfolios, to increase investment in areas such as renewable energy, to withdraw capital from high energy consumption activities and to encourage companies and other entities to reduce their emissions and support the transition to a low-carbon economy.

Source: Portfolio Decarbonization Coalition

Divestment

A particular climate risk management strategy which has gained notable attention is fossil fuel divestment ("divestment"). Divestment can be one way to approach sector reallocation and is most often focused on eliminating exposure to thermal coal, oil sands or the broader oil and gas sector (or fossil fuel reserve owners). While divestment is a relatively blunt instrument, it does appeal to some investors for a variety of reasons:

[23] SASB Climate Risk Technical Bulletin (TB001-10182016)

- Implementing a divestment approach can be viewed as a way to align an investment portfolio with core organization values, where they exist.
- Where an investor has strong conviction that swift policy action and technology development will result in significant asset stranding of fossil fuel companies/reserve owners, this may outweigh the current and future costs of implementing and monitoring divestment.
- Further, it can be argued that full fossil fuel divestment reflects a meaningful contribution to halting the progression of climate change by stigmatizing fossil fuel producers or emitters and restricting their funding available for new harmful projects, as well as creating political and social momentum towards successful climate mitigation.

However, when considering divestment, we believe it is important to remain cognizant that:

- Consistent with the 80 / 20 Rule, the majority of carbon emissions are attributed to a proportionally smaller group of high emitters.
- Some diversified energy companies will contribute to the successful transition to a low-carbon economy.
- Fossil fuels represent a very significant component of today's energy mix and are used in a wide range of commercial and consumer applications beyond the energy sector.
- A 2°C pathway will include ongoing utilization of oil and gas reserves, albeit they will represent a diminished component of global energy generation.
- Divestment, without a fiduciary investment thesis, may give rise to allegations of breach of fiduciary duty to deliver an appropriate level of investment return, denying a pension fund member the ability to accumulate the level of funds needed for retirement.
- Divestment will likely introduce up-front (and possibly ongoing) implementation (and monitoring) costs.
- Divestment alone cannot remove emissions from the atmosphere or directly impact the underlying companies in the near term as other shareholders will buy the divested securities.
- "Divestors" forfeit the right to vote proxies and weaken the basis for engagement.
- Avoiding exposure to the sector presupposes capital markets have not adequately factored in the risk of a rapid low carbon transition on fossil fuel companies.

Investors should perform holistic due diligence in considering a divestment strategy. This due diligence should seek to quantify and qualify the impact of climate change on risk, return and reputation and apply both retrospective and prospective assessment techniques as possible/practicable. If after this assessment has been completed the organization does not have conviction in the stranded asset risk thesis or believes the market is adequately pricing for this risk then divestment is likely not going to be an appropriate solution for fiduciaries. However some assets are particularly high-risk and susceptible to regulatory and technological disruption and may warrant further focus in the near term. To this end:

Mercer recommends that the Systems review their divestment approaches and consider excluding high-cost, high-carbon reserve owners and thermal coal power utilities if an investment belief is adopted which acknowledges that the continued transition to a low-carbon economy is likely to strand these assets.

Low Carbon Approaches

Given portfolio decarbonisation is still in its infancy, there have been a number of asset owners that have developed a custom approach or seeded a new index. We expect this to continue as innovation in this area evolves. Over time, we would expect the market to mature, with carbon

efficient indices becoming more common and appealing to a broader set of investors. The following are examples of investors who chose to develop a new or customized low carbon approach for public equity.

Figure 10: Sample Customized Low Carbon Approaches

INVESTOR	APPROACH
PFZW (Netherlands)	PFZW developed a custom benchmark which uses a rules-based approach for their market-weighted passive strategy (primarily affecting energy, utilities and material sectors). PFZW did not want to use an optimized approach as they wanted to have a conversation with companies that would no longer be in their benchmark[24]. They now plan to move into their beta strategies.
NY State Common Retirement Fund (US)	NYSRS allocated $US 2B to an internally managed 'Risk-Aware Low Emission' equity strategy (a passive index that underweights large emitters) which was developed with Goldman Sachs.
AP4 (Sweden)	AP4 was one of the early adopters of carbon reduction strategies worked with Northern Trust in 2013 to develop a new Emerging Markets Custom Low Carbon Dioxide Equity Index Fund. It has since expanded into other equity strategies and aims to have 100% of their global equity strategies in low carbon strategies by 2020.
HSBC	HSBC UK Pension Scheme chose a new LGIM multi-factor fund with a climate change "tilt" as the equity default option in their £2.6bn DC scheme. The Future World Fund tracks a new FTSE Russell index that combines smart beta, or factor investing, with climate-change parameters.

All of these investors emphasize the importance of engagement as a complementary activity to implementing portfolio tilts.

Mercer recommends that NYCRS move some of its existing market cap passive equity towards an ESG or low-carbon alternative (whether custom developed or an existing index).

This would offer a relatively low-cost solution toward acting on a belief that companies that do a better job of managing ESG related risks and reducing their carbon emissions (on a sector-relative basis) provide a more attractive opportunity set for the System as a long-term investor.

PORTFOLIO – INVEST

Investing in sustainability themes offers attractive opportunities to access the growth potential of companies providing solutions to the challenges of resource scarcity, demographic changes and a range of other environmental and social issues. These include investments in

[24] http://www.top1000funds.com/analysis/2015/11/27/pggm-halves-co2-footprint-in-investments/

areas such as renewable energy, energy efficiency and clean technology, water and waste management and sustainable timber and agriculture.

Assets targeting sustainability themes exceed USD $330 billion globally and grew at an annual rate of 55% between 2014 and 2016[25]. Further in-depth analysis of the various themes is available in Mercer's paper, *The Pursuit of Sustainable Returns*[26].

Sustainability themes can be accessed across asset classes, as outlined in the below table. These asset classes should generally be expected to offer investors upside and potential downside protection in an environment where a transition to a low carbon economy is accelerated.

Figure 11: Sustainability Themed Asset Classes

Asset Class	Description
Sustainable Public Equity	Sustainable equities are expected to capture upside from a low carbon transition through greater exposure to climate change solutions providers. Relative to the broader market, this segment of the equity market is expected to disproportionately benefit from a growth in climate mitigation related policy and technological advancement.
Sustainable Private Equity	Mostly venture and growth funds at this stage of the market's development focused on clean technology investments or on companies with services supporting environmental sustainability.
Sustainable Infrastructure	Sustainable infrastructure consists of a broad range of projects and solutions including renewable energy, water and waste management, and energy efficiency investments. These areas are expected to benefit from clean technological innovation and strong policy action to combat emissions. Similar to other sustainability themed asset classes, sustainable infrastructure would benefit from avoiding exposure to assets which may become stranded in a low-carbon transition.
Green Bonds	The green bond market is currently dominated by government/supranational issuances, but more corporate issuance is expected going forward. Corporate green bonds will be issued by organizations that have, in general, proactive climate risk management practices overall and thus be less susceptible to climate-related default risk.

[25] Global Sustainable Investment Alliance; Global Sustainable Investment Review, 2016

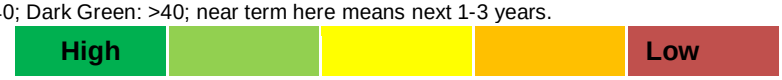
[26] For executive summary see: https://www.mercer.com/our-thinking/the-pursuit-of-sustainable-returns.html. For access to the complete paper please contact Mercer directly.

A high-level description of the opportunity set currently available in each asset class follows:

Figure 12: Overview of Current Opportunity Set for Sustainability Themed Asset Classes

Asset Class	Universe Size and Near Term Implementation Feasibility *	Near Term Implementation Feasibility Considerations for NYCRS
Sustainable Public Equity	A large number of mature and high quality sustainability-themed strategies are available globally	Developing a nuanced allocation across multiple regions or styles could pose challenges though NYCRS' size could support customization and seeding of new products as needed
Sustainable Private Equity	A large and growing number of strategies exist targeting sustainability-oriented businesses in various sectors beyond clean tech	NYCRS' size, region and venture constraints severely limit universe
Sustainable Infrastructure	A large and growing number of strategies exist targeting renewable energy installations (utility and community scale) and other forms of sustainable infrastructure	NYCRS's size constraints limit universe
Green Bonds	Green bond issuance is increasing but there remain some market liquidity concerns and few mature dedicated fund offerings; more generally sustainable product innovation in fixed income has lagged public equity	Green bonds are already owned in many traditional portfolios and concentration could potentially be increased in separately managed accounts; NYCRS' size could also support customization and seeding of new products as needed

* Based in part on the absolute availability of ESG1 rated strategies in Mercer GIMD, where available. Red: <5; Amber: 5-10; Yellow: 10-20; Light Green: 20-40; Dark Green: >40; near term here means next 1-3 years.



For the Systems to gain exposure to this opportunity set, we believe that it is beneficial to establish a reasonable, time-bound target that provides flexibility in approach (e.g. across asset classes). As we have seen from the accompanying Best Practice Review, target allocations to sustainable-themed assets range from 0.2% to almost 20% of total assets, with 2020 as a common target date. Christiana Figueres recently challenged PRI signatories to invest 1% of their assets in clean technologies and renewable energy by 2020[27].

The rationale for 1% is based on the fact that the PRI signatories currently represent approximately $70 trillion of assets under management (AUM). By 2020, 1% of PRI signatory AUM (which today equates to $700 billion) will go a long way toward bridging the approximately $1 trillion+ investment gap in renewable energy/sustainable infrastructure financing[28] [29]. The timing of 2020 is based on the premise that emissions need to start declining at a rate of 6 – 7% per year by 2020 in order to ensure an orderly transition to a low carbon economy.

[27] Figueres is the former executive secretary of the UN Framework Convention on Climate Change https://www.top1000funds.com/featured-homepage-posts/2017/09/28/pri-signatories-challenged-to-act-now/ | https://www.youtube.com/watch?v=8vSV1SvMXpA

[28] https://www.ceres.org/sites/default/files/reports/2017-03/Ceres_CleanTrillion_Report_012114.pdf

[29] http://newclimateeconomy.report/2014/wp-content/uploads/sites/2/2014/08/NCE_Chapter6_Finance.pdf

Therefore if NYCRS believes a 2°C scenario is likely to take place and/or preferable for long-term economic outcomes then aligning the organization's portfolio with such a pathway offers several potential risk and return benefits with limited downside if a 2°C scenario does not take place[30]. Based on Mercer's understanding of the opportunity set for sustainable investment, a flexible 1% target across asset classes should be achievable for NYCRS over the identified time frame. On this basis:

Mercer recommends targeting an aggregate allocation of 1% to sustainability-themed investments (across all asset classes), to be deployed between 2018 and 2020, provided that investment opportunities are available that are in line with the Systems' investment objectives and risks/return tolerance. The capital should be allocated to the opportunities it finds most attractive, broadly mirroring the Systems' overall asset allocation.

Mercer recommends the Systems re-examine their existing limitations on private equity investments to provide some allowance for smaller managers, emerging markets and lower fund size thresholds. This would allow better access to sustainability-themed investments given the nascent and global nature of the sustainable investment opportunity set in this asset class.

Engagement Actions

Figure 13 outlines the specific actions NYCRS can undertake for each of the engagement action areas (Capital Market and Company). Actions shown in green are those which the Systems have already undertaken. Following the table, we provide additional discussion for each of the two areas.

[30] Mercer; Preparing Portfolios for Transformation; 2017

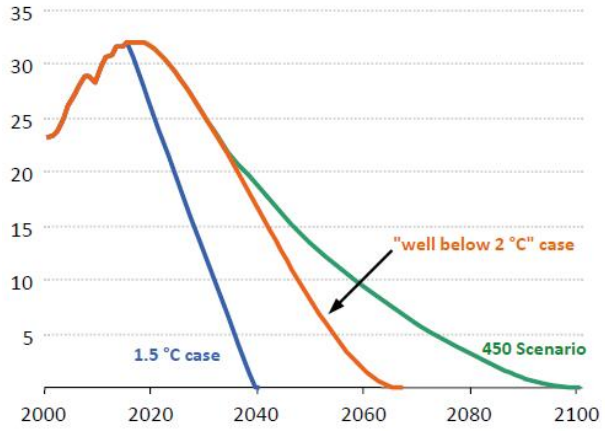
Figure 13: Illustrative Engagement Actions

ENGAGEMENT	
Capital Market	Company
- Encourage investment industry associations (e.g. ILPA) to develop more fulsome member guidance on climate risk management - Support and encourage industry education on climate (e.g. CFA) through sharing BAM's experience - Promotion of TCFD / climate disclosure requirements (stock exchanges, OSC, etc.) - Formal policy engagement (US and international) program to encourage the introduction of policies and regulations aligned with successful implementation of the Paris Agreement - Reflect approach to capital market engagement in IPS	- Vote in favor of reasonable climate related resolutions filed with investee companies - File shareholder resolutions promoting 2°C alignment of business plans - Leverage collaborative initiatives (e.g. Global Climate 100) to encourage emissions reductions and related climate change strategy development for the NYCRS' highest emitter portfolio companies. - Extend climate change mitigation engagement strategy beyond the highest emitters (e.g. other sectors, e.g. banks) - Formally articulate company expectations (e.g. for Paris Agreement and TCFD alignment) in Corporate Governance Guidelines

ENGAGEMENT – COMPANIES

A significant transformation of the economy is required to reach the 2°C target in the Paris Agreement, particularly in our production and use of energy.

Figure 14: Energy Related GHG Emissions Scenarios (Gt CO_2e)



Source: IEA, WEO 2016

The IEA World Energy Outlook 2016 lays out indicative global energy sector emissions trajectories for different decarbonisation pathways (see graph on the left). These pathways show how quickly emissions must fall to zero in order to have a reasonable expectation of meeting the goals of the Paris Agreement. The 450 Scenario represents a 50% chance of staying below 2°C.

In contrast, emissions forecasts by certain oil majors are substantially higher than what is required to meet the Paris Agreement[31].

[31] Oil Change International – "Forecasting Failure" (2017)

There has been significant debate between the merits of divestment versus engagement to influence change in the fossil fuel industry. For large, diversified investors such as NYCRS, engagement is widely viewed as an important lever for change. The Global Climate 100 Initiative has recently been launched – with NYCRS' involvement – in recognition of the critical role that investor engagement plays with the highest emitters.

ENGAGEMENT – CAPITAL MARKETS

The PRI states that public policy – covering laws, regulatory measures, administrative mechanisms and funding priorities – critically affects the ability of long-term investors to generate sustainable returns and create value. Policy engagement is, therefore, a "natural and necessary extension of an investor's responsibilities and fiduciary duties" according to UNEP.[32]

Further, the voice of investors is particularly important "in policy debates in which investors believe companies or their trade associations have taken a position that conflicts with the best long-term interests of the corporations and their shareholders".[33]

Policy makers ultimately set the context that companies and investors are working within. This context aims to align the financial system with government and civil society objectives. The importance of that system is recognised in the multiple responses to the Global Financial Crisis. These included the Kay Review, the Stewardship Code implementation in the UK and other regions, and the UNEP-FI Financial System Inquiry[34].

The number of investors actively collaborating on engagement activity is on the rise. This can be seen by efforts to coordinate investor engagement by groups such as the PRI, the Institutional Investors Group on Climate Change, the Aiming for A coalition, Global Investor Statements on Climate Change[35] and others. Growth in collaboration reflects the reality that no one investor alone can bring about the market-wide changes necessary to tackle systemic risks, such as climate change.

A further argument in favour of collaboration in public policy engagement is that this type of engagement can take longer than company engagement. It is also more complex given the number of competing stakeholders.

[32] UNEP, PRI (2015) *The Case for Investor Engagement in Public Policy.* available at: http://bit.ly/21k3sTZ

[33] Garland, M, in BlackRock and Ceres (2015) *21st Century Engagement,* page 32. https://www.blackrock.com/corporate/en-hu/literature/publication/blk-ceres-engagementguide2015.pdf

[34] For further information see: Kay Review: http://bit.ly/1kfJD9T; UK Stewardship Code: http://bit.ly/237lxGl; UNEP Inquiry: http://web.unep.org/inquiry/

[35] https://www.ceres.org/news-center/press-releases/over-200-global-investors-urge-g7-stand-paris-agreement-and-drive-its

6

Manager Selection and Monitoring

The optimal approach to integrating climate change in the selection and monitoring of external managers will be influenced by the final nature of the System's climate change strategy (that is, the beliefs and policy that is developed). Once this is in place, a formal investment implementation strategy can be developed, which may lead to clear and measurable expectations of managers (e.g. carbon reduction targets, disclosure requirements).

To support the development of an appropriate manager monitoring regime, a helpful first step would be for BAM to survey external managers on their approach to climate change. In reviewing BAM's current ESG questions in the Due Diligence questionnaires (one for each of public and private markets), we found only one (very general) reference to climate change.

An illustrative climate change manager questionnaire is provided in the table below. This questionnaire could be set up to facilitate collation of results, as well as relative assessment of approaches of individual managers. It could also help inform BAM's strategy by understanding the range of approaches employed by existing external partners, and how they vary across asset classes, regions and managers. The findings of the questionnaire could also inform the BAM staff views on key questions such as the managers belief as to the extent to which climate change is being is priced in the marketplace. It can also be used to inform and prioritize the Systems' strategy for industry-wide engagement.

The questionnaire could evolve over time based on the feedback received and reflect the Systems' climate change policy as it develops (e.g. asset class specific questions could be added) and ultimately be integrated into BAM's broader due diligence questionnaires. Inadequate attention to climate change risk and opportunities by a manager could warrant an "engage and monitor" approach with the manager. Continued failure by a manager to develop a reasonable approach to climate change could be considered grounds for putting that manager on a "watch list".

Figure 15: Illustrative Climate Risk Review Manager Questionnaire

NYCRS Climate Risk Review - Manager Questionnaire

Part 1. Perspectives on Climate Change

1. Does your firm have a stated view on climate change (e.g. a climate change policy)? If so, please provide.
2. Has your firm committed to disclosure under the FSB Task Force on Climate Related Financial Disclosures (TCFD) Recommendations? If so, what year will this reporting begin? If not, do you foresee this changing and when?
3. Does your firm have a central stewardship policy covering engagement and proxy voting on climate change? Or if it is not centralized, how is this handled?

Part 2. Risks and Opportunities for the Strategy

Risk

1. What is your perspective on climate change as an investment risk facing the strategy you manage? This should include both the transition elements of shifting to a low-carbon economy, as well as the physical impacts of climate change. Please rank each of these categories as high risk, medium risk or low risk.
2. How do you manage this risk? Please describe both top-down and bottom-up approaches.

Opportunity

1. What is your perspective on climate change as an investment opportunity in the strategy you manage – high, medium or low?
2. How do you pursue this opportunity? Please describe both top-down and bottom-up approaches.

Investment Process

In addressing how you manage climate related risks and opportunities as requested above, please address:

1. If and how you account for potential positive or negative impacts of climate related policies (e.g. price of carbon, emission reduction requirements) on your investments.
2. If and how you track current and emerging climate change regulations and policy developments.
3. If you track the assumptions being made by individual portfolio companies about future environmental regulation and technological innovation (in particular, as relates to fossil fuel demand forecasting models).
4. If and how you consider the potential for physical climate related risks to affect portfolio companies today and in the future.
5. How you monitor climate related issues at the portfolio level.

Disclosure

1. What reporting on climate change related metrics are currently available for the strategy (e.g. carbon footprinting, stewardship, other)? How do you see your climate related reporting evolving?

Part 3. Industry participation

Initiative	***Status*** *(Where you do not participate please comment on why not, and if/when you foresee this changing)*
TCFD	*Signatory to supportive statement (y/n)*
PRI	*Signatory (y/n)*

Regional group on climate change (i.e. Investor Network on Climate Risk, IIGCC, AIGCC, IGCC)	*Member (y/n)*
Climate Action 100	*Participant (y/n)*
Paris Pledge for Action	*Signatory (y/n)*
Global Investor Statement on Climate Change	*Signatory (y/n)*
Portfolio Decarbonisation Coalition	*Participant (y/n)*
Other	
Part 4. Strategy Characteristic	
- Asset class - Style	- Geography

Mercer recommends that NYCRS conduct a climate risk review of their external managers to understand what the managers' perspectives are on climate change and how they identify and manage climate-related investment risks and opportunities.

Mercer recommends that, once the Systems develop a climate change strategy, BAM reflects any new expectations of managers in all stages of the due diligence process (including the due diligence questionnaires) and that the weightings given to climate change (and/or ESG) questions be reviewed and increased, as appropriate.

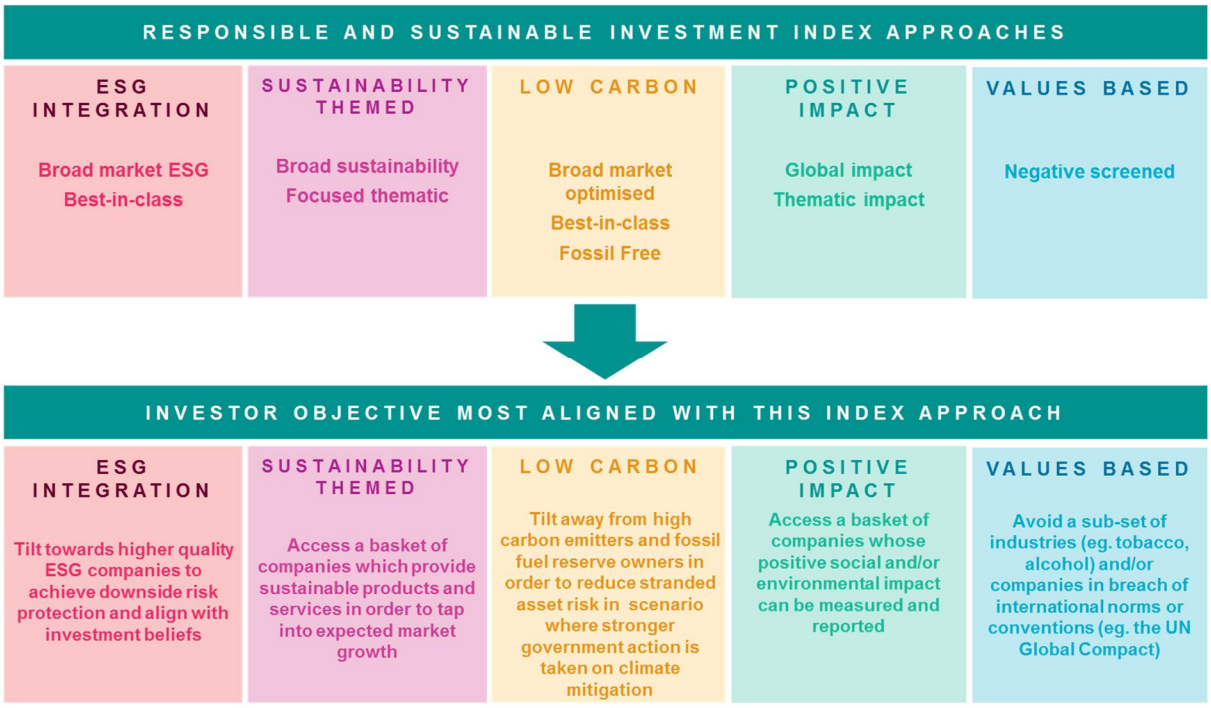
Benchmarks

As noted earlier, benchmark selection can be a key component of implementing a climate change strategy. While not relevant to all asset classes or mandates, benchmarks allow an investor to reflect its overall investment beliefs and strategy in a clearly defined investment universe which external managers are then often asked to execute on. As more investors are developing their climate change strategy (and/or ESG strategy more broadly), investor demand for ESG integration and sustainability themed solutions has increased. Combined with a shift towards index-tracking management, this has led to a significant increase in the number of ESG and sustainability indices available.

Historically, ESG related indices have been characterised by a disparate approach to construction. As such, it is vital that investors keep in mind that **there is no standard definition of an ESG or sustainability index**. Investors need to understand the underlying construction methodologies of different indices in order to determine whether an index is aligned with their needs. It is for this reason that many investors have implemented their climate change strategy using custom benchmarks (as was mentioned earlier).

Broadly, in our view there are five core categories of responsible investment (RI) related indices, each of which may have several sub-categories. These are shown in the diagram below, along with a note on the investor objectives most aligned with each type of approach.

Figure 16: Overview of Responsible Investment Index Approaches



For a mainstream investor focused first and foremost on achieving optimal risk-adjusted returns, the **three indices on the left hand side** would be of most interest. These are further described as follows:

- **ESG integration indices** may provide an alternative benchmark to *track* for a passive portion of the portfolio and/or to use as a *benchmark* against which to measure the performance of external managers. Typically these indices aim to closely track the performance of their parent indices, with broadly similar levels of volatility. They provide investors with a broad market index with similar performance characteristics, but additionally overweight companies that are ESG leaders and underweight laggards.
- **Sustainability themed indices** offer a *primary or secondary benchmark* against which to measure the performance of a sustainability themed manager allocation (Note: it is rare for investors to passively track these indices given that many believe the pace of technological advancement requires active management in order to capture the significant related alpha generation opportunity).
- **Low-carbon indices** offer a method for significantly reducing exposure to carbon emissions and fossil fuel reserves for minimal tracking error and cost.

Various empirical studies have typically found that returns of RI indices compared to their conventional market cap parent indices differ depending upon the period of study and region. Overall however these studies have generally concluded that there are no significant differences in risk-adjusted returns between the RI and conventional market cap indices.

Future trends in ESG indices and benchmarks

The next wave of innovation is likely to focus on two key areas:

- **Multiple objective indices**: These indices include multiple approaches identified in the table above, such as tilting towards companies with high ESG scores and lower carbon emissions, while avoiding certain sectors, such as thermal coal producers and cluster munition manufacturers (a common screen in Europe and Canada). Flexibility to create unique benchmarks will increase along with data availability and customization services.
- **ESG factor indices**: Traditional ESG indices have market capitalization weighted parent indices. There is increasing development of ESG indices which have a parent index that utilizes a factor approach for index construction, and then overlays ESG (and/or carbon) considerations on top of that.

The range of investment products linked to RI indices is currently narrow, reflecting both limited investor demand to date and the relative immaturity of ESG indices in general. This has also been due to the additional licensing costs involved, which means that the fee for these index-tracking products is higher than for standard market cap index tracking solutions.

Key considerations for NYCRS

The primary benefit of an RI index is that it can be an important step in integrating ESG and/or climate considerations where investors have passive equity exposure. In considering whether the adoption of an RI index is the right course of action, there are several questions that the Systems should consider, including:

- Does an index-based approach offer the most suitable way of accessing the opportunity or protecting against risks?
- Does the construction methodology align with the System's investment beliefs and broader approach to ESG integration and sustainability?
- What risks is the System trying to protect its portfolio against?
- What opportunities is the System trying to gain access to?
- Are there any unintended consequences of the construction methodology?
- Could the System be introducing unexpected biases as a result?

7

Disclosure

The TCFD recommendations apply to pension funds as well as companies, and we expect leading funds to adopt the TCFD reporting framework for their 2017 year end reporting. To support this outcome, the PRI has updated its Reporting Framework[36] to include new climate-related indicators. As of the 2018 reporting cycle, PRI signatories will be able to voluntarily report and disclose on 14 new indicators and six original indicators which have been updated following TCFD recommendations[37]. As the PRI states "pilot reporting against the new indicators will help signatories inform climate strategy and investment practices; align with TCFD recommendations; demonstrate climate reporting gaps; and implement emerging industry best practice."

The below table outlines the key TCFD recommendations, as well as the additional guidance provided by the TCFD to asset owners for implementing them.

Figure 17: TCFD Recommendations and Supplemental Guidance for Asset Owners

	Governance	Strategy	Risk Management	Metrics and Targets
TCFD Recommendations	a) Describe the board's oversight of climate-related risks and opportunities. b) Describe management's role in assessing and managing climate-related risks and opportunities.	a) Describe the climate-related risks and opportunities the organization has identified over the short, medium and long term. b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning. c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C scenario.	a) Describe the organization's processes for identifying and assessing climate-related risks. b) Describe the organization's processes for managing climate-related risks. c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process. b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks. c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

[36] https://www.unpri.org/page/pri-publishes-voluntary-climate-reporting-indicators-based-on-tcfd-recommendations

[37] PRI Reporting Framework (Climate-related indicators only): https://www.unpri.org/download_report/44249

	Governance	Strategy	Risk Management	Metrics and Targets
Supplemental Guidance for Asset Owners	a) N/A b) N/A	a) N/A b) Describe how climate-related risks and opportunities are factored into relevant investment strategies. c) Asset owners that perform scenario analysis should consider providing a discussion of how climate-related scenarios are used, such as to inform investments in specific assets	a) Describe, where appropriate, engagement activity with investee companies to encourage better disclosure and practices related to climate-related risks to improve data availability and asset owners' ability to assess climate-related risks. b) Describe how they consider the positioning of their total portfolio with respect to the transition to a lower-carbon energy supply, production and use. c) N/A	a) Describe metrics used to assess climate-related risks and opportunities in each fund or investment strategy. Where relevant, asset owners should also describe how these metrics have changed over time. Provide metrics considered in investment decisions and monitoring. b) Provide the weighted average carbon intensity, where data are available or can be reasonably estimated, for each fund or investment strategy. In addition, provide other metrics they believe useful for decision making, with a description of the methodology used. c) N/A

* Where material

Mercer recommends that NYCERS (as the only NYCRS signatory to the PRI) voluntarily report under the new climate-related indicators for the 2018 reporting cycle to support the development and implementation of the System's climate change policy and implementation of emerging industry best practice.

As noted earlier, we also recommend that the Systems develop a climate change policy or strategy document which would be used, in part, to engage stakeholders on the Systems' approach to climate change.

Mercer recommends that NYCRS provide annual updates against the climate change strategy as another element of reporting and stakeholder engagement.

8

Conclusion

The investment industry is rapidly evolving its approach to climate change risk management, and the System is timely in considering its overall approach. As set forth in this report, Mercer encourages developing an approach with a foundation of good governance formed by clearly articulated beliefs and policy, which will then inform portfolio decisions. This approach takes more work up front (i.e. in debating and documenting investment beliefs), but pays dividends later, through significant time saved in debating the merits of potential portfolio activities which would be more clearly guided by the existence of investment beliefs.

The below figure plots the range of recommendations we have set forth in this report on two axes:

- On the **horizontal axis**, we consider the additional cost or disruption that taking the action would have on NYCRS or BAM.
- On the **vertical axis**, we consider the impact that the action would have on the climate – either direct (for example, in contributing to a reduction in GHG emissions by a company or building climate resilience through climate adaptation), or indirect (for example, through supporting climate policy).

Figure 18: Portfolio Risk Management Options – Climate and Operational Impact

Source: Mercer

As the chart shows, the recommended steps cover a range of actions with varying degrees of complexity from an implementation perspective, delivering both direct and indirect impacts on real world climate outcomes. These actions can be integrated into ongoing work plans and areas of responsibility for BAM staff with climate becoming a more regular agenda item for Trustees. In this way, climate risk management will become normalized with the Systems' addressing it in an integrated and fulsome manner, as it would with any other significant, forward-looking investment risk. The primary objective of the recommendations set out in this report is to help Trustees and their agents to address this emerging risk in a manner which optimizes investment outcomes for NYCRS. Agreeing key investment beliefs and articulating a clear climate strategy are the top priorities towards this goal.

9

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MERCER
MAKE TOMORROW, TODAY

CLIMATE CHANGE RISK ASSESSMENT
THE NEW YORK CITY EMPLOYEES' RETIREMENT SYSTEM (NYCERS)

JANUARY 15, 2018

MARSH & McLENNAN COMPANIES

CONTENTS

1

Executive Summary

With the Paris Agreement, countries committed to lower their greenhouse gas emissions sufficiently to keep a global temperature rise well below 2°C this century relative to pre-industrial levels. While much uncertainty remains regarding the collective ability of agreement signatories to meet this commitment, institutional investors are increasingly exploring the risks and opportunities which arise in a time of climate change.

The New York City Employees Retirement System ("NYCERS"), New York City Police Pension Fund, New York City Fire Department Pension Fund and Board of Education Retirement System (collectively referred to in this document as the "New York City Retirement Systems", "the Systems" or "NYCRS") have engaged Mercer to support the development of a climate change investment strategy. To inform this strategy development Mercer has analyzed the potential effect of different climate scenarios on the investments of each System using Mercer's proprietary climate change risk modelling framework.

This report provides the results of this climate change risk assessment for the New York City Employees' Retirement System ("NYCERS" or the "System"). The key objective of this report is to explore the potential impact of climate change through an analysis of a multi-faceted set of related risk factors at the total portfolio, asset class and industry sector levels.

In addition to conducting a climate change risk assessment for each of the four Systems, Mercer also prepared a report titled "*Climate Change Risk Management Strategy*" for the Systems, which contains recommendations and related commentary for the Systems to consider in developing a climate change strategy.

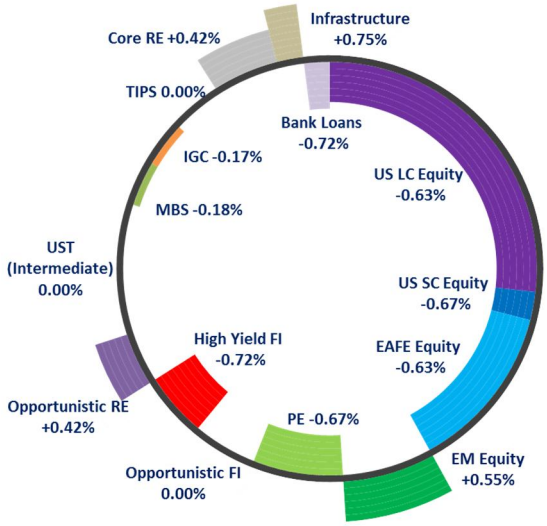
Key Findings

In order to understand the potential impact of different climate scenarios on NYCERS' investments, three key climate scenarios are considered:

- **2°C –** aligned with the ambition of the Paris Agreement
- **3°C –** assumes a coordinated and well-defined policy response
- **4°C –** business-as-usual pathway with higher expected physical damage

The report models NYCERS' current strategic asset allocation. As with any model, results should be interpreted as directional rather than precise, with the aim of informing us about the overall direction and magnitude of impact across the different scenarios, and the extent to which different risk management approaches might be useful.

Figure 1: Climate Impacts – 2°C scenario (per annum over 10 years)



A 2°C scenario has the most significant – and negative – impact on the NYCERS portfolio. The System is susceptible to experiencing overall losses in a 2°C scenario with its current strategic asset allocation. Over the next 10 years, this equates to 27 basis points of return per annum, representing a cumulative loss potential of $2,729 million. If the NYCERS board believes a 2°C scenario is likely to occur then repositioning the portfolio to manage related downside risk (e.g. decarbonizing public equities) and take advantage of potential upside from such a transition (e.g. allocating to sustainable investments) is warranted (see associated Climate Change Risk Management Strategy report for more details).

In the time horizons considered, the negative impact for the System under a 2°C scenario is larger than the negative impact under a 4°C scenario. This relationship would be expected to switch over time – particularly in the 2nd half of the Century – as the physical impacts of climate change become more severe.

Asset class return impacts can be material although the potential impact varies widely across climate change scenarios. In a 2°C scenario, expected returns for emerging market equities, infrastructure, real estate, timber and agriculture are positively impacted. On the other hand a 4°C scenario is likely to negatively impact emerging market equities, real estate, timber and agriculture. Overall, growth assets are anticipated to be more sensitive to climate risks across scenarios (negative and positive) than defensive assets.

Industry sector impacts are meaningful in terms of potential climate impacts on investment returns. The effects of a low carbon economic transition and physical climate impacts – both negative and positive – will be highly differentiated across and within industry sectors. Traditionally, asset owners focus primarily on asset allocation during portfolio construction. Drilling down within asset classes to look at sector level exposures is also an important consideration to support effective management of climate change risk.

2

Introduction

The environment dominated the 2017 global risk landscape in terms of impact and likelihood, and climate change ranks as one of the top three trends most likely to determine global developments over the next 10 years, according to the World Economic Forum's Global Risks Report.[1] With the Paris Agreement, countries committed to lower their greenhouse gas emissions sufficiently to keep a global temperature rise well below 2°C this century relative to pre-industrial levels. Though much uncertainty remains regarding the collective ability of agreement signatories to meet this commitment, institutional investors are increasingly exploring the risks and opportunities which arise in a time of climate change. In the United States, this is intensified by a sense of uncertainty around *reduced* commitment to climate mitigation at the national level and *growing* support from cities, states and companies[2].

Mercer has modelled the NYCERS Strategic Asset Allocation ("SAA") using Mercer's proprietary climate change risk modelling framework[3]. The objective of the modelling is to explore the potential impact of climate change through an analysis of a multi-faceted set of related risk factors at the total portfolio, asset class, and industry sector levels.

The report is structured as follows:

- **Mercer Climate Change Model** is covered in *Section 3* and provides an introduction to climate change scenarios and an overview of the Mercer TRIP climate change risk factor framework, including the Mercer scenarios, the climate risk factors, and the asset class-specific TRIP factor sensitivity assumptions.
- **Climate Risk Assessment Results** are covered in *Section 4* and provide an overview of the modelling results for NYCERS under the three scenarios, and over two time periods (10 years and out to 2050).

[1] World Economic Forum. Global Risks 2017 http://reports.weforum.org/global-risks-2017/

[2] Note: the U.S. pledged to reduce its emissions by 26-28 percent below 2005 levels by 2025 as part of the Paris Agreement. While the US Federal Government has announced intention to withdrawal from this Agreement the pledge has now been adopted by the 'America's Pledge' and 'We're Still In' coalitions.

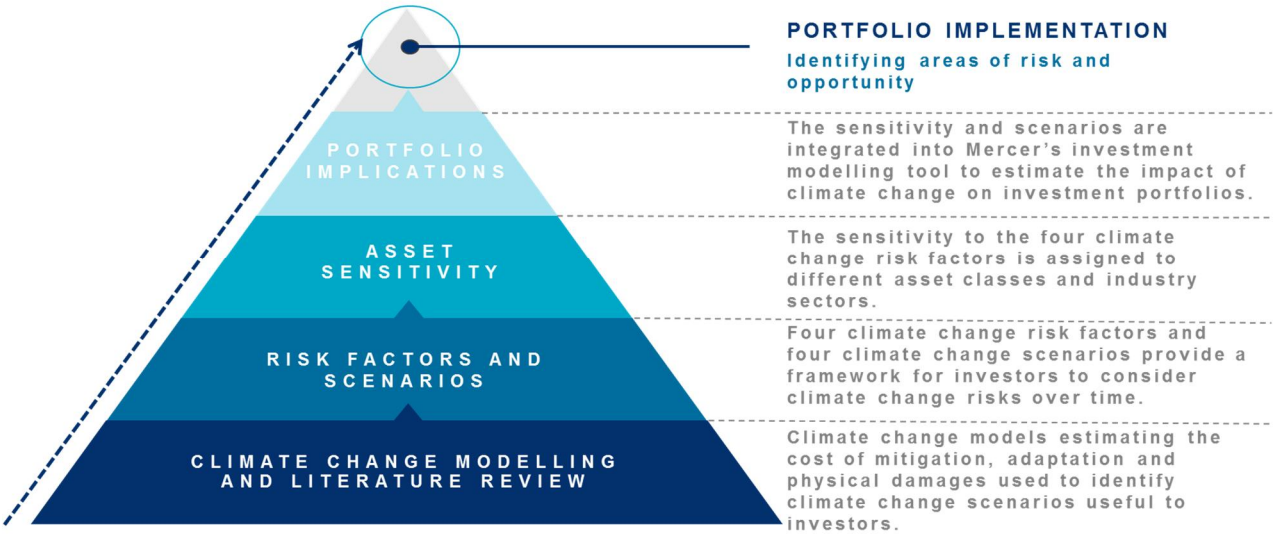
[3] Mercer's public report – *Investing in a Time of Climate Change* – provides a comprehensive review of Mercer's climate change risk modeling framework and related research: https://www.mercer.com/our-thinking/investing-in-a-time-of-climate-change.html

3

Mercer Climate Change Model

Mercer's approach encompasses 5 key stages to considering the risks of climate change on investment portfolios (as set out in the diagram below).

Figure 2: Mercer's climate change risk modeling process



Source: Mercer

Given the uncertainty and complexity of future developments with respect to climate change, we believe a scenario-based approach is optimal when considering the potential risks and opportunities.

The Tragedy of Horizons: A Challenge for Investors

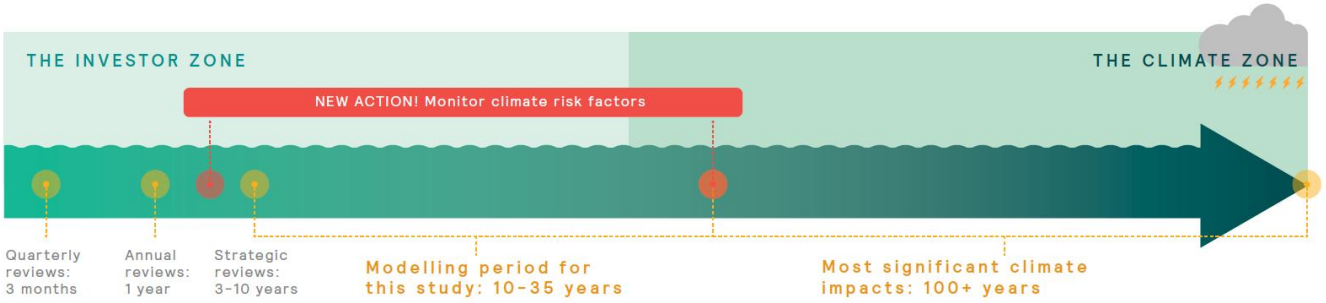
One of the key challenges for investors in considering the risks and opportunities posed by climate change is a disconnect in time-frames between investor portfolio management and climate change impacts – what Mark Carney has termed the "Tragedy of Horizons"[4]. Mercer's modelling of climate risks focuses on the timeframe out to 2050. This is very long term from an investment perspective; typically, strategic investment advice is based on a modelling period of 10 years and investment managers take investment decisions on a 3-5 year time-frame, or less. However, the physical impacts of climate change become increasingly apparent post-2050 and

[4] https://www.theguardian.com/environment/2015/sep/29/carney-warns-of-risks-from-climate-change-tragedy-of-the-horizon

climate models focus on 2100; some extending out to 2300 and beyond. 2050 is short-term from a climate change perspective.

In particular, the physical impacts of climate change; such as extreme weather events and sea level rises are expected to be relatively limited over the period to 2050. However, the further forward we look the greater the uncertainty in outcomes making it difficult to justify investment modelling beyond our 30+ year time-frame. Nevertheless the post-2050 implications should not be ignored.

Figure 3: Time-Frame Challenge



Source: Mercer

While there is notable disconnect between the time-frame of investment decision-making and that of climate change considerations, there are nearer-term actions that investors can take and signposts that investors can monitor to better understand future climate change-related developments.

This disconnect may diminish overtime. Financial markets have begun to appreciate that climate change is having an impact today—whether through extreme weather events, strengthening policy commitments (i.e. the Paris Agreement) or changes in capital allocation (i.e. to favor "climate solutions"). As evidence of this shift in perspective, the World Economic Forum's Global Risk Report 2017 shows that environmental risks have been rising steadily amongst the top-ranked risks in terms of likelihood and impact over a ten year horizon. Climate change is now viewed as one of the top trends expected to influence economic development over this relatively near-term time frame.

Certainly we anticipate that efforts such as the Financial Stability Board's Task Force on Climate-Related Financial Disclosures (TCFD) to develop climate change reporting standards will also assist the financial sector in better understanding how long-term impacts from climate change can have an impact on business strategy and investment decisions today. All of this being said, the extent to which markets are anticipating and pricing climate change risks and opportunities remains unknown and the signals to date from industry[5] and policymakers[6] have been mixed leading to substantial uncertainty around the eventual climate outcome to be

[5] http://www.cnbc.com/2016/12/12/global-coal-demand-will-barely-grow-through-2021-says-iea-report.html
[6] For instance, the Paris Agreement laid out a baseline goal of 2°C but country commitments going into Paris only amounted to an estimated 2.7°C outcome: http://newsroom.unfccc.int/unfccc-newsroom/indc-synthesis-report-press-release/

expected. One of the central drivers behind the creation of the Mercer model was that climate change may not be priced by markets (adequately or at all) and that current risk assessment and asset allocation modeling techniques may not provide an appropriate view of such risk necessitating a supplemental or overlay approach. On balance, evidence suggests the market is currently underpricing climate change risk:

- As per commentary above on the Tragedy of Horizons, short term pressures on market participants at various levels[7] may cause investors to miss longer term risks like climate change.
- There is very limited historical data on the impact of climate change on market returns.
- Research into behavioral economics indicates certain human biases which would suggest climate change is less likely to be priced by markets[8].
- Surveys suggest only a small minority of investors are actively considering climate change risk in their portfolios[9].
- The final, critical point, is that the future is uncertain – no one (including the market), knows exactly how transition and physical risks associated with climate change will unfold.

In light of the above, uncertainty exists as to the extent of potential market mispricing regarding climate change. On this basis, climate scenario results from the Mercer model are presented in comparison with a "base case" which employs the standard capital market assumptions provided by NYCERS' investment consultant with no explicit consideration of climate change risk. This base case could also be considered an "efficient market" scenario as it presumes climate change risk is otherwise embedded in the standard capital market assumptions and will be appropriately valued by markets. Generally speaking, more or less stock can be placed in the results of the base case or the Mercer climate scenarios depending on the view of the NYCERS board on market pricing of climate risk and which scenario is deemed most likely.

We believe the prospective scenario-based analysis described in the subsequent sections provides a unique and beneficial approach to climate change risk assessment for investors, although we acknowledge the various limitations to such an approach and expect the discipline of climate change investment risk modeling to evolve over time. These limitations are discussed in the following box, the Appendix of this document and prior research published by Mercer[10].

[7] See research catalogues at https://www.fcltglobal.org/ and http://www.tragedyofthehorizon.com/ for examples of the short term orientation of markets.

[8] See the collective works of Richard Thaler, Daniel Kahneman and Amos Tversky and the comprehensive list of cognitive biases identified in psychological and economic literature on Wikipedia. See also recent work by Andrew Lo on the Adaptive Markets Hypothesis, an attempt to marry behavioral economics with the efficient markets hypothesis.

[9] http://www.internationalinvestment.net/regions/europe/95-european-pension-funds-ignore-climate-change-impact-mercer/

[10] Mercer; Preparing Portfolios for Transformation; 2017

STRUCTURAL CHANGE: PAST PERFORMANCE IS NOT A GUIDE TO FUTURE PERFORMANCE

A particularly difficult task for investors is in identifying and managing structural changes. The greater the level of change, the more disparity between the winners and losers, and today's "giants" often become tomorrow's "dinosaurs", as those that fail to adapt are left behind. Such changes can create new industries at the expense of existing industries.

It remains very difficult to capture long-term forward-looking changes within quantitative investment modelling processes, and although we know that in practice long-term, economic patterns are not going to follow the same path as historical economic patterns, we have not sought to reflect all of these uncertain future structural changes within our investment modelling. Therefore:

- **Industry classification is based on today's definition:** We have not made allowance for new industries and/or any re-classification that would be expected as markets reflect the adaptation to a low carbon economy.
- **We have not attempted to forecast changes in the regional composition of global equity indices:** However, over the period modelled to 2050, we would expect certain nations currently classified as emerging markets to be re-classified to developed markets.
- **There is a "negative bias" to the TRIP factor heat maps (that is, more red than green), as a result of our analysis being based on a starting point of today:** We recognise that there will be opportunities created and that across different industries and regions there will be winners and losers, as some companies will adapt business models accordingly and others will not. Within industries and sectors there will continue to be different supply and demand drivers, including those industries where overall sensitivity may be neutral.

Mercer Climate Change Scenarios

Three scenarios, 2°C, 3°C and 4°C were developed, each reflecting different climate change policy ambitions that result in varying CO_2 emissions pathways, temperature outcomes and levels of economic damages related to climate change. These were developed using existing climate change integrated assessment models (IAMs) and through an extensive literature review.

These three scenarios were identified as collectively representing a reasonable range of potential outcomes and thereby useful for investors to consider climate change possibilities.

Figure 4: Climate change scenarios modelled

1. 2°C	
Ambitious and stringent climate change policy and mitigation action put the world on a path to limiting global warming to 2°C above pre-industrial temperatures by the end of this century.	
Climate perspective	This is the most ambitious of the four scenarios considered in this study in terms of climate policy but also the most contentious. This scenario serves as a critical benchmark: from a scientific perspective it increases the chance of avoiding dangerous climate change, with international climate policy supporting the transformation to a low carbon economy. However, some believe this scenario is already "off the table" as policy makers have not reacted quickly enough to date, with many pledges to reduce emissions not being met sufficiently. If transformation is to occur, time is certainly of the essence and ongoing reporting under the Paris Agreement and progress toward filling investment gaps will remain crucial signposts as to its likelihood.
Investor perspective	Where change is fast, near-term and significant, investors that have not considered the risks and opportunities posed by climate change action are likely to be caught off guard. A transformation scenario could cause significant shorter-term market volatility. Investors that have considered the risks and opportunities posed by climate change should be well positioned relative to those that have not considered such risks and would be expected to benefit from first-mover advantage relative to peers.

2. 3°C	
Climate change policy and mitigation actions are aligned and cohesive, keeping warming to 3°C above pre-industrial temperatures by the end of this century.	
Climate perspective	While not as ambitious as 2°C this scenario assumes a coordinated and well-defined policy response to reduce emissions by 2030.
Investor perspective	Where change is more measured and anticipated, investors have more time to react and position their portfolios accordingly. Early movers would be expected to benefit in the shorter term as the policy response becomes increasing apparent to the broader market. However, investors would need to be careful that policy transparency is not mistaken for adequacy in terms of the scale of ambition as this could cause investors to under-estimate the economic damages associated with the long-term physical impacts of climate change.

3. 4°C	
Limited climate action and lack of co-ordination result in warming rising to 4°C or above from pre-industrial temperatures by the end of this century. The physical impacts of this warming are felt more severely.	
Climate perspective	This scenario assumes a fragmented policy response (both by region and ambition) with limited additional action from policy agreements currently in place.
Investor perspective	If the policy response is disparate in terms of commitment and timing by region, an increased level of uncertainty is created for investors. In the shorter-term, a lack of policy action could lull investors into a false sense of security that it is business as usual, from a longer term perspective investors cannot afford to be complacent about structural economic change and emerging market policy. Those investors that have an increased understanding of the potentially divergent responses are likely to be better able to adapt their investment strategy by anticipating regional differences and

positioning their portfolios accordingly. Investors with exposure to investments expected to be most sensitive to the physical impacts of climate change should monitor the risks posed by climate change carefully (particularly where investments are illiquid).

While the 2°C scenario is an ambitious benchmark and could be seen as a "best-case" scenario from a climate change perspective, the 4°C scenario is by no means a "worst-case" scenario. While it is the least favorable (from a climate change perspective) of the scenarios considered in the study, it broadly equates to a temperature warming of 4°C and is consistent with business-as-usual emissions trajectories. Should countries renege on their commitments under Paris or if consumption increases faster than expected without offsetting efficiency gains, there is the potential for a more divergent and negative outcome to occur (resulting in a level of warming higher than 4°C).

UNDERSTANDING THE BUILDING BLOCKS OF THE CLIMATE CHANGE SCENARIOS

Mercer's climate change scenarios were developed with an understanding of the key concepts utilized in the wide body of scientific and economic literature to describe the various causes and effects of climate change. Several of these key terms are defined in the following list.

GREEN-HOUSE GAS (GHG) EMISSIONS: There is now wide spread scientific consensus that man-made GHG emissions are the dominant cause of the climate change observed over the past half century. Carbon dioxide (CO_2) is the most prevalent GHG and therefore CO_2 emissions are used as a proxy for GHG emissions more broadly. The level of atmospheric warming is directly related to the level of GHG emissions and so CO_2 emissions pathways are an indicator of the potential extent of warming.

LEVEL OF TEMPERATURE WARMING: The most common reference is the rise in temperature above pre-industrial levels. The Parties to the Paris Agreement have recognized the scientific evidence that limiting global warming to 2°C is required to avoid "dangerous" interference with the climate. If temperature increases exceed this level, the world starts to rapidly increase its risk exposure.

MITIGATION ACTIVITIES: Human intervention to limit climate change and the resulting impacts by reducing GHG emissions (e.g. through subsidies to increase the deployment of renewable energy) or increasing GHG 'sinks' (e.g. through afforestation). Mitigation refers to efforts to limit the cause of warming in the first place.

ADAPTATION ACTIVITIES: Protecting against the impacts of climate change (e.g. building flood walls). Adaptation refers to managing the warming that occurs by making changes in the physical landscape or improving the financial capacity of individuals or entities to withstand climate events.

MITIGATION VERSUS ADAPTATION: The greater investment made in mitigation activities today, the less investment will be required in adaptation activities in the future. The inverse unfortunately is not also true. While investment in adaptation today will improve resilience tomorrow, without some degree of mitigation the impact of climate change may overwhelm human adaptive capacity.

ECONOMIC DAMAGES: The level of economic damages caused by climate change based on how sensitive the climate and the economy are to future levels of CO_2 concentrations and/or efforts to abate them.

In order to consider the impact on investment returns and volatility under the different climate change scenarios, Mercer identified four climate change risk factors that can be used to translate each of the climate change scenarios (based on the outputs of the climate change modelling and literature review) into the language of investments. This allows us to build the climate change scenario pathways into the investment modelling tool.

Climate Change Investment Risk Factors

Mercer's modelling has built on Mercer's previous work to consider four climate change related investment risk factors: Technology, Resources, Impact of Physical Damages and Policy, together known as the "TRIP" factors, as outlined in the figure below. These risk factors are quantified on a relative scale of -1 to +1 for industry sectors and asset classes and indicate the relative sensitivity of these sectors and asset classes to each risk factor. The importance of these risk factors varies across scenarios. For a more detailed description of how these risk factors are modified across scenarios see the Appendix subsection *Future Pathways: Combining Scenarios and TRIP Risk Sensitivities*.

Figure 5: Mercer's TRIP climate change risk factors

TECHNOLOGY (T)

The rate of progress and investment in the development of technology to support the low carbon economy.

The Technology factor captures technological advancement and the opportunity for increased efficiency through technological change.

The speed, scale and success of low carbon technologies, coupled with the extent of transformation and disruption of existing sectors, or development of new sectors, are key considerations for investors.

RESOURCE AVAILABILITY (R)

The impact of chronic weather patterns (e.g. long-term changes in temperature or precipitation).

Resource availability is a new aspect being added to the previous Mercer study (in 2011[11]) to identify how changes to the physical environment might impact investments reliant on the use of resources, such as water and agricultural resources at risk of becoming scarcer or, in some cases, more abundant over the log-term as a result of changes to weather patterns. The impacts on agriculture, energy and water are key.

IMPACT OF PHYSICAL DAMAGES (I)

The physical impact of acute weather incidence (i.e. extreme or catastrophic events).

This factor can be interpreted as the economic impact of climate change on the physical environment caused largely by changes in the incidence and severity of extreme weather events.

Examples include damage to property caused by flooding as a result of sea level rises; damage caused by hurricanes and damage caused by wildfire.

POLICY (P)

Collectively refers to all international, national, and sub-national regulation (including legislation and targets) intended to reduce the risk of further man-made climate change.

This factor can be interpreted as the level of co-ordinated ambition of governments to adopt and adhere to policies and regulations to reduce greenhouse gas emissions. Examples of climate-related policy include greenhouse gas emissions targets, carbon pricing, subsidies and energy efficiency standards.

Policies can be classified into those that focus on the supply side (by encouraging the substitution of high emission products with lower emission alternatives) and those that focus on the demand side (by reducing demand for high emission products).

[11] Mercer, Climate Change Scenarios: Implications for Strategic Asset Allocation; 2011

Sensitivity to the climate change risk factors – industry sector level

Climate risk impacts are expected to be most pronounced at the industry sector (versus the asset class-level). As shown in the figure below, we have focused our attention on those industries we believe to be of most interest for investors: those that are expected to be the most sensitive (either positively or negatively) to climate change.

Figure 6: Sensitivity to the climate change risk factors: industry and sector level

INDUSTRY SECTOR	T	R	I	P
ENERGY	-0.25	-0.75	-0.75	-0.75
Oil	-0.50	-0.75	-0.75	-0.75
Gas	<0.25	-0.50	-0.75	<0.25
Coal	-0.50	-0.75	-0.75	-1.00
Renewable	0.50	-0.25	-0.25	1.00
Nuclear	0.50	-0.75	-0.25	0.50
UTILITIES	-0.25	-0.75	-0.50	-0.50
Electric	-0.50	-0.75	-0.50	-1.00
Gas	-0.25	-0.75	-0.25	-0.50
Multi	-0.25	-0.75	-0.50	-0.75
Water	-0.25	-0.50	-0.25	-0.75
MATERIALS	<0.25	-0.75	-0.25	-0.50
Metals and mining	<0.25	-0.75	-0.25	-0.75
INDUSTRIALS	<0.25	>-0.25	-0.50	-0.25
Transport and infrastructure	<0.25	>-0.25	-0.75	<0.25
CONSUMER DISCRETIONARY	0.00	0.00	0.00	>-0.25
CONSUMER STAPLES	0.00	-0.25	0.00	>-0.25
HEALTH	0.00	<0.25	<0.25	0.00
FINANCIALS	0.00	>-0.25	-0.50	0.00
IT	<0.25	0.00	0.00	0.00
TELECOMMUNICATIONS	0.00	0.00	>-0.25	0.00

Negative — Positive

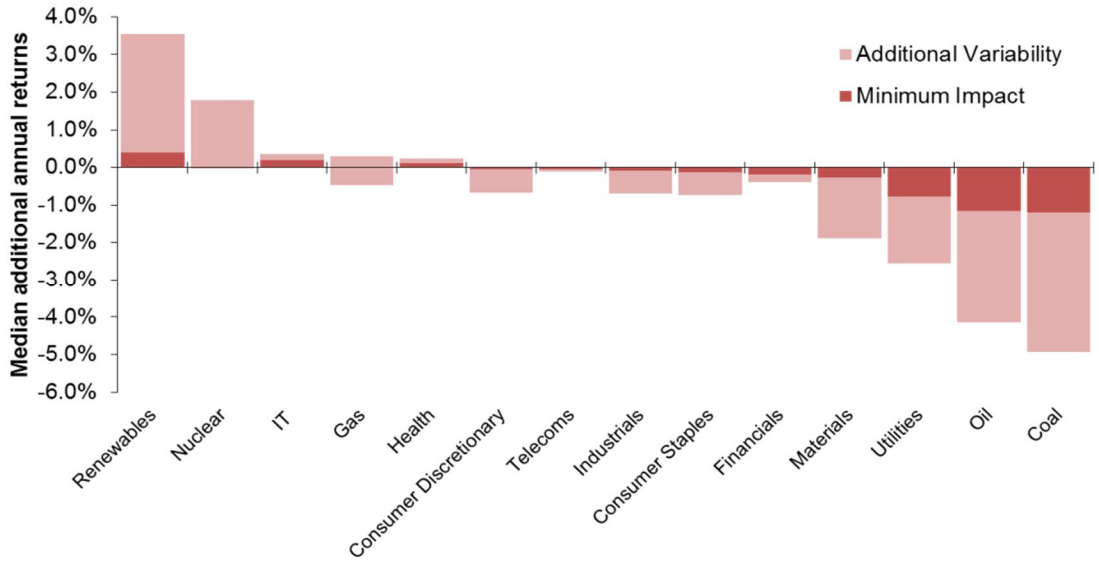
Key observations include:

- Policy is the most significant risk factor in terms of sensitivity. The industries expected to be most sensitive are energy and utilities and the sectors with the highest negative sensitivity to policy are coal, electric while renewables has the highest positive sensitivity.

- Energy and utilities have the greatest negative sensitivity to resource availability and physical impacts, with industrials also sensitive to physical impacts.
- Within each sector there will be “winners and losers” at a security level, including those sectors where overall sensitivity is expected to be neutral.

The figure below shows the potential climate impact on median annual returns for industry sectors from 2015 to 2050 across the four scenarios modelled. The range shows the minimum impact and the additional variability, to reach a maximum potential impact for each industry sector when climate considerations are included. These impacts should be considered in context as a percentage of the underlying expected returns, which range from 6-7% per annum. The energy sector is broken down into its sub-sectors, as one of the industries identified as most sensitive to TRIP risk factors.

Figure 7: Climate impact on return by industry sector (2015 to 2050)



Sensitivity to the Climate Change Risk Factors – Asset Class Level

The following figure identifies the assessed sensitivity of different asset classes to the TRIP factors. For public equities, Mercer's approach is to aggregate the sector exposure by region and consider any adjustments necessitated by considerations at a country level. For example, we would expect US, Australian as well as UK equities to be more sensitive to TRIP risk factors given their higher exposure to carbon-intensive sectors.

Figure 8: Sensitivity to the climate change risk factors: asset class level

ASSET CLASS	T	R	I	P
Developed Market Global Equity	<0.25	>-0.25	>-0.25	>-0.25
Emerging Market Global Equity	<0.25	-0.25	-0.50	<0.25
Low Volatility Equity	0.00	>-0.25	>-0.25	>-0.25
Small Cap Equity	<0.25	>-0.25	>-0.25	>-0.25
Developed Market Sovereign Bonds	0.00	0.00	0.00	0.00
Investment Grade Credit	<0.25	>-0.25	>-0.25	>-0.25
Multi Asset Credit	0.00	0.00	>-0.25	0.00
Emerging Market Debt	0.00	>-0.25	>-0.25	<0.25
High Yield Debt	0.00	>-0.25	>-0.25	>-0.25
Private Debt	0.00	0.00	0.00	0.00
Global Real Estate	<0.25	0.00	-0.75	<0.25
Private Equity	<0.25	>-0.25	-0.25	>-0.25
Infrastructure	0.25	>-0.25	-0.50	<0.25
Timber	<0.25	-0.75	-0.50	0.25
Agriculture	0.25	-1.00	-0.50	0.25
Hedge Funds	0.00	0.00	0.00	0.00

Negative — Positive

Key observations include:

- Growth assets, such as equities, are more sensitive to climate change than defensive assets, such as sovereign bonds.
- Global developed market equities are expected to have a negative sensitivity to policy and a positive sensitivity to technology. Emerging market equities are expected to benefit from additional climate change policy and technology developments, which should help to protect long-term sustainable economic growth in emerging markets.
- Real estate, agriculture and timberland have the greatest negative sensitivity to the impact of physical damages and resource availability. Agriculture and timberland are the most sensitive (positive) to policy while infrastructure and agriculture have the greatest positive sensitivity to technology.
- Within bonds, emerging market and high yield debt are the most sensitive to the risk factors.
- We do not expect private debt or hedge funds, in aggregate, to be sensitive to the risk factors.

4

Portfolio Climate Risk Assessment Results

For the purposes of this climate risk assessment we have modelled NYCERS' strategic asset allocation (SAA) as at December 31, 2016. The table below presents the SAA alongside each asset classes' assumed sensitivities to the climate change TRIP risk factors.

Figure 9: NYCERS Strategic Asset Allocation & TRIP Risk Factor Sensitivity Assumptions

ASSET CLASS	SAA	T	R	I	P
US LC Equity	26.8%	0.2	-0.2	-0.2	-0.2
US SC Equity	2.2%	0.22	-0.22	-0.22	-0.22
EAFE Equity	13.0%	0.2	-0.2	-0.2	-0.2
EM Equity	7.0%	0.2	-0.25	-0.5	0.1
Opportunistic RE	4.0%	0.1	0	-0.75	0.1
Core RE	5.0%	0.1	0	-0.75	0.1
Infrastructure	2.0%	0.25	-0.2	-0.5	0.1
PE	7.0%	0.2	-0.2	-0.25	-0.2
TIPS	4.0%	0	0	0	0
Opportunistic FI	5.0%	0	0	0	0
UST (Intermediate)	10.0%	0	0	0	0
IGC	3.5%	0.06	-0.06	-0.06	-0.06
MBS	3.5%	0.06	-0.06	-0.06	-0.06
High Yield FI	5.0%	0	-0.12	-0.15	-0.12
Bank Loans	2.0%	0	-0.12	-0.15	-0.12
TOTAL	100.0%				

Mercer has modelled the portfolio under a base case (zero TRIP risk factor impact) and the four climate change scenarios described in the prior chapter over two time periods – 10 years and to 2050.

For the purpose of this investment modelling, all results were produced using Callan's[12] capital market assumptions. Mercer's objective with this model is to understand and assess the relative directional potential impact of the TRIP climate risk factors on the risk and return profile for the

[12] http://www.callan.com

portfolio. Thus, although we show total portfolio expected returns under all scenarios (including the Base case where TRIP factors are not applied), we are most interested in how the risk-return metrics under each of the four climate scenarios compare relatively to the Base Case; that is, the climate 'TRIP' risk factor impact.

Climate 'TRIP' Impacts on Returns and Risk – Overall Portfolio

The following two figures present the total portfolio implications for the NYCERS portfolio. The return and risk impact estimates shown are based on two timeframes: 10-years and out to 2050. Ten-year return impacts may differ in relative terms from the impacts projected out to 2050 driven by the characteristics of each climate scenario (see Appendix subsection *Future Pathways: Combining Scenarios and TRIP Risk Sensitivities* for more detail).

Based on 10-year projections the 2°C and 4°C scenarios result in losses to the portfolio (given the current asset allocation); whereas a 3°C scenario would have a negligible impact on the portfolio's expected return and risk.

Based on projections out to 2050, the 2°C scenario still results in a loss to the portfolio, albeit diminished versus the 10-year result for the same scenario.

In the time horizons considered, the negative impact under a 2°C scenario is larger than the negative impact under a 4°C scenario. This relationship is expected to change in the 2nd half of the Century – as the physical impacts of climate change become more severe.

Figure 10: Portfolio Climate Risk Dashboard – 10 Year Results

Portfolio Results	Zero TRIP (Base Case)	2°C	3°C	4°C
Expected Return	6.85%	6.59%	6.85%	6.75%
Impact vs Base (bps)	-	-27	0	-10
Impact vs Base ($m)*	-	-$2,729	-$5	-$1,057
Standard Deviation	13.88%	14.06%	13.92%	13.91%
Reward to Risk	0.49	0.47	0.49	0.49

* Expected returns compounded linearly over 10 years for each portfolio; based on starting value of $56.9B.

Figure 11: Portfolio Climate Risk Dashboard – to 2050

Portfolio Results	Zero TRIP (Base Case)	2°C	3°C	4°C
Expected Return	6.85%	6.69%	6.82%	6.76%
Impact vs Base (bps)	-	-16	-3	-9
Impact vs Base ($m)*	-	-$27,250	-$5,580	-$16,517
Standard Deviation	13.88%	14.06%	13.93%	13.91%
Reward to Risk	0.49	0.48	0.49	0.49

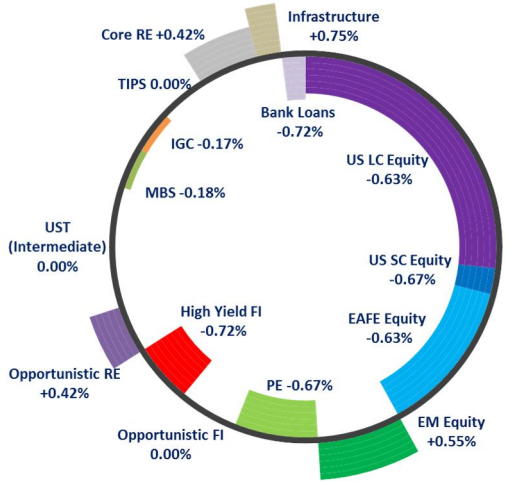
* Expected returns compounded linearly over 34 years for each portfolio; based on starting value of $56.9B.

The following circle charts represents the modelled NYCERS asset mix, with the width of each asset class section representing the respective percentage weighting. Asset class sections that may experience a reduction in returns under the specific scenario will move towards the center of the circle, and asset class sections that may experience additional returns will move outwards from the circle.

Investors should prioritize their actions for asset classes by those with the largest weightings and largest movements inwards or outwards from the black circle. Under the 2°C scenario, the System experiences positive returns from Real Assets and Emerging Markets, while Developed Markets Equity, including the US, as well as High Yield Debt and Private Equity detract from performance. In contrast, losses under the 4°C scenarios are concentrated in Real Assets and Emerging Markets.

Figure 12: Annual Portfolio and Asset Class Impacts – 2°C Scenario, 10 years and to 2050

Metric	Zero TRIP (Base Case)	2°C 10 years	Metric	Zero TRIP (Base Case)	2°C to 2050
Expected Return	6.85%	6.59%	Expected Return	6.85%	6.69%
Standard Deviation	13.88%	14.06%	Standard Deviation	13.88%	14.06%
Reward to Risk	0.49	0.47	Reward to Risk	0.49	0.48



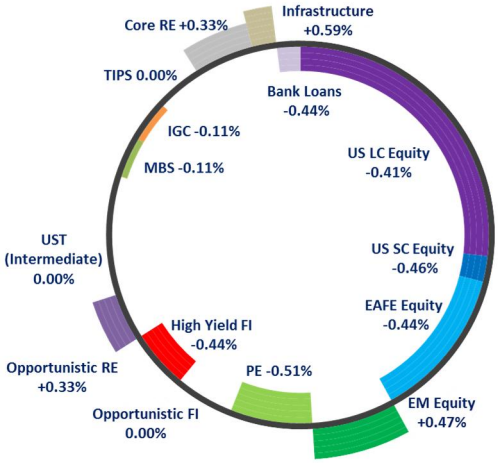
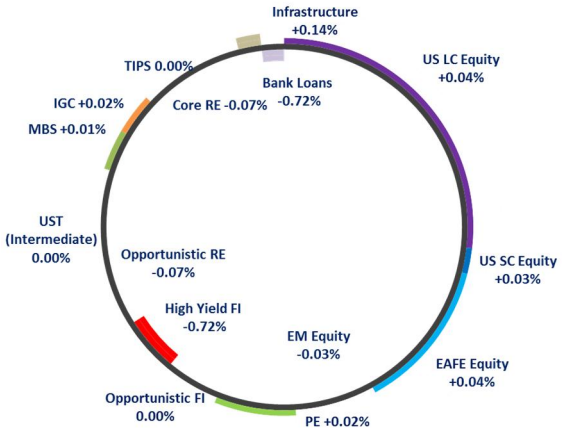


Figure 13: Annual Portfolio and Asset Class Impacts – 3°C Scenario, 10 years and to 2050

Metric	Zero TRIP (Base Case)	3°C 10 years	Metric	Zero TRIP (Base Case)	3°C to 2050
Expected Return	6.85%	6.85%	Expected Return	6.85%	6.82%
Standard Deviation	13.88%	13.92%	Standard Deviation	13.88%	13.93%
Reward to Risk	0.49	0.49	Reward to Risk	0.49	0.49



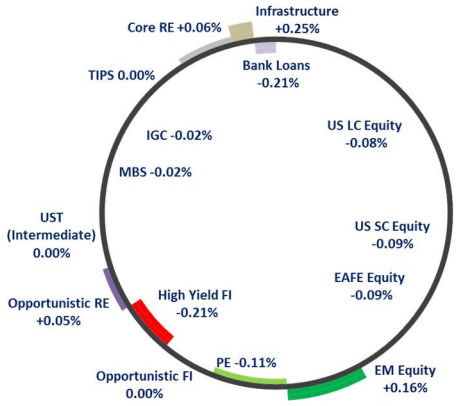
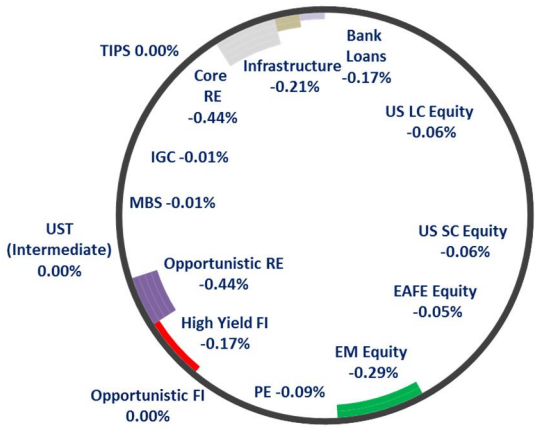
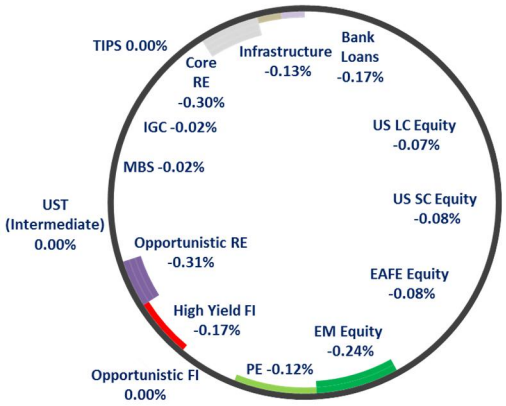


Figure 14: Annual Portfolio and Asset Class Impacts – 4°C Scenario, 10 years and to 2050

Metric	Zero TRIP (Base Case)	4°C 10 years	Metric	Zero TRIP (Base Case)	4°C to 2050
Expected Return	6.85%	6.75%	Expected Return	6.85%	6.76%
Standard Deviation	13.88%	13.91%	Standard Deviation	13.88%	13.91%
Reward to Risk	0.49	0.49	Reward to Risk	0.49	0.49

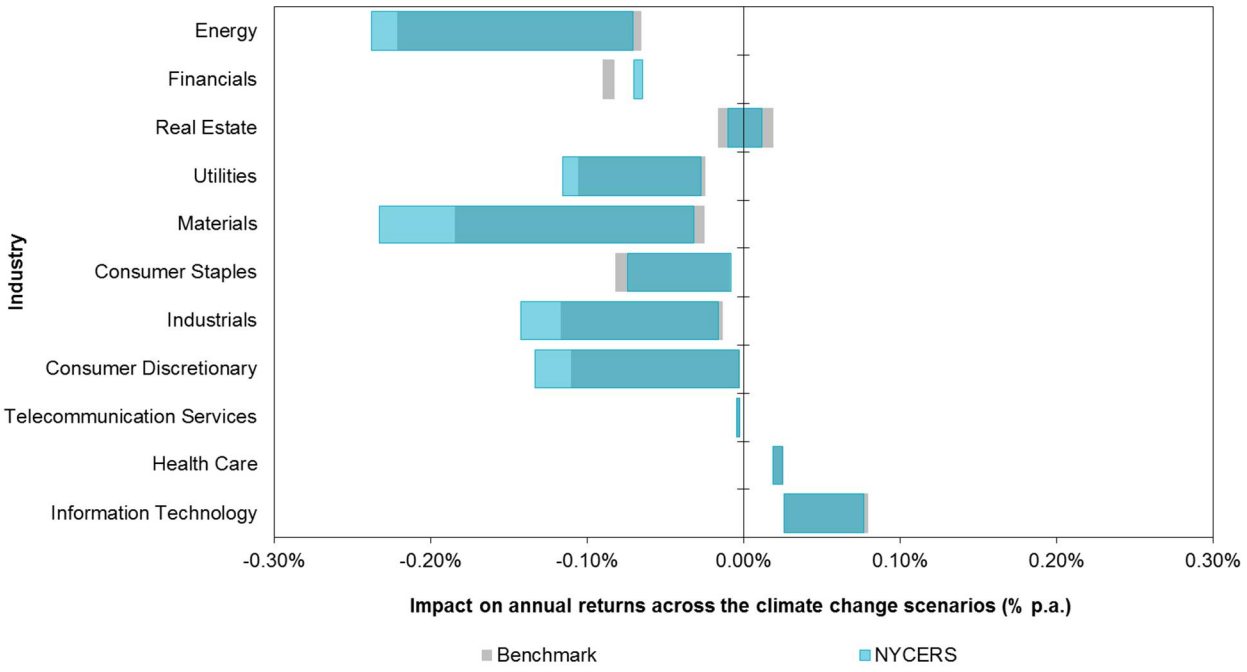




Climate Impacts – Sector Analysis for Actively Managed Strategies

The figure below demonstrates potential annual impact as a function of TRIP factor sensitivity over the next 10 years across climate change scenarios for the NYCERS actively managed equity portfolio**.** The width of the sector bars represent the range of climate change impacts across the scenarios modeled. To the extent the blue bars extend past the gray bars in either direction this represents a sector over or under weight in the portfolio.

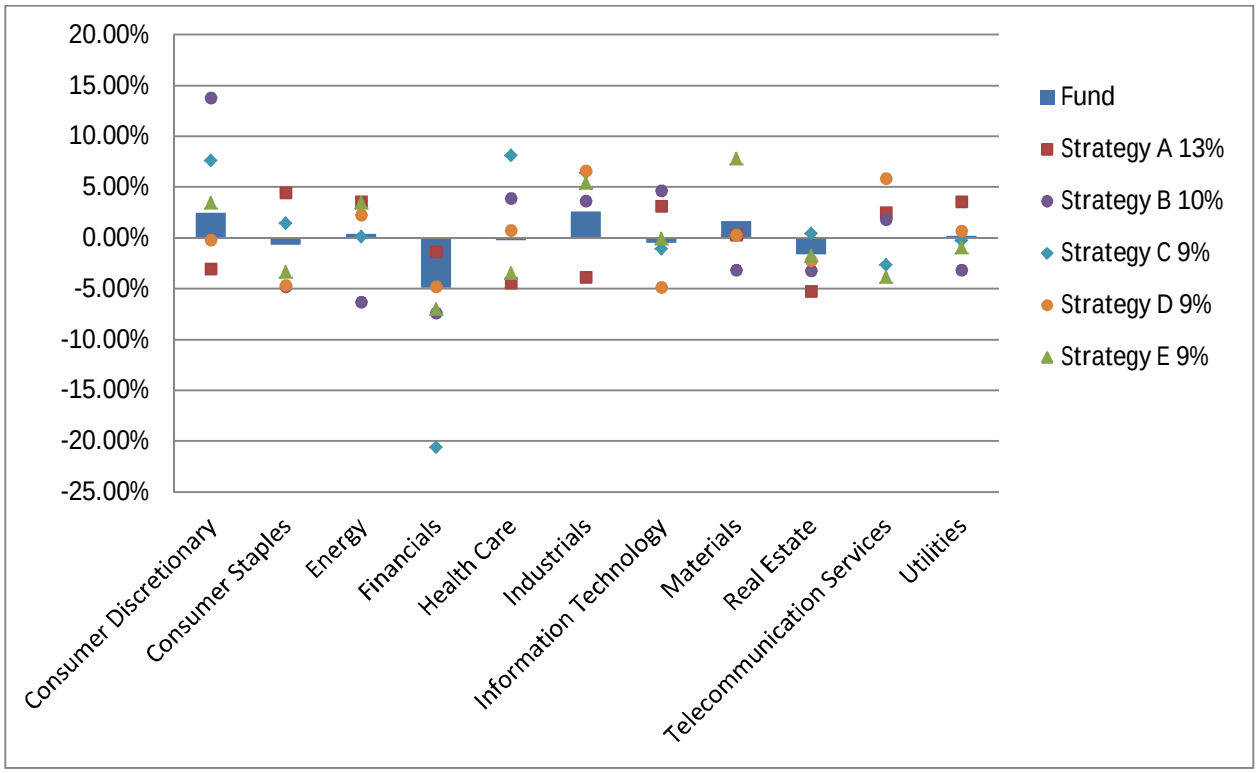
Figure 15: NYCERS Actively Managed Equity Sector Contribution to Portfolio Climate Change Risk



Overall, the System holds an overweight allocation to several sectors that could increase climate risk exposure, including energy, utilities, materials, and industrials. However, there are climate solutions present in the energy and industrials sectors, which could assist these sectors in offsetting climate risk exposure. As an industry overall, information technology is likely to aid annual returns across climate change scenarios, and NYCERS is closely aligned with benchmark exposure, indicating an ability to capture potential positive TRIP return impact.

The chart below displays the System's aggregate equity over and underweights in the various industries relative to each strategy's benchmark and weight in the fund. The bar values are relative to a composite benchmark that incorporates all benchmarks used in the fund as well as the appropriate weight relative to the strategy weights. The top 5 equity strategies in the fund, by allocation relative to equity sector exposure, are dotted to display their individual over and underweights relative to their own benchmarks. This chart displays that Manager A's strategy accounts for 13% of the NYCERS pension active equity sector exposure, and further, the top 5 strategies in the fund account for 50% of the pension's active equity sector exposure.

Figure 16: NYCERS Top 5 Actively Managed Equity Strategies – Sector Analysis



The pension's actively managed assets favor fixed income (57%) over equity (43%); however the vast majority of NYCERS' industry exposure (72%) comes from equity, while only 28% of the System's industry exposure comes from fixed income strategies[13]. In contrast to equities, the fixed income sleeve of the fund provides more exposure to sectors such as government-related, Treasury, and Agencies (particularly US securities). Most developed market government bonds (including the US) are expected to have limited climate change risk exposure. We did attempt to assess the sector exposure of the corporate bonds in the NYCERS portfolio, however due to a lack of underlying detail below the Industrials classification (which includes nine industry sub-classifications, including Energy, and constitutes the lion's share of NYCERS corporate bond holdings) makes drawing strong conclusions difficult.

[13] Given the fixed income exposure to US Treasuries and other non-corporate issuances.

5

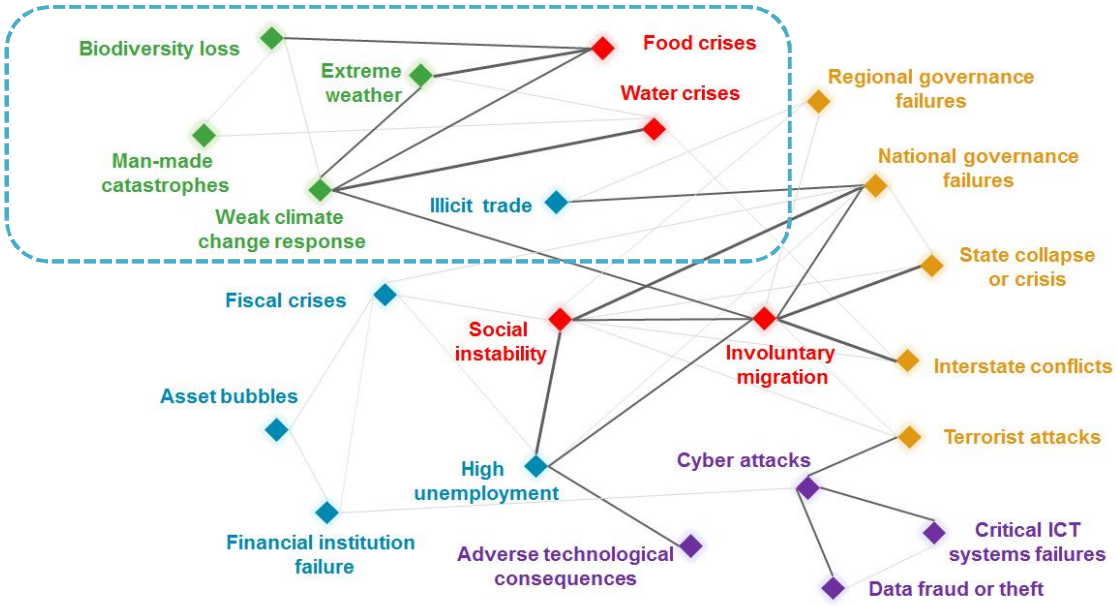
APPENDIX: Mercer Climate Change Model – Additional Detail

While climate change as caused by human activities is an established scientific fact, there remains uncertainty around how climate change will develop and questions prevail, including:

- What level of temperature increase is the world heading for and how sensitive is the climate to greenhouse gas emissions (GHGs)? What are the implications for weather patterns, food and water security and global demographics?
- Will a global climate change agreement have a material impact on efforts to reduce GHGs? What impact will climate-related policies and regulations have on who the winners and losers will be across different industries and sectors?
- Will science and technology developments offer solutions? How quickly can economies adapt?
- How will geopolitical relations develop? What will a model for sustainable growth look like?

The complex world between future global economic development and climate change is an extremely difficult minefield to navigate. The following figure shows the magnitude and degree of interconnection between certain risks as identified by the World Economic Forum's Global Risk Report 2017 with the risks most related to climate change encircled.

Figure 17: Global Risk Landscape 2017



Note: Global Risk Perceptions Survey (745 responses worldwide): Respondents were asked to identify three to six pairs of the most strongly connected global risks. Thickness of connecting lines corresponds to citation frequency.
Source: World Economic Forum, *Global Risks Report 2017*

Many of the global risks are influenced by climate change and the degree and magnitude of their combined effect on the global economy – and by extension on investment returns – is important for long-term investors to understand. To help, we have used scenario analysis and adapted Mercer's prospective investment modelling tool to consider some of the potential future climate change pathways, the impact these may have from an economic perspective and the implications for investors.

The "Well Below 2°C" Target

The target agreed to in the Paris Agreement is to keep a global temperature rise well below 2°C this century, relative to pre-industrial levels, and to strive for 1.5 degrees Celsius.

How warm can we go? The significance of 2˚C…

While those in the field of climate science and climate policy are as familiar with the notion of a *2°C world* as investors are with risk and return, the concept of temperature pathways, driven by carbon emission trajectories and climate sensitivity is unfamiliar to many investors. So why is 2°C considered the benchmark for climate policy makers?

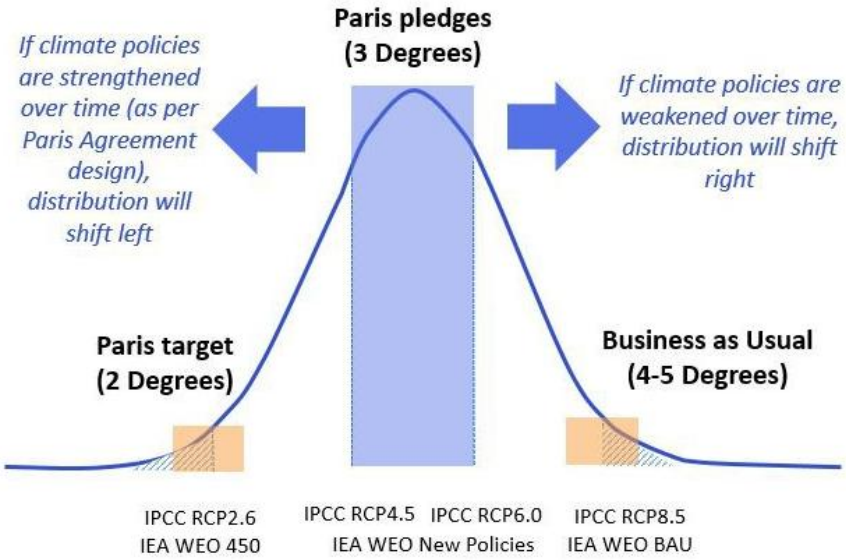
A 2°C rise in average global temperatures, from pre-industrial levels to 2100, has been identified by climate scientists as the limit to avoid "dangerous" interference with the climate system. It is currently estimated that there has already been a 1.0°C increase and that a 1.5°C rise is 'baked in' to the system, and cannot be avoided, regardless of changes we make now. Sources: World Bank, 2014; NASA, 2016

The national pledges (NDCs) made by governments leading up to and following the Paris Agreement fall short of the long term commitment. It is estimated that, based on current NDCs we would have a 50% chance of temperature rise of 3.2°C or more, relative to pre-industrial levels by 2100[14]. The Paris Agreement has a five year review cycle, under which pledges will need to ratchet up over time, with countries re-submitting every 5 years. CICERO[15] describes a 2°C pathway as a lower probability scenario with uncertainties regarding the ability to reach the targets, and the reliance on negative-emission technology. A 3°C scenario (in line with current NDCs) is considered more probable.

[14] Carbon Action Tracker, based on NDCs as at November 1, 2017 http://climateactiontracker.org/global.html

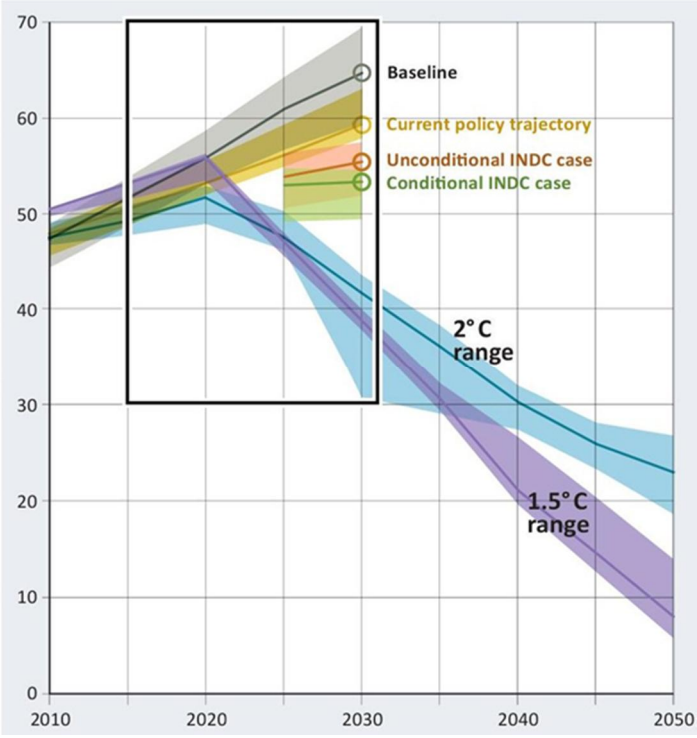
[15] CICERO is a Norwegian institute for climate change research. http://cicero.uio.no/en/CF-scenarios-and-shades

Figure 18: CICERO Probability Distribution of Climate Change Scenarios



Thus, we still need significant ramp-up of commitment and action to reach the Paris Agreement target of 2°C or the aspirational goal of warming of no more than 1.5°C.

Figure 19: Annual Global Total Greenhouse Gas Emissions (GtCO2e) [16]



The figure to the left from the United Nations Environment Program (UNEP) Emissions Gap Report 2016 shows the potential trajectories of annual total global greenhouse gas emissions under various scenarios. This visually shows how significantly the trajectory of emissions needs to change in order to meet the Paris Agreement target.

The blue area shows pathways limiting global temperature increase to below 2°C by 2100 with > 66% chance.

The purple area shows pathways limiting global temperature increase to below 1.5°C by 2100 with > 50% chance.

Source: UNEP Emissions Gap Report, 2016

[16] UNEP Emissions Gap Report, 2016 http://www.unep.org/emissionsgap/

Climate Change Signposts for Investors

By considering the climate change scenarios through the lens of our climate change risk factors, we are able to highlight signposts that investors can monitor in order to be prepared for changes that may occur as a result of climate change. We have focused on the following elements; each represented by our TRIP factors, that we believe are important signposts for investors:

- The timeframe of CO_2 emissions peaking, potential changes to the energy mix out to 2050 and modelled mitigation cost estimates
- The rate of investment required in technologies designed to facilitate the transition to a low carbon economy
- Potential shifts in long-term weather patterns and resultant economic impacts as a result of global warming
- Potential shifts in the level of economic damages caused by shifts in the frequency and/or severity of catastrophic weather events, such as floods and hurricanes.

The figure below outlines the investor signposts under each of the scenarios by risk factor. Development against these signposts will allow investors to consider the likelihood of different climate change scenarios as additional evidence is presented.

Overall, the highest climate change risk factor impact over the period to 2050 is that of Policy under the 2°C scenario. Under both the 2°C and 3°C scenarios, Policy and Technology are dominant relative to Resource Availability and Impact of Physical Damages given the physical impacts of climate change become increasingly apparent post 2050. For the 4°C scenario, Resource Availability and Impact (Physical Damages) are more apparent and are not dominated by Policy and Technology developments, which are expected to be limited.

Figure 20: Key signposts for investors by climate change scenario (to 2050)

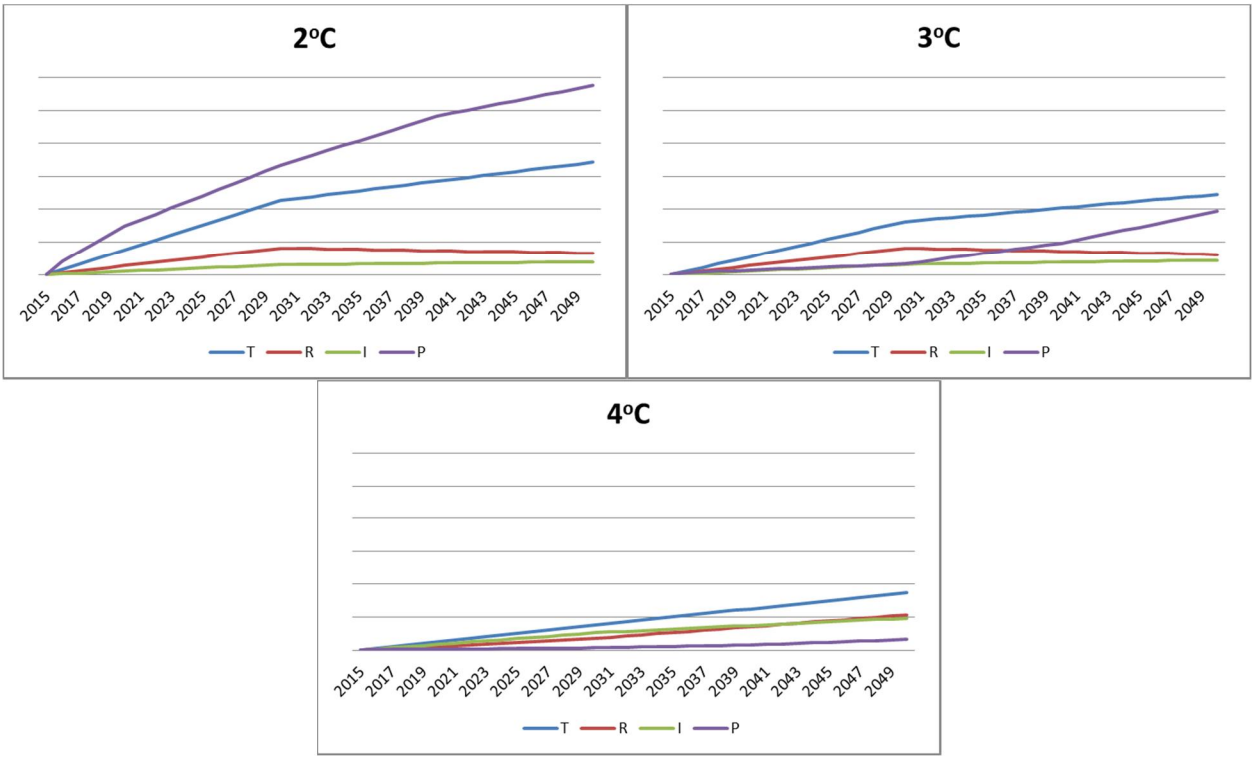
SIGNPOST FOR INVESTORS		2°C	3°C	4°C
Potential changes to the energy mix	T	Significant change to the energy mix: fossil fuels represent less than half of the energy mix at 2050.	Fossil fuels represent c.75% of the energy mix at 2050.	Fossil fuels continue to be the dominant energy source, representing 85% of the energy mix at 2050.
Rate of investment in technologies supporting the low carbon economy	T	Cumulative investment of US$65 trillion in energy supply and efficiency (ex-fossil fuels) required over 2015–2050.	Cumulative investment of US$47 trillion in energy supply and efficiency (ex-fossil fuels) required over 2015–2050.	Total energy investments increase to US$3.13 trillion in 2050. Limited investment into low carbon energy
Potential shifts in long-term weather patterns and impact on resource availability	R	Limited impact by 2050.	Limited impact by 2050.	Estimated net loss from resource availability as a percentage of global GDP of 0.8% at 2050. Driven by losses due to energy, water, and biodiversity.
The level of physical damages caused by catastrophic events, such as floods and hurricanes	I	Limited impact by 2050; driven by losses from (extra) tropical storms and coastal flood.	Limited impact by 2050; driven by losses from (extra) tropical storms and coastal flood.	Estimated net loss as a percentage of global GDP of 0.7% at 2050. Primarily represents losses from wildfire, coastal flood, and extreme temperatures.
Global policy response	P	Most effective from a climate change mitigation perspective, Aggressive introduction of carbon pricing, and related policy / regulation, likely to result in shock to financial markets.	Existing policy pledges with respect to carbon emissions are implemented with mitigation efforts extended to 2030.	Divergent with limited efforts beyond existing pledges. Although a reduction in emissions of 10% (versus 2010 levels) is achieved by 2050 in developed markets, this is outweighed by increases in emissions in emerging markets.
Expected cost of carbon ($US2013/t CO2)	P	Global carbon pricing introduced relatively swiftly, then flattening out to around $180 by 2050.	Global carbon pricing introduced more slowly, picking up pace after 2030 and reaching $210 in 2050.	Lack of development of a global carbon price recognized by the market.
Global greenhouse gas emissions at 2050[17]	P	22 Gt CO_2e/yr. 56% decrease vs. 2010 levels.	37 Gt CO_2e/yr. 27% decrease vs. 2010 levels	67 Gt CO_2e/yr. 33% increase vs. 2010 levels
Timeframe for emissions level peaking	P	Emissions peak by 2020.	Emissions peak by 2030.	Emissions peak after 2040.

[17] CO_2e, stands for carbon dioxide equivalent. It expresses the impact of different greenhouse gases in terms of the equivalent amount of CO2 that would create the same amount of warming. This enables a carbon footprint consisting of lots of different greenhouse gases to be expressed as a single number.

Future Pathways: Combining Scenarios and TRIP Risk Sensitivities

The figure below indicates the pathways modelled for the climate change risk factors under each of the climate change scenarios. The pathways are a translation of the scenarios developed (using the climate change Integrated Assessment Models (IAMs) and literature review) into Mercer's investment modelling process. They show the relative magnitude of the climate change risk factors to each other under the four different scenarios over time.

Figure 21: Pathways of the Climate Change TRIP risk factors to 2050 by Scenario



2°C Scenario

- Under the 2°C scenario, the dominant climate change risk factor impact is Policy. Investment flows into the low-carbon economy – as indicated through the Technology risk factor – are also sizeable. Policy is clearly connected to the role of Technology. The two factors are fairly well linked with technology investment flows and are expected to correlate to a large degree with the extent of policy interventions, but there may be a decoupling in the future where successful new technology is less reliant on policy settings.
- Resource Availability and Impact (physical damages) have some influence, but the impact is limited for the timeframe of the study. Physical damages are expected to be greater beyond 2050.

3°C Scenario

- Policy action is limited under the 3°C scenario. Despite the lack of policy intervention, technology innovation attracts investment flows. As such, the Technology risk factor is the

most significant climate risk factor under the 3°C scenario. Policy interventions begin to increase towards the end of the projection period.

- Similar to 2°C, Policy and Technology are dominant relative to Resource Availability and Impact (physical damages).

4°C Scenario

- The Technology and Policy pathways are relatively low for this scenario versus the others. The primary difference between relates to the level of expected weather effects, which is represented by changes in the two climate change risk factors associated with the physical impacts of climate change:
    - Resource Availability (the impact on resources, such as water, as a result of changes in long-term weather patterns), and
    - Impact of physical damages (the impact of catastrophes such as flooding caused by sea level rises).
- The Resource Availability pathway rises more slowly between 2015 and 2030 (recognizing that agricultural gains in some regions will offset losses during this period), but then rises steeply after 2030 in recognition of growing resource challenges under this emissions trajectory and using a more severe damage function (DICE). In the 2oC and 3°C scenarios the Resource Availability pathway rises to 2030, but then plateaus and declines as potential economic resource gains from climate change begin to fall. It would be expected to rise again over time as expected economic gains switch to losses.

6

Important Notices

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

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Resolution Regarding NYC Pension Funds Divestment and Exclusion Strategy for Fossil Fuel Reserve Owners submitted by Mayor Bill de Blasio & Comptroller Scott Stringer

Resolution Regarding NYC Pension Funds Divestment and Exclusion Strategy for Fossil Fuel Reserve Owners

Submitted by Mayor Bill de Blasio & Comptroller Scott Stringer

January 2018 Common Investment Meeting

WHEREAS, the issue of climate change is already having and will continue to have a profound impact on our society and economy; current and future changes in risk, regulations, and attitudes towards the use of fossil fuels should be taken into account as we evaluate our investment portfolio; and

WHEREAS, it is important for us as fiduciaries to consider the various ways that we should assess and mitigate the risks that different sectors and industries have from the impacts of climate change, the long-term transition to a less carbon-intensive economy, and the potential for fossil fuel reserves and companies to lose a substantial portion of their value; and

WHEREAS, the Board has taken action to address the risks of climate change for our portfolio, including integrating environmental, social and governance (ESG) factors in investment decisions and taking leadership in actively engaging portfolio companies to reduce their carbon footprint; and

WHEREAS, the Board has completed a carbon footprint analysis of our public equity assets, an assessment of potential climate change investment risks to our portfolio, and a review of approaches to integrating climate change risks and opportunities in our asset allocation, manager selection and risk management; and these assessments and reviews have demonstrated that it would be in the interests of the System and its beneficiaries to consider additional prudent investment actions that protect our portfolio from potential impacts of climate change and prepare it for a transition to a low-carbon economy; and

BE IT RESOLVED, that the Board will initiate a process for determining a prudent divestment and exclusion strategy for fossil fuel reserve owners that responsibly reduces our portfolio's exposure to carbon risk and mitigates financial risks resulting from climate change, consistent with our fiduciary duty; and

BE IT RESOLVED, that in order to protect the long-term interests of our beneficiaries and determine the most efficacious way to safeguard our portfolio from the economic risks of climate change, the Board will utilize an investment consultant to assist the Board in determining prudent steps to divest and exclude from our portfolio the securities issued by fossil fuel reserve owners including evaluating the anticipated impacts on risk and return characteristics of the portfolio, and seek legal opinion to determine whether any divestment plan and actions by the Board fulfills the Board's fiduciary duty to beneficiaries.