

**INVESTING IN A TIME OF CLIMATE  
CHANGE**  
NEW YORK STATE COMMON RETIREMENT  
FUND (NYSCRF)  
PORTFOLIO CLIMATE RISK ASSESSMENT  
SEPTEMBER, 2015

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## EXECUTIVE SUMMARY

NYSCRF has recently partnered with Mercer and 17 other participants in a research study (“the Study”) to gain further insights into the investment implications of climate change. The timing is no coincidence: 2015 is a critical year, with global governments meeting in Paris in December to negotiate a new global climate change agreement.

Climate change is an environmental, social and economic risk, expected to have its greatest physical impact in the long term. But to address it, and avoid dangerous temperature increases, policy action is needed now. The extent to which this action will occur is an open question.

To seek to quantify the risks and opportunities which arise in a time of climate change, and appropriate actions as a result of them, the Study has brought together a cross-section of the global investment industry including asset owners, investment managers, insurance companies and private banking firms. The Study also benefitted from the input of an advisory group composed of renowned experts in the fields of investment and climate finance. Appendix A provides a list of participants.

The public report – *Investing in a Time of Climate Change* – provides a comprehensive review of the Study’s research, methodology and findings. This tailored report includes a short overview of the research methodology, but is focused on the key findings and implications for NYSCRF.

### NYSCRF – ACTIONS AND MOTIVATIONS

NYSCRF has already taken a number of steps in developing its approach to the management of environmental, social and governance (ESG) risks and opportunities outlined in the Recommendations for NYSCRF section. The organization’s motivations for joining this Study were to:

- Gain a broader understanding of climate risk and opportunity, and how these interact with the asset classes and sectors to which NYSCRF has exposure;
- Determine the appropriate positioning for NYSCRF’s investment portfolio in relation to climate change by identifying relevant risks and opportunities;
- Develop a series of specific steps which NYSCRF can take to evolve its investment approach in the context of climate change in order to optimize risk-adjusted returns for members over the long term.

## KEY FINDINGS FOR NYSCRF

This report provides the estimated return implications under the four climate scenarios and four climate risk factors, modelled between 2015 and 2050, with commentary on the specific implications for NYSCRF. The return estimates developed as part of this research apply at the total portfolio, asset class and industry sector levels.

Key findings for or NYSCRF based upon the analysis described herein follow:

### 1. NYSCRF's Equity portfolio would be most negatively impacted by a Transformation outcome.

NYSCRF's equity allocations heavily favor developed markets which are expected to suffer most in the event of swift/strong policy action such as envisioned under the Transformation scenario. Such exposures include Developed Market Equity, US Equity, Small Cap Equity and Private Equity and represent 59.25% of NYSCRF's total asset allocation.

### 2. The impact of climate change on the total portfolio is potentially significant

After assessing the aggregate impact of the TRIP factors under each climate scenario on NYSCRF's total portfolio we find it would be reasonably well insulated from loss under a Coordination scenario and only moderately impacted under the Fragmentation scenarios. However it would be quite vulnerable under a Transformation scenario – particularly over the coming decade – where the Fund could see a -0.35% per annum (p.a.) impact on median returns. For \$183.5 billion in assets invested in 2015 this relates to a cumulative loss of approximately \$12 billion by 2025.

### 3. The Fund's active equity managers have only slightly less exposure than a custom benchmark<sup>1</sup> to the industry sectors expected to be the most negatively impacted by climate change: Energy and Utilities.

The slightly lower exposure of active equity managers to Energy and Utilities appears to be the result mainly of reactions to energy commodity market shifts (e.g. the price of oil) occurring in late 2014. While this is potentially a positive from a climate risk management perspective, the motivations underlying this reallocation by active equity managers should first be understood to ensure active equity managers appreciate and address NYSCRF's own view of short term climate policy risk. Further discussions with active equity managers to better understand their positions with respect to climate change risk may thus be warranted.

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<sup>1</sup> 75% Russell 3000 and 25% Russell Global ex US

## RECOMMENDATIONS FOR NYSCRF

The Study recommends integrating climate considerations to achieve sustainable growth by following a holistic and thoughtful Beliefs, Policy, Process and Portfolio framework. This report captures which of the study's recommendations for action have already been addressed by NYSCRF and where, given the findings, NYSCRF could focus its attention next.

We recommend NYSCRF do the following:

### Operational Activities

- **Develop its own house view of climate change risk** based on the results of this study and other climate risk assessment efforts underway or being contemplated. The scenario or combination of scenarios used for planning purposes will influence risk management decisions and determine NYSCRF's role as a Future Taker or Future Maker
- **Continue to collaborate across departments and asset classes** to embed climate change risk management practices throughout the organization.
- **Develop a holistic climate change risk management strategy** which reflects its own view of risk and outlines work plan for future one-time and ongoing activities.
- **Address resourcing needs** to ensure appropriate execution of climate change strategy.

### Strategy Implementation

- **Finalize its ESG investment beliefs** with inclusion of appropriate references to NYSCRF's own view of ESG risk/return and climate change risk.
- **Revise its investment policy document(s)** to reflect these beliefs, including specific reference to the future management of climate risk throughout the Fund's investment process.
- **Undertake carbon footprinting analysis** of public equities and extend, over time, such analysis to other asset classes as carbon data improves. The carbon footprinting will provide a baseline measure with which to assess and adjust, as appropriate, the various measures employed to address carbon risk (e.g. assess the extent to which carbon intensity of the equity portfolio is reducing over time). Over time, NYSCRF could consider to what extent the results of the carbon footprint analysis could be made available publicly.
- **Assess the climate risk exposure of its Real Asset and Real Estate portfolios** through undertaking a geographic climate risk assessment of key assets (either directly and/or in conjunction with external manager(s)/consultants).
- **Use the results of this Mercer TRIP analysis** in conjunction with any carbon footprint assessment, real estate/real asset climate risk assessment and strategy-level ESG ratings/assessments to work with investment managers to ensure they are undertaking appropriate ESG and climate due diligence as part of their investment and voting/engagement processes. This will enable richer discussions with managers and ensure over the long-term their view of climate risk aligns with NYSCRF's.

- **Update NYSCRF's engagement strategy** with clear objectives focused on gaining clarity regarding the 2°C business plans of underlying company holdings (whether via passive/active managers and/or direct engagement by NYSCRF) and investment managers.
- **Confirm accountabilities and performance targets** amongst the investment team for development and implementation of an integrated climate change strategy.
- **Develop a strategy for communicating** NYSCRF's climate change strategy internally, to managers and to the public, with consideration given to the resource requirements to support such efforts.
- **Examine Public and Private Equity portfolio and consider multiple angles for risk reduction/opportunity capture** such as reallocating a portion of passive exposures towards lower-carbon indices, allocating a portion of active equities towards thematic manager(s) focused on sustainability and/or low-carbon investments, gaining additional exposure to Emerging Market Equity (public or private), which is expected to be positively impacted under a Transformation scenario, or taking other steps to diversify growth assets.

New York State Comptroller Thomas P. DiNapoli is the administrative head of the New York State and Local Retirement System (NYSLRS) and the Trustee of the New York State Common Retirement Fund (Fund or NYSCRF), a statutorily created trust that holds NYSLRS' assets. As Trustee, the Comptroller has a fiduciary duty to invest those assets prudently and for the exclusive benefit of the more than one million members, retirees and beneficiaries of NYSLRS. This report contains a number of recommendations pertaining to NYSCRF investments. As is the case with any recommendation relating to the NYSLRS' assets, each decision regarding potential implementation of Mercer's recommendations is subject to the exercise of the Comptroller's duties as a fiduciary.

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## STUDY SYNOPSIS

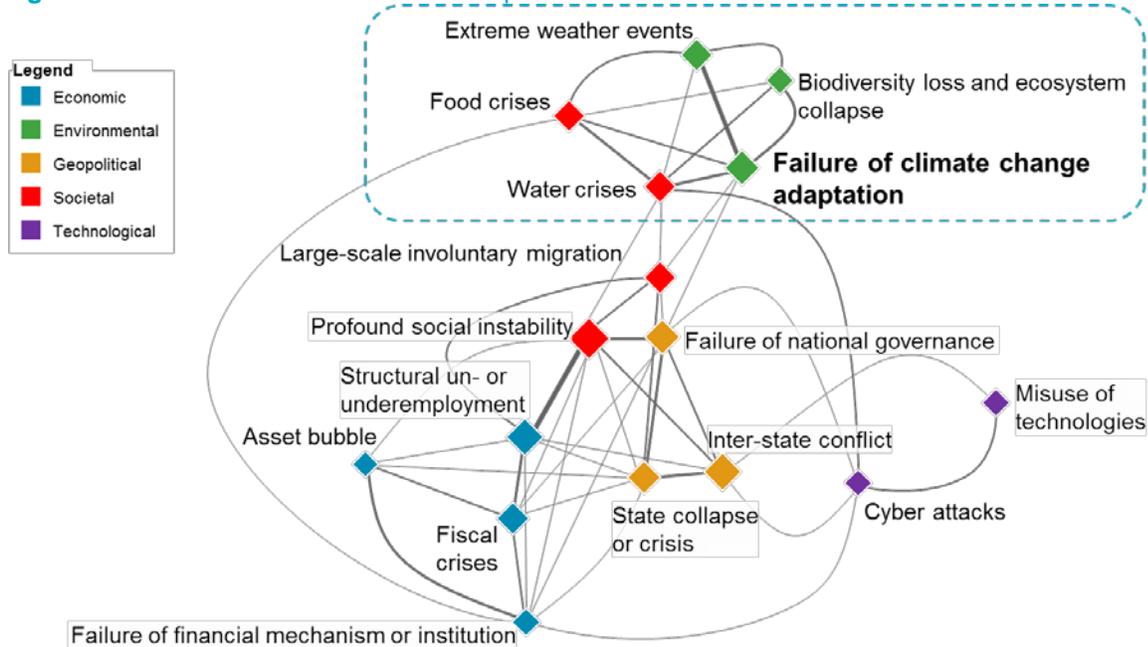
### AN INTERCONNECTED WORLD: CLIMATE CHANGE IS AN INVESTMENT ISSUE

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 GHGs? What are the implications for weather patterns, food and water security and global demographics?
- Will a global climate change agreement be reached in 2015? If not, who will the winners and losers be? Can society mitigate the risks in time?
- Will science and technology developments offer solutions? How quickly can we 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. Figure 1 shows the magnitude and degree of interconnection between certain risks as identified by the World Economic Forum's Global Risk Report 2015. All of these pressing 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.

Figure 1: Global Risk Interconnections Map



Source: World Economic Forum, Global Risks Report 2015

## TIME-FRAME DISCONNECT: A CHALLENGE FOR INVESTORS

One of the key challenges for investors in considering the risks and opportunities posed by climate change is the disconnect in time-frame between investor portfolio management and climate change impacts. Mercer’s study focuses on a 35 year timeframe from 2015 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, climate change impacts become increasingly apparent post 2050 and climate models focus on 2100; extending out to 2300 and beyond. 2050 is short-term from a climate change perspective.

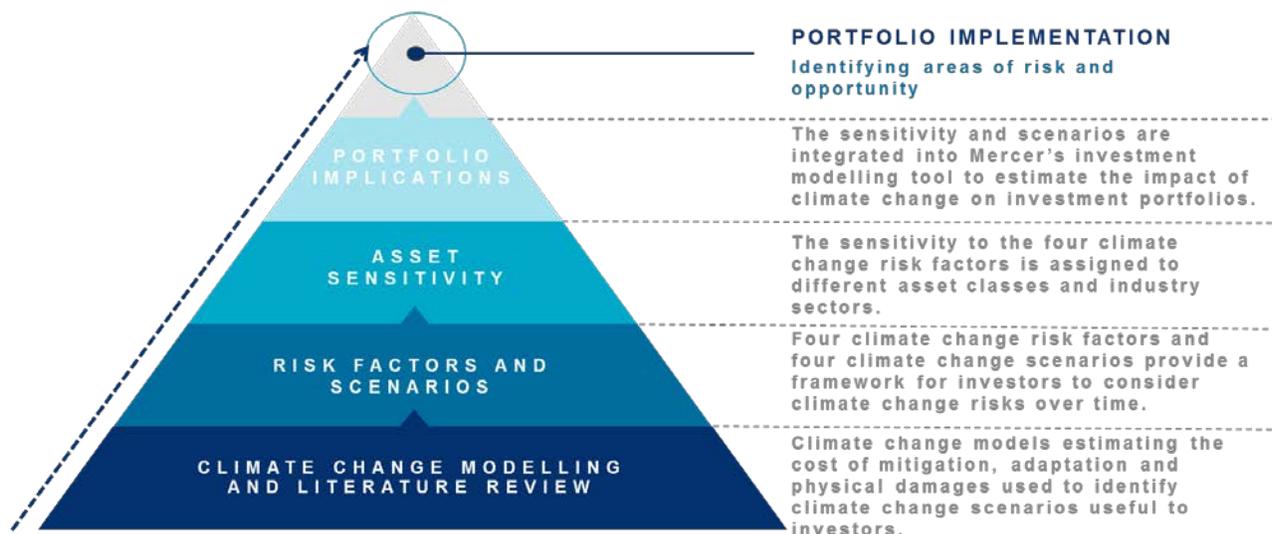
In particular, the physical impacts of climate change; such as extreme weather events and sea level rises are expected to be relatively limited over the period to 2050. Given the New York State and Local Retirement System (System) remains open to both new entrants and future accruals, the Fund’s liabilities should be expected to stretch out well beyond this time horizon. However, the further forward we look the greater the uncertainty in outcomes making it difficult to justify investment modelling beyond our 35 year time-frame. Nevertheless the post 2050 implications should not be ignored.

While there is notable dis-connect 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.

## STUDY APPROACH: FROM CLIMATE CHANGE MODELLING TO INVESTMENT PORTFOLIO IMPLEMENTATION

There were 5 key stages to the study to consider the risk 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 used a scenario-based approach to considering the potential risks and opportunities.

## CLIMATE CHANGE SCENARIOS

Four climate change scenarios were developed as part of the study, each reflecting different climate change policy ambitions that result in varying CO<sub>2</sub> 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.

Four scenarios, Transformation, Coordination, Fragmentation (Lower Damages) and Fragmentation (Higher Damages) were identified as collectively representing a reasonable range of potential outcomes and thereby useful for investors to consider climate change possibilities.

Figure 3: Climate change scenarios modeled

<b>1. TRANSFORMATION</b>	
<b>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.</b>	
<b>Climate perspective</b>	The most ambitious of the four scenarios considered in this study in terms of climate policy but also the most contentious. This scenario is the 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 the results of the Paris negotiations later this year will be a crucial signpost as to its likelihood.
<b>Investor perspective</b>	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.
<b>2. CO-ORDINATION</b>	
<b>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.</b>	
<b>Climate perspective</b>	While not as ambitious as Transformation, this scenario assumes a coordinated and well-defined policy response to reduce emissions by 2030.
<b>Investor perspective</b>	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. FRAGMENTATION (LOWER DAMAGES)

**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.**

<b>Climate perspective</b>	This scenario assumes a fragmented policy response (both by region and ambition) with limited additional action from policy agreements currently in place.
<b>Investor perspective</b>	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.

### 4. FRAGMENTATION (HIGHER DAMAGES)

**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.**

<b>Climate perspective</b>	This scenario follows the same CO <sub>2</sub> emissions pathway and policy response as Fragmentation (Lower Damages) but scales up the potential physical impacts of climate change.
<b>Investor perspective</b>	On top of the considerations highlighted for the Fragmentation (Lower Damages) scenario, 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 Transformation scenario is an ambitious benchmark and could be seen as a “best-case” scenario from a climate change perspective, the Fragmentation (Higher Damages) 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 existing policy commitments. Should countries renege on existing commitments, there is the potential for a more divergent and negative outcome to occur (resulting in a level of warming higher than 4°C).

## THE BUILDING BLOCKS OF THE CLIMATE CHANGE SCENARIOS AND THE IMPORTANCE OF 2°C

**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<sub>2</sub>) is the most prevalent GHG and therefore CO<sub>2</sub> 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<sub>2</sub> 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. All major countries, including the US and China, have recognised 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. It is important to note that even if the world stopped all GHG emissions tomorrow, it would still be ‘locked in’ to a degree of further global warming, which is currently estimated to be 1.5°C (Source: World Bank Group, Turn Down the Heat).

**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.

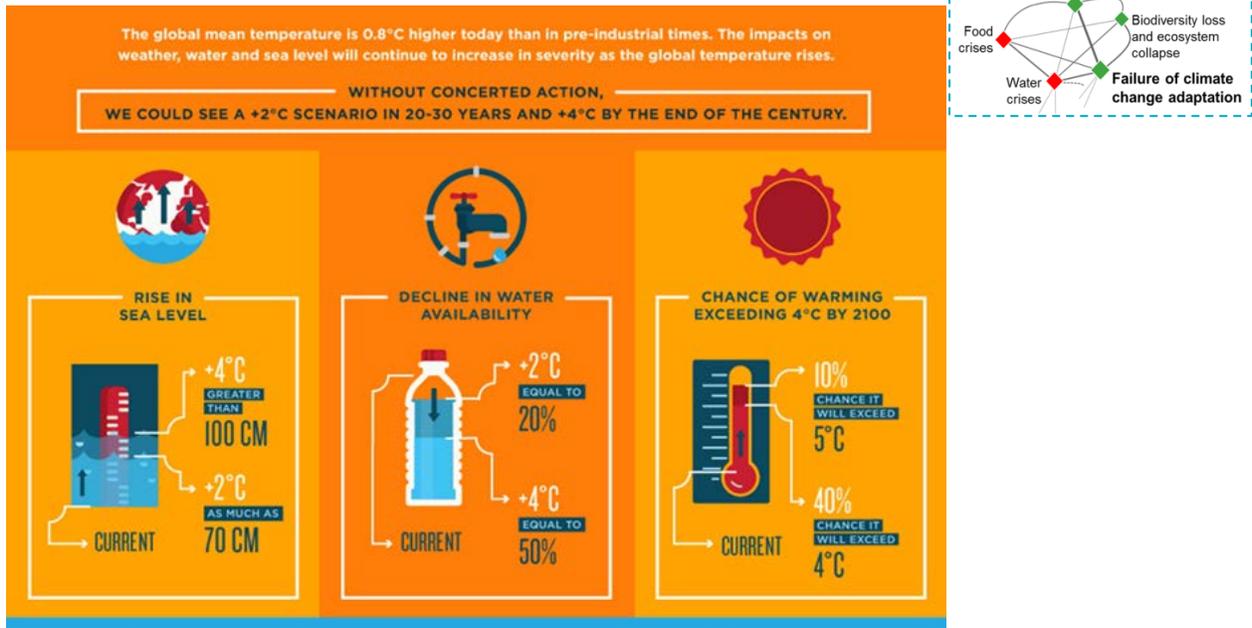
**ADAPTATION ACTIVITIES:** Protecting against the impacts of climate change (e.g. building flood walls). Adaptation refers to managing the warming that occurs by making changes in the physical landscape or improving the financial capacity of individuals or entities to withstand climate events.

**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 is likely to increase unabated until adaptive capacity is overwhelmed.

**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<sub>2</sub> concentrations.

The diagram below from the World Bank Group highlights some of the changes that may occur across different levels of temperature warming and links back to the global risks considered by the World Economic Forum.

**Figure 4:** Considering different levels of warming: putting the Mercer scenarios into context



**Source:** World Bank Group, Turn Down the Heat

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

This study 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.

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 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 long-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 green-house gas emissions.

Examples of climate-related policy include green-house 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).

## 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<sub>2</sub> 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 table 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 Transformation scenario. Under both the Transformation and Co-ordination 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 Fragmentation scenarios, particularly Fragmentation (Higher Damages), 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 6: Key signposts for investors by climate change scenario (to 2050)

SIGNPOST FOR INVESTORS	TRANSFORMATION	CO-ORDINATION	FRAGMENTATION LOWER DAMAGES	FRAGMENTATION HIGHER DAMAGES
<p>Potential changes to the energy mix</p> 	<p>Significant change to the energy mix: fossil fuels represent less than half of the energy mix at 2050.</p>	<p>Fossil fuels represent c.75% of the energy mix at 2050.</p>	<p>Fossil fuels continue to be the dominant energy source, representing 85% of the energy mix at 2050.</p>	
<p>Rate of investment in technologies supporting the low carbon economy</p> 	<p>Cumulative investment of US\$65 trillion in energy supply and efficiency (ex-fossil fuels) required over 2015–2050.</p>	<p>Cumulative investment of US\$47 trillion in energy supply and efficiency (ex-fossil fuels) required over 2015–2050.</p>	<p>Total energy investments increase to US\$3.13 trillion in 2050. Limited investment into low carbon energy</p>	
<p>Potential shifts in long-term weather patterns and impact on resource availability</p> 	<p>Limited impact by 2050.</p>	<p>Limited impact by 2050.</p>	<p>Estimated net benefit from resource availability as a percentage of global GDP of 0.5% at 2050. Driven by gains in agriculture, partially offset by losses related to biodiversity.</p>	<p>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.</p>
<p>The level of physical damages caused by catastrophic events, such as floods and hurricanes</p> 	<p>Limited impact by 2050; driven by losses from (extra) tropical storms and coastal flood.</p>	<p>Limited impact by 2050; driven by losses from (extra) tropical storms and coastal flood.</p>	<p>Estimated net loss as a percentage of global GDP of 0.4% at 2050. Driven by losses from (extra) tropical storms and coastal flood.</p>	<p>Estimated net loss as a percentage of global GDP of 0.7% at 2050. Primarily represents losses from wildfire, coastal flood, and extreme temperatures.</p>
<p>Global policy response</p> 	<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.</p>	<p>Existing policy pledges with respect to carbon emissions are implemented with mitigation efforts extended to 2030.</p>	<p>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.</p>	

<b>Expected cost of carbon</b> (\$US2013/t CO <sub>2</sub> )	 <b>P</b>	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.
<b>Global greenhouse gas emissions at 2050<sup>2</sup></b>	 <b>P</b>	22 Gt CO <sub>2</sub> e/yr. 56% decrease vs. 2010 levels.	37 Gt CO <sub>2</sub> e/yr. 27% decrease vs. 2010 levels	67 Gt CO <sub>2</sub> e/yr. 33% increase vs. 2010 levels
<b>Timeframe for emissions level peaking</b>	 <b>P</b>	Emissions peak by 2020.	Emissions peak by 2030.	Emissions peak after 2040.

### HOW SENSITIVE ARE DIFFERENT INVESTMENTS TO CLIMATE CHANGE?

Now that we have identified how different climate change scenarios may develop to 2050 by looking at how the four climate change risk factors progress in terms of influence over time, the next stage is to consider how sensitive different investments are to the climate change risk factors. By combining the development of the TRIP factors over time with the sensitivity of different investments to the TRIP factors we are able to look at the potential impact of climate change on the Fund’s investments.

Mercer has developed climate change sensitivity heat maps that summarize our assessment of the sensitivity of different asset classes and industry sectors to the TRIP factors. We have assigned sensitivity on a relative basis using a scale of -1 where we expect the most negative impact on investment returns, to +1 where we expect the most positive impact on investment returns.

While investors do not typically consider industry level detail when making strategic investment decisions, it is necessary to “drill-down” to this level due to the disparity of sensitivity across different industries. We have focused our attention on those industries we believe to be of most interest for this study; those that are expected to be the most sensitive to climate change. Although we have not looked at security level analysis as part of this study, it is crucial that NYSCRF understands where risks and opportunities might lie and to ensure that the Fund’s investment managers are fully considering these risks when building portfolios, particularly when investing in asset classes, industries and sectors with the highest sensitivity.

<sup>2</sup> CO<sub>2</sub>e, stands for carbon dioxide equivalent. It expresses the impact of different greenhouse gases in terms of the equivalent amount of CO<sub>2</sub> 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.

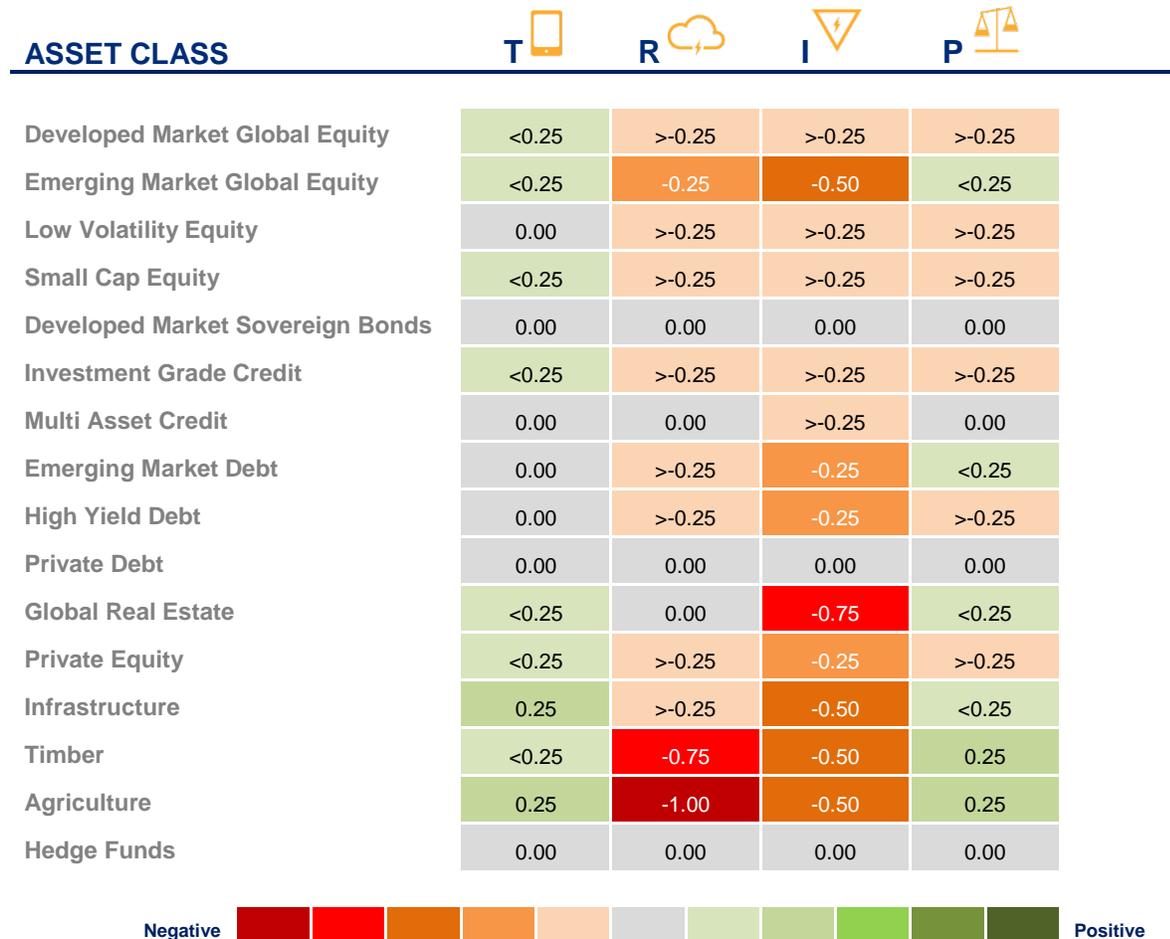
## STRUCTURAL CHANGE: PAST PERFORMANCE IS NOT A GUIDE TO FUTURE PERFORMANCE

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, sustainable global economic growth is not going to follow the same path as historical economic growth, we have not sought to reflect 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 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.

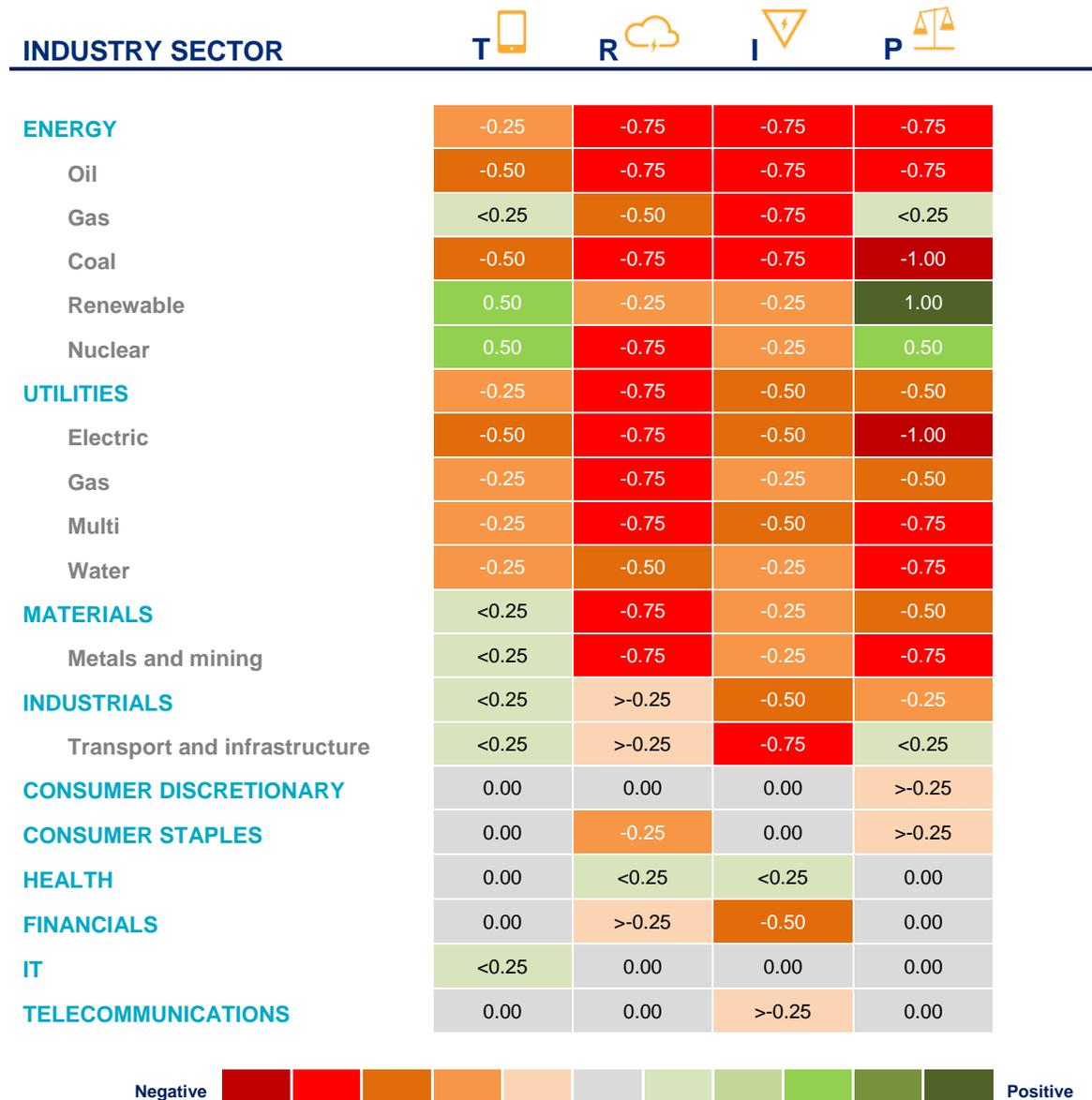
Figure 7: Sensitivity to the climate change risk factors: asset class level



- 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.
- Within bonds, emerging market and high yield debt are the most sensitive to the risk factors.
- 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.

- We do not expect private debt or hedge funds, in aggregate, to be sensitive to the risk factors.

Figure 8: Sensitivity to the climate change risk factors: industry and sector level



- 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. Corporate debt could be subject to downgrade and defaults.

### STUDY HIGHLIGHTS: COMBINING THE SCENARIOS AND RISK SENSITIVITY

- Over the long term (35 years), for a well-diversified portfolio, a Transformation scenario does not jeopardize financial returns. Meaning the economic implications of short-term policy action to combat further GHGs does not impact investors negatively over the long term, assuming no action is taken to limit negative impacts and capture upside at the sector and asset class level.
- The Fragmentation (Higher Damages) scenario is increasingly detrimental to returns over time and the Transformation scenario becomes increasingly favorable relative to the other scenarios.
- At a total portfolio level, under the Transformation scenario, while the overall impact is less significant (given positive and negative impacts for different asset classes) there are key areas that investors should focus on: e.g. developed market equities vs. EM equities and real assets.
- The most apparent differential between winners and losers is at an industry sector level and investors can position themselves accordingly to manage the downside risks as well as position for favorable opportunities.

Figure 9: Climate impact on return by industry sector (35 years)

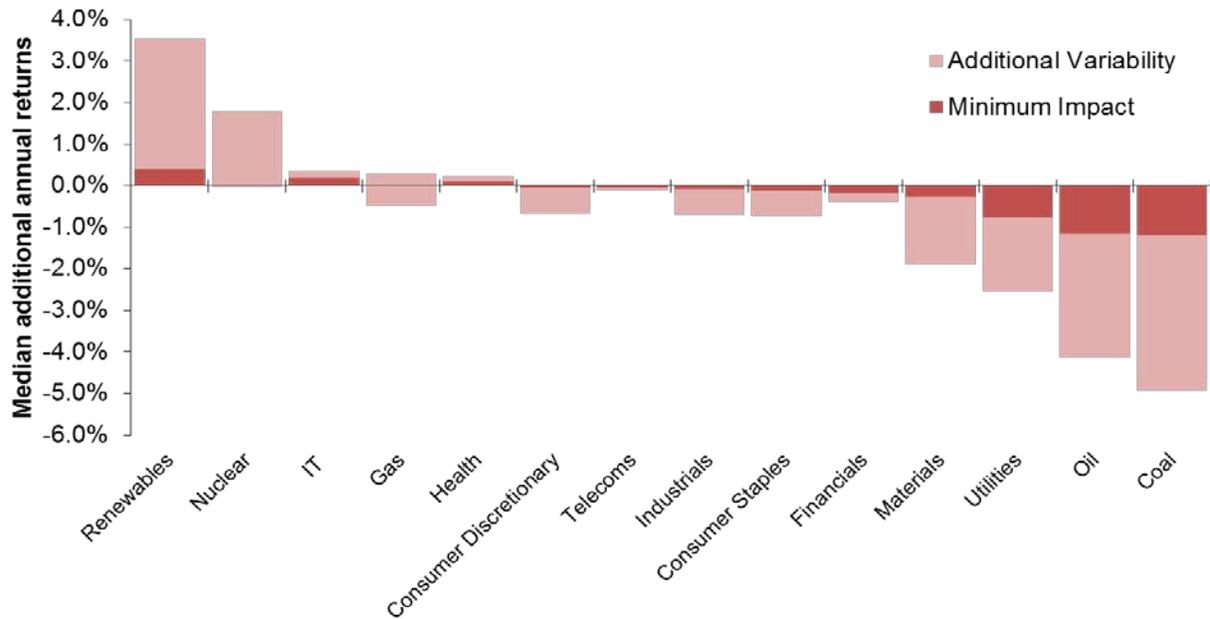
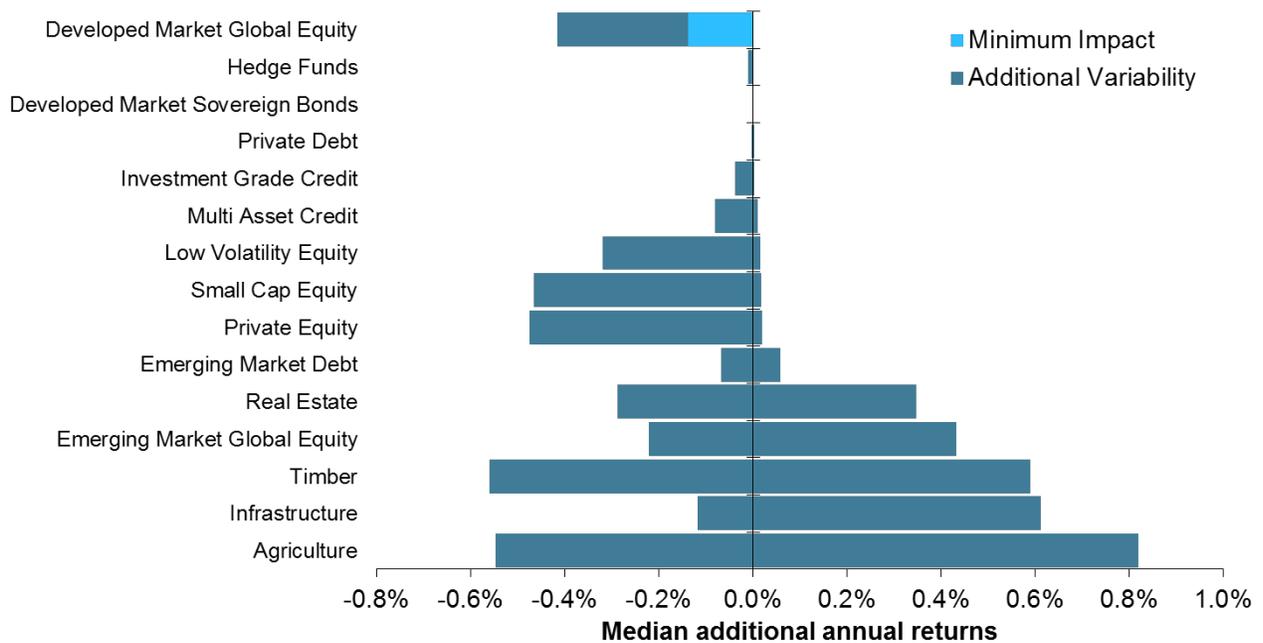


Figure 10: Climate impact on return by asset class (35 years)



# 3

## ANALYSIS AND KEY FINDINGS

Mercer has reviewed the climate risk exposures of NYSCRF using our TRIP factor framework and considering the portfolio impacts under the four climate change scenarios described herein.

### CURRENT STRATEGIC ASSET ALLOCATION

Asset allocation details were provided as follows as at 3/31/15:

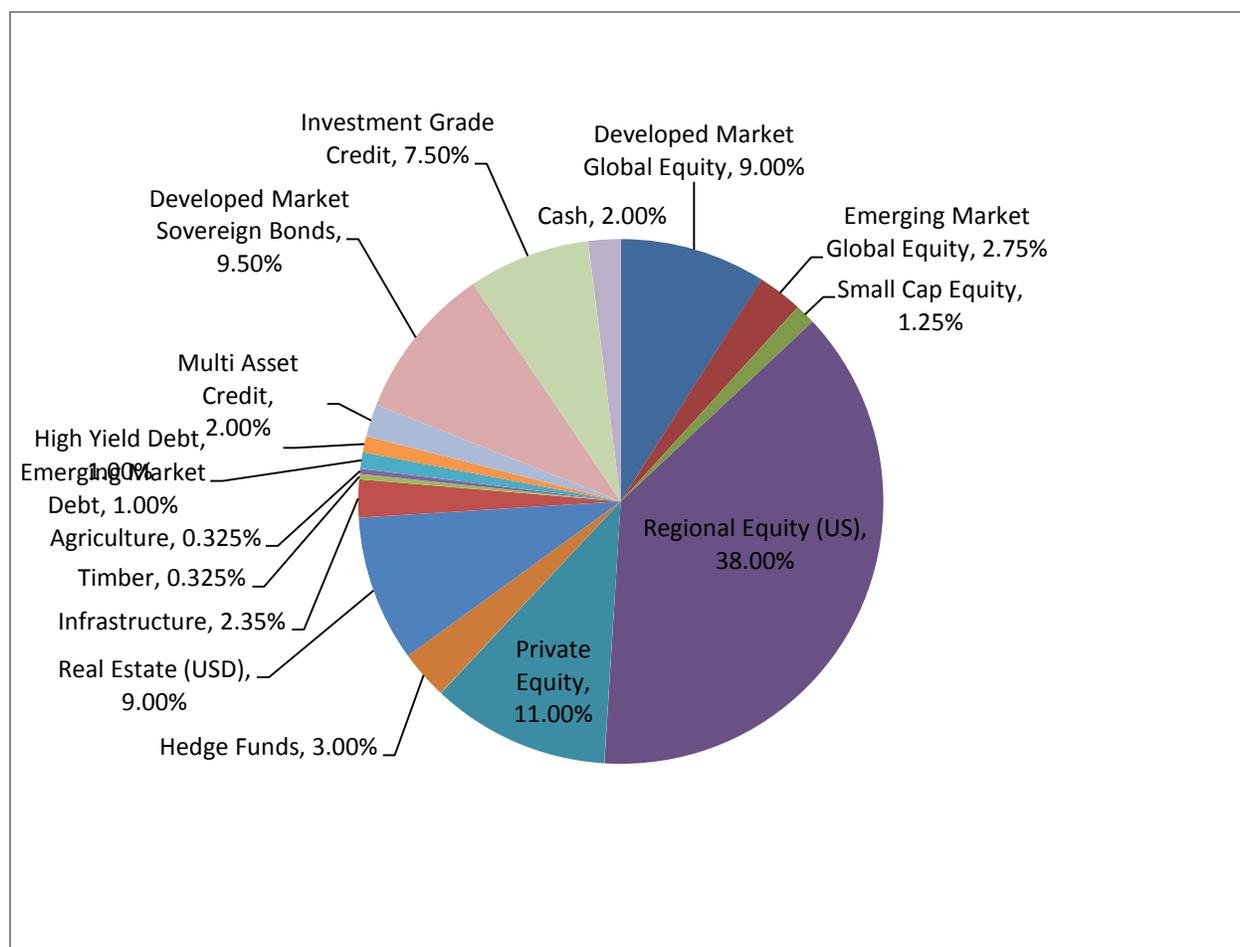
Figure 11: NYSCRF Strategic Asset Allocation<sup>3</sup>

NYSCRF Asset Mix Categories	Mercer Asset Class	NYSCRF (3/31/15)
Broad US Equity	Regional Equity (US)	38.00%
Broad International Equity	Developed Market Global Equity	9.00%
	Emerging Market Equity	2.75%
	Small Cap Equity	1.25%
CRF Private Equity and CRF Opportunistic	Private Equity	11.00%
Diversified Hedge Funds	Hedge Funds	3.00%
Core & Non-Core Real Estate and CRF Opportunistic	Real Estate (USD)	9.00%
CRF Real Assets <sup>4</sup>	Infrastructure	2.350%
	Timber	0.325%
	Agriculture	0.325%
CRF Non-Core Fixed Income and CRF Opportunistic	Emerging Market Debt	1.00%
	High Yield Debt	1.00%

<sup>3</sup> This table represents NYSCRF's strategic asset allocation as opposed to its realized asset allocation.

<sup>4</sup> NYSCRF's Custom Real Assets strategic allocation includes 13.51% Diversified Inflation Strategies, 5.41% REITs, 27.03% Infrastructure, 10.81% Timber, 32.43% Energy, and 10.81% Agriculture weighting. Since the Mercer Asset Allocation framework does not include specific categories for Energy, Diversified Inflation Strategies or REITs, these have been included under the Infrastructure asset class.

	<b>Multi Asset Credit</b>	2.00%
<b>Int. Duration Fixed Income + TIPS</b>	<b>Developed Market Sovereign Bonds</b>	9.50%
<b>Int. Duration Fixed Income</b>	<b>Investment Grade Credit</b>	7.50%
<b>Cash Equivalents</b>	<b>Cash</b>	2.00%
	<b>Total</b>	<b>100%</b>



## KEY FINDINGS

### **NYSCRF's Equity portfolio would be most negatively impacted by a Transformation scenario.**

Given the strength and scale of response required to transform the economy onto a low-carbon pathway, the impact of the TRIP factors on investment portfolio returns is strongest under the Transformation scenario. Both the US and Developed Market Equity asset classes – which together make up nearly half of NYSCRF's total exposures – are expected to be negatively impacted. Add Small Cap Equity and Private Equity into the mix (the latter of which is assumed to have a beta of 1.5 vs. US Equity and is therefore more sensitive to the push and pull of our TRIP factors *in extremis*) and negatively impacted exposures would account for nearly 60% of NYSCRF's total fund. NYSCRF can seek to address these risks through the following activities (some of which are already underway):

- Reallocating a portion of passive exposures towards lower-carbon indices.
- Allocating a portion of active equities towards thematic manager(s) focused on sustainability and/or low-carbon investments.
- Increasing exposure to Emerging Market Equity (public or private), which is expected to be positively impacted under a Transformation scenario, or taking other steps to diversify growth assets<sup>5</sup>.
- Updating NYSCRF's engagement strategy with clear objectives focused on gaining clarity from portfolio companies about their "2°C business plans" (whether engagement by passive managers, active managers and/or directly by NYSCRF).

### **The impact of climate change on the total portfolio is potentially significant**

After assessing the aggregate impact of the TRIP factors under each climate scenario on NYSCRF's total portfolio we find it would be reasonably well insulated from loss under a Coordination scenario and only moderately impacted under the Fragmentation scenarios. However it would be quite vulnerable under a Transformation scenario – particularly over the coming decade – where the Fund could see a -0.35% p.a. impact on median returns. For \$183.5<sup>6</sup> billion in assets invested in 2015 this relates to a cumulative loss of approximately \$12 billion by 2025<sup>7</sup>.

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<sup>5</sup> Note, NYSCRF's current exposure to EME of 2.75% (5.4% of total public equity allocation) is below the 10.6% weighting to EME in the MSCI ACWI (Source: MSCI; July 2015)

<sup>6</sup> NYSCRF Total Investments as at March 31, 2015 (Source: <http://www.osc.state.ny.us/pension/snapshot.htm>; accessed August, 2015)

<sup>7</sup> Assumes a 7.7% stable annual portfolio return over the 10 years without the influence of climate change as compared to 7.35% under a Transformation scenario.

**When compared to a custom benchmark<sup>8</sup>, the Fund’s active equity managers have only slightly less exposure to the industry sectors expected to be the most negatively impacted by climate change: Energy and Utilities.**

The slightly lower exposure of active equity managers to Energy and Utilities appears to be the result mainly of reactions to energy commodity market shifts (e.g. the price of oil) occurring in late 2014. While this is potentially a positive from a climate risk management perspective, the motivations underlying this reallocation by active equity managers should first be understood to ensure active equity managers appreciate and address NYSCRF’s own view of short term climate policy risk. Further discussions with active equity managers to better understand their positions with respect to climate change risk may thus be warranted.

### ASSET CLASS IMPACTS

The following circle charts illustrate where asset classes are expected to experience a gain or reduction in median returns, when considering climate risk. The black circle represents the total portfolio, with the width of each colored bar reflecting the size of allocation to a given asset class. Asset classes that are expected to experience a reduction in returns under a specific scenario will move towards the center of the circle, and asset classes that are expected to experience additional returns will move outwards from the circle.

#### Asset class implications – 10 years

- Under the Transformation scenario nearly 60% of NYSCRF’s assets suffer a significant loss (-0.65% to -0.83%). This is only partially offset by gains in Real Estate and Real Assets (+0.45% to +0.76%), which collectively represent 12% of NYSCRF’s portfolio. Defensive assets (including Cash and Hedge Funds) which are relatively insulated from climate change impacts account for the remainder.
- Under the two Fragmentation scenarios, all asset classes suffer losses meaning there are no “winners” to offset adverse impacts.
- With the exception of meaningful impact on a small sliver of NYSCRF’s Real Asset portfolio (Agriculture, Timber and Infrastructure represent 3% total), the total fund is relatively insulated from a Coordination scenario at the ten-year time horizon.

#### Asset class implications – 35 years

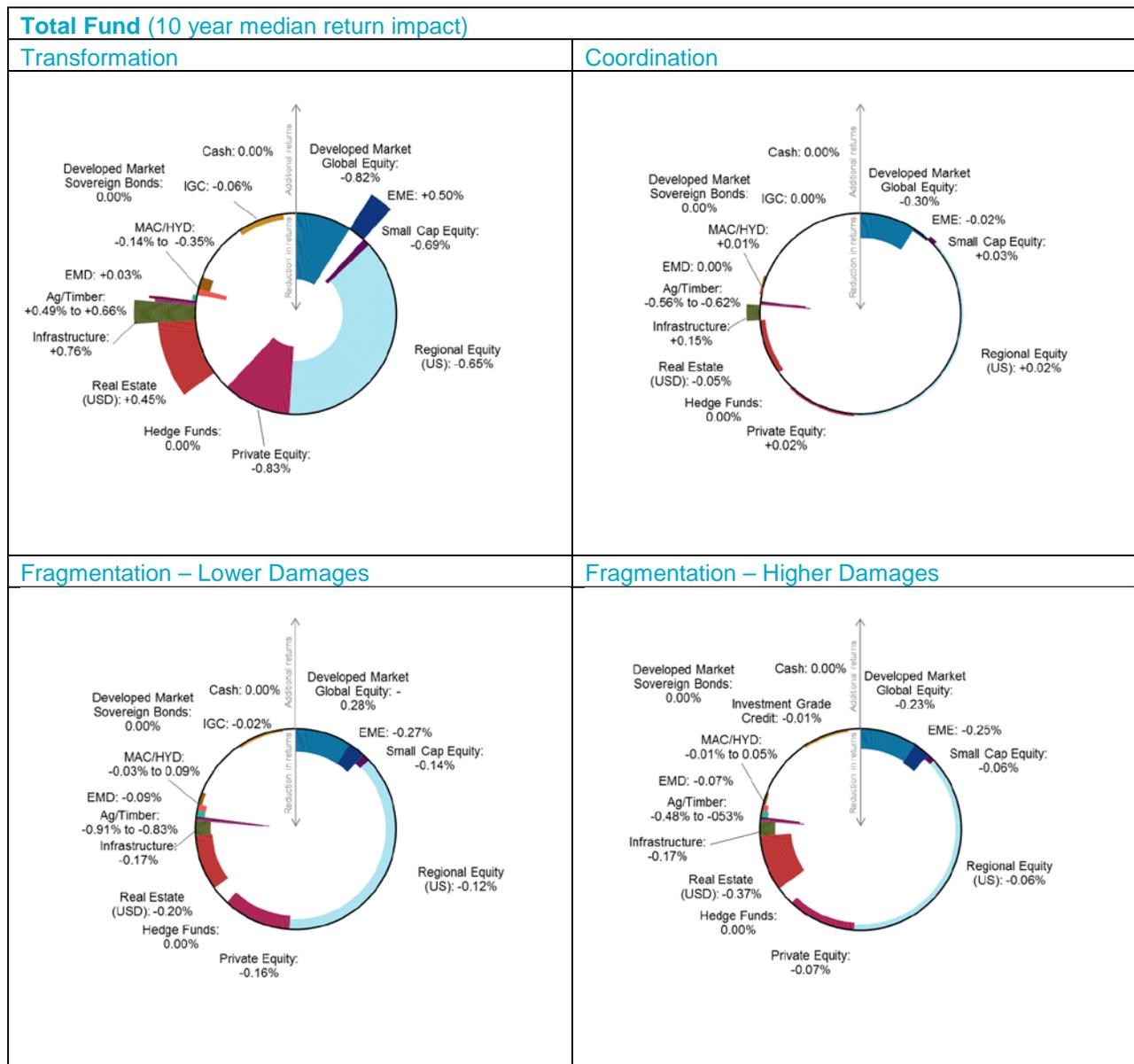
- Annualized median return expectations at the 35-year time horizon are directionally similar and less severe versus those at the 10-year time horizon for almost all asset classes with the notable exception of Real Estate and Real Assets under the Transformation and Coordination scenarios.

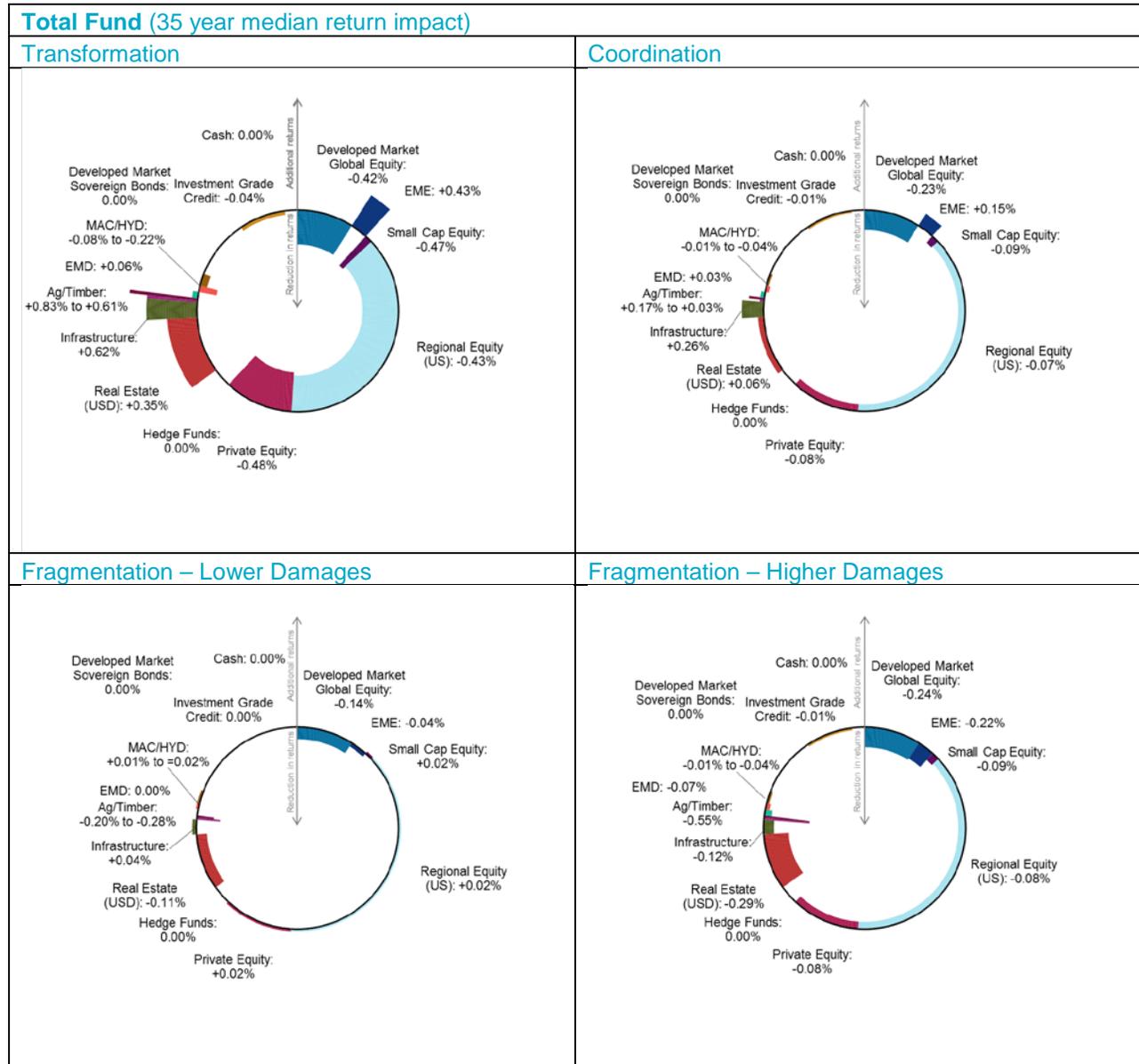
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<sup>8</sup> 75% Russell 3000 and 25% Russell Global ex US

- **Transformation:** Agriculture annualized returns increase over the longer time frame.
- **Coordination:** Real Estate, Agriculture and Timber return values switch from a loss to a slight gain in the 25 years between snapshots while Infrastructure median annual returns increase by 11 bps.

Figure 12: Median asset class return impacts at 10 and 35 years.





### Considering Mitigation vs. Fragmentation Scenarios

The **Transformation** and **Coordination** scenarios envision stronger levels of mitigation than we see in the Fragmentation scenarios, with the Policy and Technology risk factors representing the most significant influences.

- If NYSCRF places a reasonable probability on the likelihood of one of these scenarios eventuating, it should take action to manage the Policy risk in its equity portfolios and seek to gain exposure to investments that are expected to respond positively to the Technology risk factor.
- If NYSCRF views the **Transformation** scenario as reasonably plausible, then equal focus should be placed on managing Policy risk in its Public and Private Equity portfolio. However, under the **Coordination** scenario, US and Private Equity are less negatively impacted.
- The Technology factor is a strong signal in both mitigation scenarios, and should lead to positive positioning for companies focused on providing solutions for the transition to a low-carbon economy.
- The **Fragmentation** scenarios also see negative impact for equities, but this would be driven more by the Resource Availability and Impact factors. This leads logically to a larger focus on climate risk management versus policy risk management from an equities perspective. The Fragmentation scenarios would also more heavily impact real estate and infrastructure holdings, which may in this case warrant increased risk assessment regardless given the extent to which the physical effects of climate change have already been “baked in” to the global climate system.

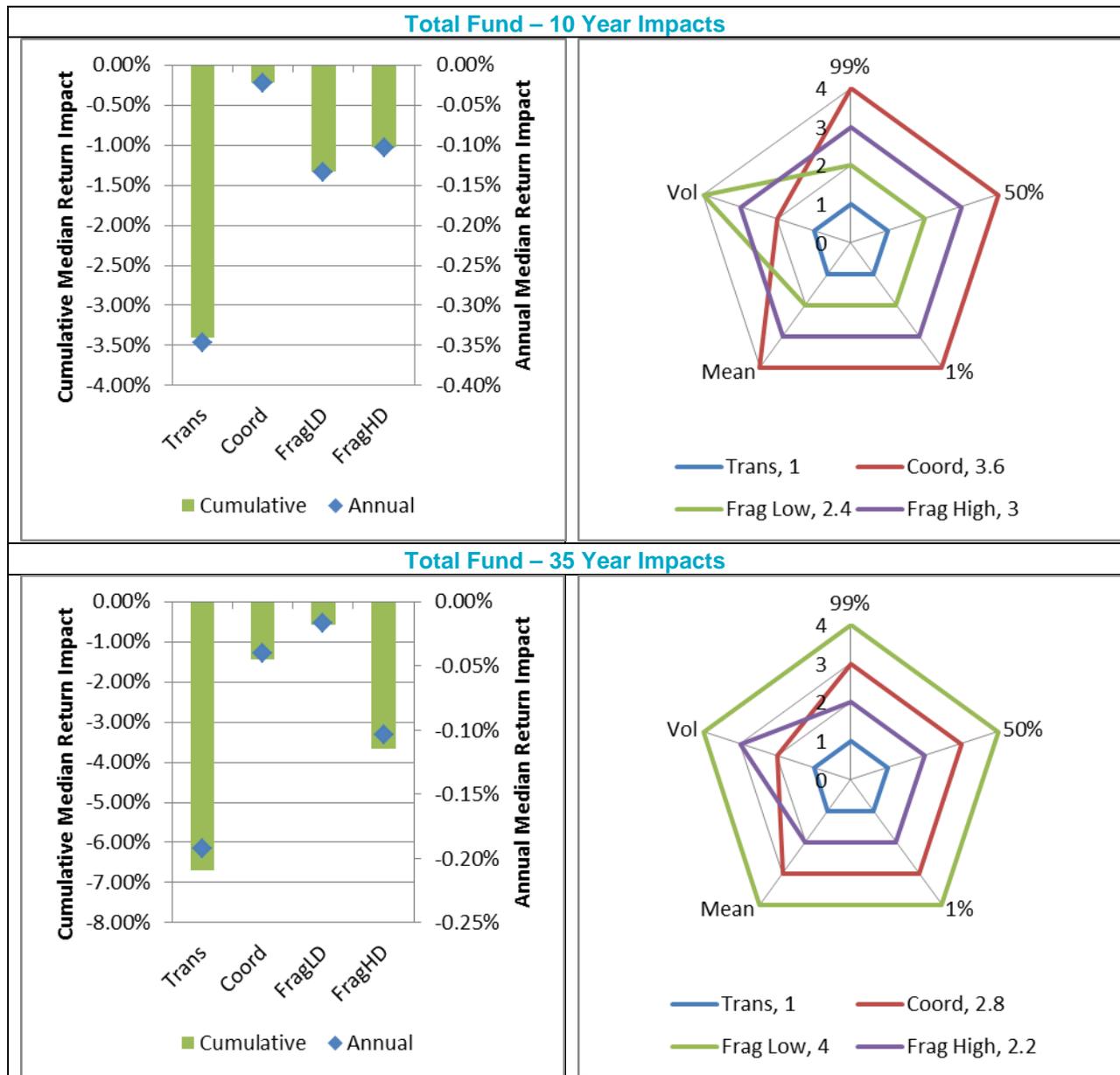
## TOTAL PORTFOLIO IMPACTS

For the purposes of quantifying total fund impact, we have assessed the aggregate influence of each scenario on NYSCRF’s portfolio, as shown in Figure 13. Two means of assessment are depicted. The bar chart shows the cumulative impact of climate change on total fund returns at the median for each scenario and time frame. The “spider web” graphic shows the relative performance of NYSCRF’s portfolio under each scenario based on a discrete set of metrics including the median return outcome, the mean return outcome, two return outcomes on the distribution tail (95% and 1%) and return volatility (for a discussion of the volatility metric in particular refer to the Technical Addendum delivered to partners as part of the public report). The values shown after the scenario name in the legends of these graphics corresponds to the average score of each scenario across the five factors equally weighted. An easy way to interpret these charts is to look at the surface area encompassed by each scenario line – NYSCRF’s portfolio performs the best under the scenario with the most coverage.

From these graphics the Transformation scenario stands out as the most adverse for NYSCRF’s portfolio. Stated otherwise the modeled NYSCRF portfolio would be most negatively impacted by a scenario resulting from significant policy action to limit future GHG emissions or encourage low-carbon growth. This is true at both the 10- and 35-year time horizons where the Transformation results are the worst cumulatively and score lowest on all five measures of portfolio resilience used in the comparative spider diagram.

The NYSCRF portfolio would be most insulated from loss under the Coordination scenario at the 10-year time horizon and under the Fragmentation – Lower Damages scenario at the 35-year time horizon.

**Figure 13: Impact on total portfolio median returns by scenario**  
 Cumulative return impact over 10 years (to 2025) and 35 years (to 2050)



## INDUSTRY SECTOR IMPLICATIONS

Consistent with the findings in the public report, the impact on different sectors varies widely. This can result in significant variations within equity portfolios. Compared to the custom benchmark NYSCRF’s active equity managers have a bias towards the Materials, Industrials and Financials sectors and away from the Energy, Utilities, IT and Consumer Staples sectors. Since this active equity portfolio data was sourced as of 3/31/15, this tilt away from Energy in part reflects a reaction by managers to the drop in oil price experienced in 4Q14.

**Figure 14: NYSCRF active equity sector weights versus custom benchmark**

Sectors	Custom Benchmark (3/31/15)	NYSCRF Active Global Equity Portfolio (3/31/15)	Difference
IT	16.52%	15.57%	-0.96%
Health	13.15%	12.61%	-0.54%
Telecoms	2.61%	3.45%	0.84%
Consumer Discretionary	13.02%	13.02%	0.01%
Industrials	11.52%	12.59%	1.07%
Consumer Staples	8.71%	7.75%	-0.97%
Materials	4.61%	5.81%	1.21%
Utilities	3.08%	2.32%	-0.77%
Financials	19.74%	20.81%	1.07%
Energy	7.04%	6.08%	-0.97%
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>-</b>

The charts below show the range, across the four climate change scenarios, of the potential impact on annual returns for the Fund’s active equity managers as measured against the selected benchmark. The charts show the impacts (median annualized) over both 10 and 35 years. The charts reflect the climate return impact at the sector level times the weighting for each industry sector.

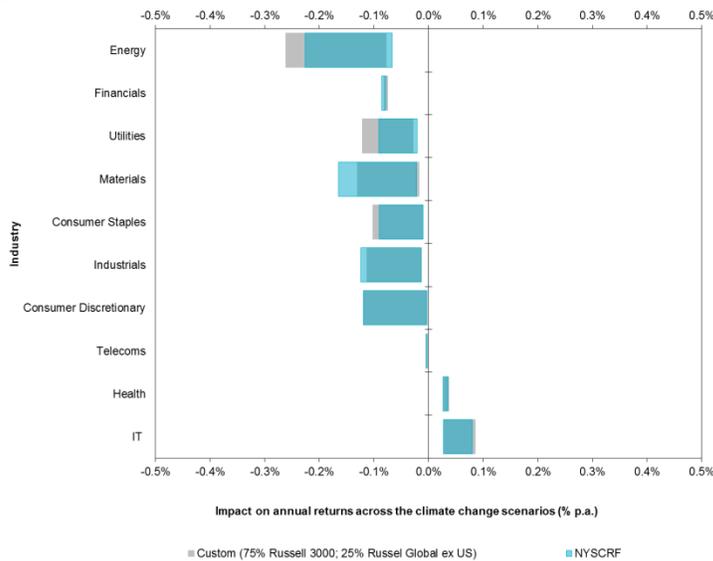
NYSCRF’s greater relative exposure to Materials and Industrials in its active global equity book drives greater loss potential versus the benchmark at both time horizons. However, active management away from Energy and Utilities has provided NYSCRF with some climate risk protection judging from the less severe negative potential impact of Energy stocks on equity portfolio performance. All other active equity sector allocations contribute to portfolio gains/losses in line with the benchmark.

ACTIVE GLOBAL EQUITIES: INDUSTRY LEVEL ANALYSIS

Figure 15: Active global equities: industry sector level analysis  
Median annual return impact over 10 years (to 2025) and 35 years (to 2050)

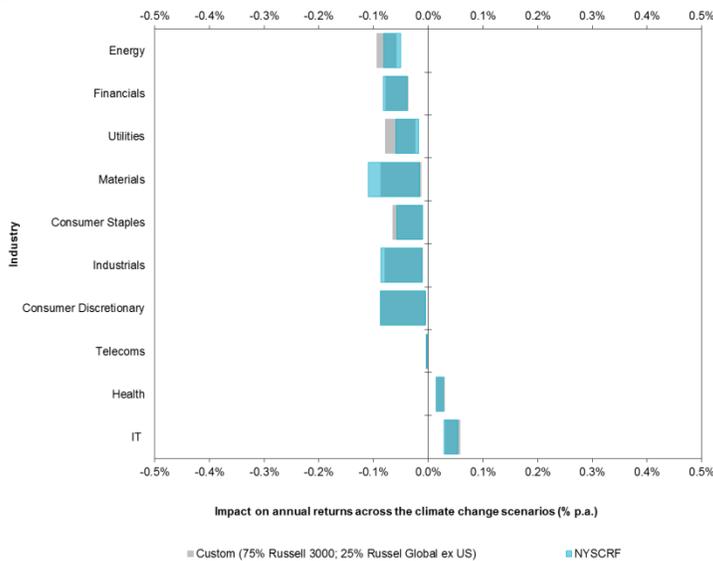
Active Global Equities

10 years



As a group, the Fund's active global equity managers are largely in line with the index in terms of their exposure to climate sensitive sectors.

35 years



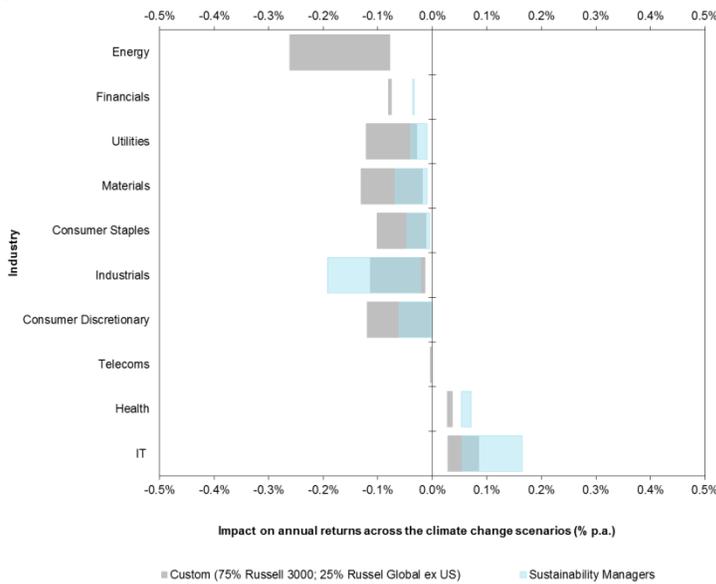
The potential sector impacts narrow over the 35 year time period. NYSCRF should continue its efforts to ensure its active equity managers understand the implications of climate risk on their holdings.

### Sector exposure of sustainability-themed managers

For comparison purposes, the following chart displays the sector exposure of a group of three global equity sustainability-oriented thematic managers versus the NYSCRF custom global equity benchmark. As is apparent, the climate sensitivity of the combined sector weights of these managers is lower than the benchmark. This helps to demonstrate the potentially positive influence that the addition of one or more sustainability-oriented managers could have on the overall sector profile of NYSCRF's active global equity exposure.

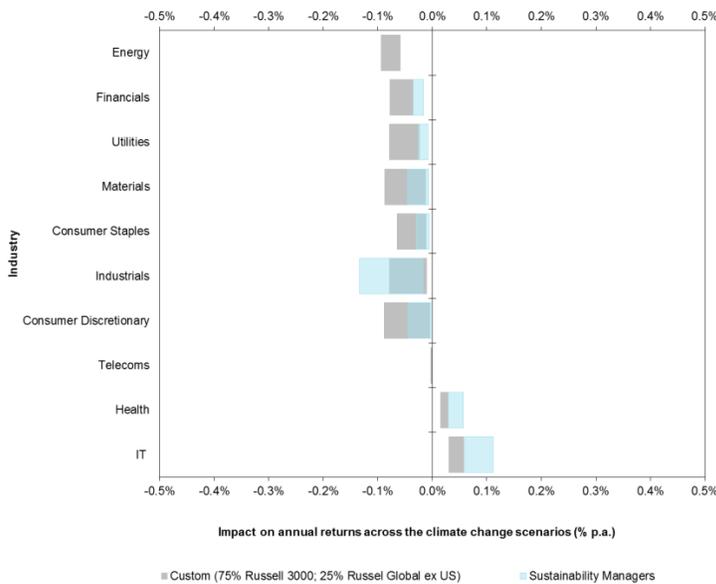
**Figure 16:** Sample sector profile of three sustainability-themed global equity managers versus custom benchmark

**10 years**



As is apparent, this group of sustainability themed global equity managers have lower exposure to the sectors that are expected to be the most negatively impacted by climate change: energy and utilities. The managers are positively biased towards IT.

**35 years**



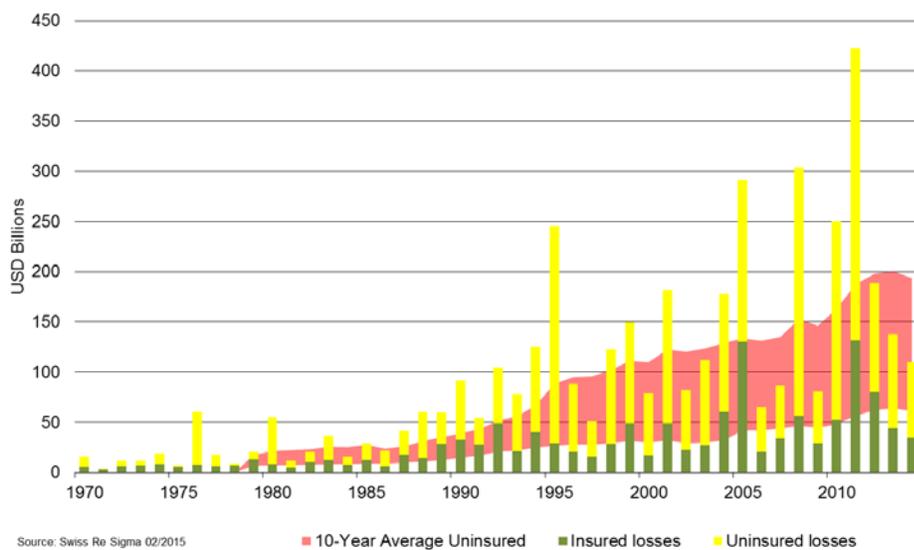
The sustainability themed managers have more exposure to Industrials, wherein stock selection focuses on companies providing solutions to the low-carbon economy.

### Real Estate and Real Asset Investments – Supplementary Asset Allocation Detail

Real Estate and Real Asset investments, including Agriculture, Timber and Infrastructure, offer investors a variety of attractive attributes, such as a higher return profile than typical fixed income options and a relatively low correlation to broader fixed income and equity markets. They also stand to gain from climate policy action and related technological investment flows. However, by virtue of their direct and tangible exposure to the physical manifestations of climate change (short- and long-term weather shifts), the vulnerability of real asset exposures to higher temperature outcomes (e.g. our Fragmentation scenarios) are relatively high versus other asset classes.

Such push and pull results in large return variability across climate scenarios for Real Estate and Real Assets as depicted by the positive influence of the climate risk factors on all such subclasses under the Transformation scenario and detraction of returns under the Fragmentation scenarios (see above circle charts). This range of outcomes demonstrates a greater need for monitoring of such tangible exposures at the portfolio level to ensure climate change risks – which are in this case largely location dependent – are being monitored and managed. Moreover, since many such assets are typically held for long tenors, an assessment of their exposure to long-term risks such as climate change should be incorporated at the time of investment origination as well as ongoing.

**Figure 17: Worldwide Uninsured Catastrophe Losses – A Widening Gap**



As shown here, the gap between economic and insured losses is widening. Monitoring portfolios for overall exposure to extreme risks and ensuring adequate catastrophe insurance coverages are in place should be a priority going forward.

The manner and method of monitoring these exposures and related protections will differ depending on the manner and method of Real Estate and Real Asset investment utilized (e.g. direct investment vs. outsourcing to a fund manager and listed public vs. unlisted private exposures). These asset classes and related methods of exposure access differ insofar as they have different liquidity and risk/return profiles. The turnover of investments underlying third-party funds is also important.

**Figure 18: NYSCRF Real Estate and Real Asset exposures by vehicle type**

NYSCRF Real Estate and Real Asset Exposures by Vehicle Type		Allocation
Real Estate <sup>9</sup>	Closed-end commingled funds (including co-investments)	4.51%
	Open-end commingled funds	0.02%
	Joint Ventures	3.74%
	Direct	0.74%
Real Assets	Infrastructure	2.35%
	Timber	0.325%
	Agriculture	0.325%
<b>Total</b>		<b>12.01%</b>

- Real Estate Closed-End Funds:** The largest portion of NYSCRF’s Real Estate portfolio is invested in closed-end comingled funds (including co-investments). Such funds are likely to be relatively illiquid when compared to most other forms of outsourced Real Estate investment. This illiquidity profile makes understanding the climate change-related risks of these investments all the more important. To understand such risk, collecting info regarding the prospective building and geographic profile of a new fund is essential. It is also important when entering such an investment to understand how managers are evaluating TRIP factor risks as part of their ESG and investment analysis process. As funds begin to be deployed it becomes important to understand the actual realized building/geographic exposure profile of the fund.
- Real Estate Joint Ventures and Direct Investments:** Joint Venture investments in properties – which represent the next largest vehicle type used in NYSCRF’s Real Estate portfolio – generally require a long-term buy-and-hold strategy to realize target gains both from rental income and value appreciation. For these assets, exposure to climate change is highly location dependent. To appropriately understand the climate change

<sup>9</sup> Percentage allocations for Real Estate vehicles in this table have been developed using the following formula: actual allocation to each vehicle type / total actual allocation to Real Estate \* total strategic allocation to Real Estate. On the other hand strategic asset allocations are shown for Real Assets since only limited actual allocations have been made to these asset sub-classes by NYSCRF to date and some uncertainty remains around ultimate vehicle type mix.

risk profile of these assets, portfolio location-level information is necessary, and can be used to analyze related exposure to climate risk. There are a variety of ways in which to gain an appreciation of geographic exposure and/or to calculate probabilistic exposure to weather/catastrophe risk, which we would be happy to explore with NYSCRF in more detail.

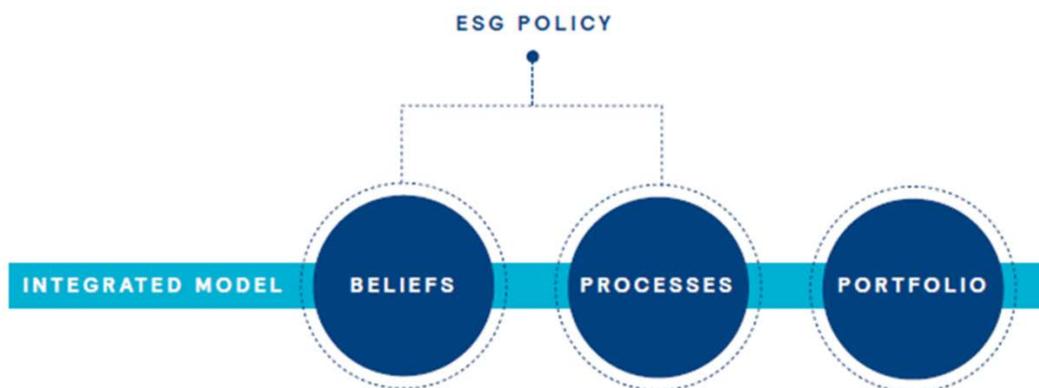
- **Real Assets:** As NYSCRF continues to realize its 3% strategic allocation to Real Assets it will be important for the Fund to monitor and manage the geographic profile of its portfolio and to ensure adequate diversity of exposures when it comes to their climate resilience. The characteristics of each investment which may otherwise indicate climate sensitivity (e.g. crop type) should also be monitored in conjunction with the liquidity profile of such investments which can vary depending on the means of accessing such exposure.

# 4

## RECOMMENDATIONS FOR NYSCRF

Consistent with a key finding of the public report, our NYSCRF-specific findings suggest the Fund is susceptible to investment risk from climate but outcomes can be improved by being prepared. Addressing climate risk within portfolio decisions is most effective when it is integrated within standard investment decision-making processes. This is consistent with Mercer’s recommended approach to incorporating broader environmental, social, and governance (ESG) considerations into investment processes (Figure 19).

**Figure 19: Integrated Model for Addressing ESG Considerations**



Source: Mercer<sup>10</sup>

## RECOMMENDATIONS AND NEXT STEPS

The following sections outline our recommendations for NYSCRF based on the actions undertaken by the Fund to date. Ongoing and future actions have been organized in line with the above framework – Beliefs, Policy, Process and Portfolio. We have organized the recommended actions in the following pages into two categories – Operational Activities and Strategy Implementation. The former include *general* activities which NYSCRF can undertake to evolve its overall portfolio management to be attendant to climate change risk. The second are

<sup>10</sup> Mercer; An Investment Framework for Sustainable Growth, 2014, available at <http://www.mercer.com/services/investments/investment-opportunities/responsible-investment.html>, accessed 11 May 2015.

*specific* and more tangible short-term tasks which the various teams within NYSCRF can undertake to evolve the Fund's approach to climate change risk management and opportunity capture.

### **Operational Activities**

- **Develop its own house view of climate change risk** based on the results of this study and other climate risk assessment efforts underway or being contemplated. The scenario or combination of scenarios used for planning purposes will influence risk management decisions and determine NYSCRF's role as a Future Taker or Future Maker
- **Continue to collaborate across departments and asset classes** to embed climate change risk management practices throughout the organization.
- **Develop a holistic climate change risk management strategy** which reflects its own view of risk and outlines work plan for future one-time and ongoing activities.
- **Address resourcing needs** to ensure appropriate execution of climate change strategy.

### **Strategy Implementation**

- **Finalize investment beliefs** and ensure inclusion of reference to ESG and climate change risk/opportunity.
- **Incorporate climate change risk into General Investment Policies** document. Adding such language to core documentation ensures managers are fully aware of the Fund's expectations regarding the management of ESG risks, including those related to climate change, and how these should be monitored by them and will be monitored by NYSCRF staff.
- **Risk assessment and monitoring:**
  - **Finalize carbon footprint analysis**, which would provide a baseline from which to measure the impact of various carbon exposure measures. Begin with equity holdings, and extend process to fixed income assets in 2016 to the extent data availability warrants/permits.
  - **Undertake environmental and climate resilience assessment** of real asset holdings (directly, or in conjunction with managers/third-parties).
  - **Continue to work across departments** aligning the ESG risk assessments driven by the Corporate Governance team with risk assessments conducted by the Risk Management team.
- **Portfolio construction:**
  - **Equities:** With close to a 60% allocation to Public and Private Equity and with a decidedly developed-world focus, NYSCRF has a significant exposure to climate policy action as contemplated under the Transformation scenario. If NYSCRF believes a Transformation outcome or similar is likely in the near term (e.g. next five years) consider diminishing this exposure in one or multiple of the following ways:

- **Regional Equities:** Consider diversifying regional exposure to include more Emerging Market Equities (at least in line with global benchmarks) while possibly diminishing exposure to US/Developed Market Equities.
- **Active equities:** Consider adding more thematic sustainability manager(s) to the global equity mix.
- **Passive Equities:** Continue efforts to reallocate a portion of passive equity holdings to low-carbon alternatives.
- **Private Equity:** Consider further allocations to emerging market or thematic PE strategies focused on sustainability.
- **Real Assets:**
  - **Infrastructure:** Consider a larger allocation to this asset class with a focus on green/resilient infrastructure.
  - **Timber and Agriculture:** Continue to work to realize strategic allocation to these asset classes.

## Summary of Current Activities

Information regarding the status of NYSCRF's current activities was collected in July, 2015. NYSCRF's Corporate Governance team has four main goals:

1. Integrate ESG into investment process
2. Active ownership to mitigate against potential ESG risks
3. Vote NYSCRF proxies consistent with the Comptroller's fiduciary duty
4. Effectively communicate achievements

The team has made substantial progress towards achieving these goals to date. Current related activities are listed in the following table:

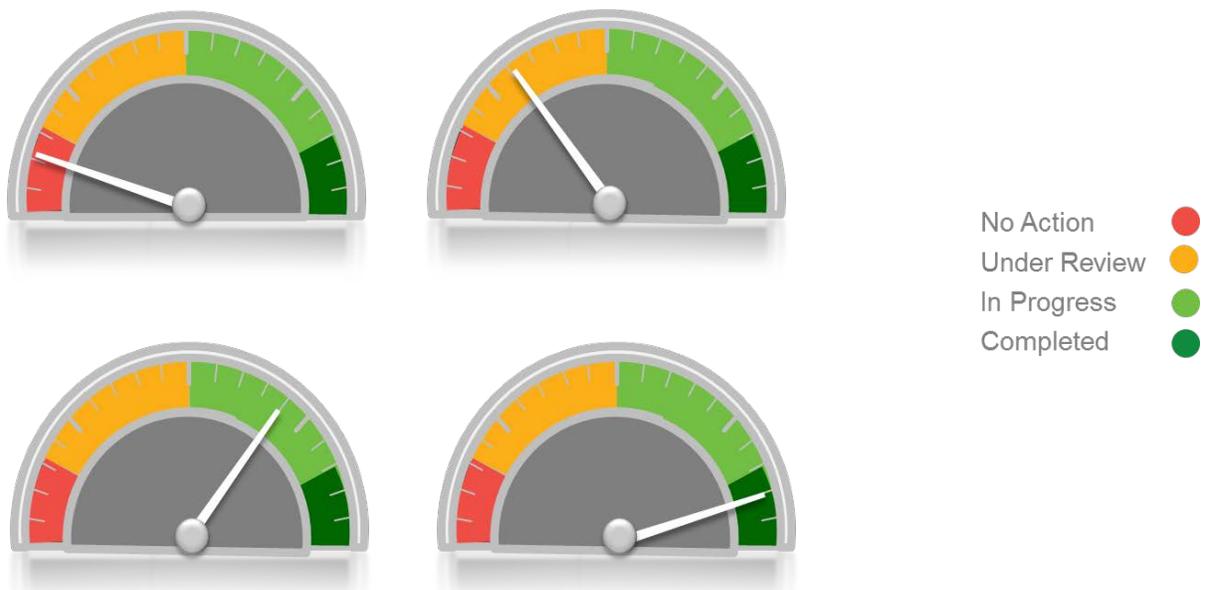
NYSCRF – Current Sustainable Investment Practices	
Investment	Engagement
<ul style="list-style-type: none"> <li>• Sustainable Investment Subcommittee with representation across asset classes meets monthly to discuss and progress sustainable investment topics.</li> <li>• Over \$2B committed and/or invested in clean energy, clean technology, energy efficiency and sustainable businesses including:                             <ul style="list-style-type: none"> <li>○ Public equity investments in two index funds focusing on sustainability and climate change – the HSBC Climate Change Index Fund and the FTSE Environmental Technology 50 – and two</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Corporate Governance team votes proxies and files shareholder resolutions in house.</li> <li>• Proxy voting                             <ul style="list-style-type: none"> <li>○ In 2014 approximately 2000 meetings voted and over 19,000 votes cast.</li> <li>○ Engaging with proxy advisory firms to improve their ESG analyses.</li> <li>○ Proxy Voting Guidelines updated in January 2015 and include positions supportive of climate risk disclosures by portfolio companies.</li> </ul> </li> <li>• Shareholder resolutions                             <ul style="list-style-type: none"> <li>○ In 2014-15 48 resolutions were filed with</li> </ul> </li> </ul>

<p>active strategies – with Generation Investment Management and Rockefeller Asset Management.</p> <ul style="list-style-type: none"> <li>○ Private equity investments in two clean tech/renewable energy funds – Hudson and Craton – and an In-State Private Equity Investment Program which has invested in some green businesses.</li> <li>○ Fixed income investments in World Bank green bonds.</li> <li>○ Real estate investments in Community Preservation Corporation which itself has made some investments in energy efficient affordable housing projects.</li> <li>○</li> <li>● The Green Strategic Investment Program (GSIP) was launched in 2008; \$500M committed to the effort.</li> <li>● ESG research data license.</li> <li>● ESG risk management through targeted exclusions/restrictions (Iran &amp; Sudan; Tobacco; Firearms; Private Prisons).</li> <li>● ESG issues included in investment Recommendation Memos sent from portfolio managers up to CIO (and from CIO to Comptroller) for approval.</li> <li>● NYSCRF is currently assessing its approach to low-carbon indices, with the expectation that the approach and portfolio allocation could grow over time. This low carbon investment strategy will be aligned with its engagement strategy.</li> </ul>	<p>9 covering climate change risk. One notable resolution sought disclosure on an energy company's plans to address global concerns regarding the contribution of fossil fuel use to climate change, including analysis of long and short term financial and operational risks to the company. Another notable resolution asked how the company could adapt its business model to enable increased deployment of low-carbon electricity as a means to reduce greenhouse gas emissions.</p> <ul style="list-style-type: none"> <li>○ 24 agreements achieved on a variety of ESG issues in 2014, including 5 on climate change risk - these 5 companies agreed to study and report on what it could do to help meet the US's (Obama Administration's) goal of reducing carbon emissions by 80 percent by 2050.</li> <li>● In addition NYSCRF issues or signs many letters focused on various ESG advocacy issues including climate risk.</li> <li>● Unique ESG survey developed in house and sent annually to managers and consultants (includes many questions focused on climate risk) providing managers and consultants a clearer idea of NYSCRF's ESG expectations).</li> <li>● Internal <i>ad hoc</i> portfolio manager and consultant meetings are held periodically to discuss sustainability issues.</li> <li>● NYSCRF has representation on the Board of Ceres and CII and maintains active membership in numerous industry groups (e.g. UN PRI) with a primary aim of increasing influence and reach of engagement activities.</li> </ul>
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## Climate Actions Table

Information regarding the status of NYSCRF's current activities was obtained through interviews with NYSCRF staff and a review of literature in the public domain and/or provided to us directly by NYSCRF staff in July, 2015. To highlight focus areas for future investment of resources by NYSCRF we have deployed a progress/advancement indicator for each activity type in Figure 20 below in line with the following scale:

Figure 20: Climate action progress indicator



Progress against best practices has been determined based upon Mercer's industry knowledge and the actions of other climate change study partner with respect to climate change and related investment implications.

**Figure 21:** Overview of NYSCRF climate-change related actions within the Mercer Framework for Sustainable Growth

Framework Step		Total Portfolio
1. BELIEFS	<p><b>Investment Beliefs</b></p> 	<p><b>Status:</b> NYSCRF is governed by a Sole Trustee (NY State Comptroller). ESG integration has historically been driven from the top down. Other than references to beliefs in the Fund's Proxy Voting Guidelines<sup>11</sup>, NYSCRF has not yet formalized a set of investment belief(s), though a staff steering committee is working on a set presently. Related conversations are taking place across asset class teams. ESG considerations are likely to be incorporated into these beliefs,</p> <p><b>Recommendation:</b> NYSCRF's investment beliefs, once formalized, should articulate its outlook with respect to climate risk and opportunity in the context of industry best practice, fiduciary duty, and stakeholder expectations. The Fund should consider soliciting broad-based input during the beliefs development process to ensure they are adequately socialized prior to being finalized.</p> <p>It should be noted that the lack of a written beliefs statement has not hindered the progression of various sustainable investing initiatives within NYSCRF to date (see following sections of this table).</p>
2. POLICIES	<p><b>Investment Policies</b></p> 	<p><b>Status:</b> NYSCRF's <a href="#">General Investment Policies</a> are being updated to reflect ESG considerations which are considered throughout its investment processes as relevant to the investment under consideration (see following section of this table). NYSCRF's <a href="#">Proxy Voting Guidelines</a> explicitly state the Fund's positions with respect to climate risk issues (pages 18-19). NYSCRF is in the process of revising its formal policies to incorporate references to methods of assessing and implementing climate change risk and opportunity in investments.</p> <p><b>Recommendation:</b> While the Fund's current actions already demonstrate a commitment to ESG integration and climate risk management, moving forward we encourage the Fund's ongoing effort to develop formal policy documents which delineate its approach to ESG risks and opportunities including those related to climate change in its investment activities. Quantitative and qualitative metrics should be embedded in policies where possible to support periodic progress reviews and could include references to the following: risk constraints based on ESG metrics, measures of compliance with ESG investing procedures and measures of resources needed to carry out ESG evaluations.</p>

<sup>11</sup> Page 19 states "The Fund believes that environmental responsibility is a necessary element of doing good business, and supports efforts aimed at preservation of the environment. The Fund's policies related to global warming are based on the assumption that corporations that address these issues responsibly, fully and transparently are likely to experience sustained growth in financial performance."

3. PROCESSES

Portfolio Specific



**Status:** In general NYSCRF utilizes robust ESG investment and engagement processes, the effectivity of which is limited primarily by resource constraints. In the Fund’s investment process ESG considerations – including those related to climate change – are embedded throughout from initial review through to approval:

- **ESG Manager Surveys and Meetings:** All prospective and current managers are surveyed regarding their consideration of ESG issues. Survey questions include several related to climate change.
- **ESG Research:** Corporate Governance provides *ad hoc* support to the asset class teams by conducting due diligence on ESG issues with the end goal of Incorporating ESG evaluation into each investment recommendation.
- **ESG in Recommendation Memos:** Every portfolio manager when making an investment recommendation is required to include in its memo a section on ESG risks and opportunities (supported by Corporate Governance). ESG and climate considerations vary widely depending on investment class/sector.
- **Sustainable Investment Subcommittee:** Cross asset-class group meeting monthly to discuss sustainable investment issues with a particular focus on climate change and carbon risk; ensures broad awareness across investment team of sustainable investment practices/processes.

In addition to the above the Comptroller maintains an Investment Advisory Committee (IAC) and a Real Estate Advisory Committee (REAC). REAC is part of the chain of approval that must sign off on real estate investment decisions including sustainable investments before they reach the Comptroller for final approval. IAC assists in the reviews of CRF investment strategies and provides investment advice (including sustainable investments) to the Comptroller. On the engagement side, resolutions and voting strategy are set late summer/early fall of each year. As respects the former, in 2015 Corporate Governance focused on climate risk & sustainability resolutions (39% of total resolutions). The resolution process also benefits greatly from NYSCRF’s affiliation with a variety of outside membership organizations including CERES (INCR), PRI and CII.

As respects proxy voting, the published guidelines are based on the Fund’s view of best practices in corporate governance and encompass a variety of issues including climate risk. Some efforts have been made to maximize the use of internal resources by providing its proxy vendor with more voting rules to make current in-house proxy voting more efficient.

**Recommendation:** To provide further support to portfolio managers the Corporate Governance team should consider developing greater and more consistent ESG research capabilities across asset classes. While this effort is already underway given recent ESG research procurement from a third-party provider, current resourcing levels might make it difficult for NYSCRF to maximize this data to the fullest extent possible. Supplemental analyst-level resources to support this research function may be beneficial.

Additionally consistency of climate change risk integration into due diligence processes should be sought across asset classes and sectors. To do this effectively NYSCRF should establish resourcing needs to incorporate climate risk within current investment procedures including portfolio risk management; and manager selection and monitoring. Developing a consistent framework for climate risk assessment and opportunity identification will also serve to facilitate data collection, reporting and communication of related progress to stakeholders (e.g. in future Green Strategic Investment Reports).

	<p><b>Systemic (Market-Wide)</b></p> 	<p><b>Status:</b> NYSCRF is well represented at industry forums and membership groups including: UN PRI (a signatory); the Comptroller’s Office participating on the board of Ceres and CII and staff being active in INCR, etc. NYSCRF also does well to leverage these networks to the benefit of the Retirement System’s members by signing onto industry/regulatory letters proposed/drafted by these groups and cosigning resolutions (e.g. those referencing the <a href="#">Ceres Principles</a>).</p> <p><b>Recommendation:</b> Continue to encourage mandatory company reporting on climate risk and related metrics. Also consider engaging (supra)national bodies to encourage regulations that enable capital to flow easily into climate mitigation and adaptation as well as appropriate valuation of natural capital (aka ecosystem services).</p>
<p>4. PORTFOLIO</p>	<p><b>Risk Assessment</b></p> 	<p><b>Status:</b> While completion of this tailored report represents a significant step toward best-practices assessment of climate risk, NYSCRF is also exploring the conduct of carbon analytics. This assessment would cover the Fund’s global equities only at this point.</p> <p><b>Recommendation:</b> Complete carbon risk assessment at the strategy and portfolio levels with company-level detail. NYSCRF should also look to assess (or ask its managers to assess) the geographic exposure profile of Real Estate and Real Asset classes and Private Equity (where NYSCRF’s stake is controlling and insurance procurement can be influenced) as these risks are highly susceptible to the physical impacts of climate change and the presence of adequate insurance given their underlying physical exposure characteristics. NYSCRF should continue to monitor the efforts of credit rating agencies to address climate change risk in their assessments of debt issuers and review existing manager approaches across asset classes to ensure climate-risk analysis is integrated into their processes. This can be supplemented by possible holdings-level and strategy-level analysis using external research provider data.</p>
	<p><b>Risk Reduction, Transfer, Hedging</b></p> 	<p><b>Status:</b> NYSCRF is currently developing a low carbon investment strategy, which will be aligned with its engagement strategy.</p> <p><b>Recommendation:</b> Rebalance/reallocate and adapt portfolios to reduce downside risk. For passively managed strategies this could involve tilting away from carbon-intensive assets using low-carbon index-linked funds, other “smart beta” approaches or even exclusionary techniques (e.g. ex Thermal Coal). For actively managed strategies, ESG integrated funds, broad sustainability oriented funds or thematic funds (e.g. water, renewables, agriculture) all could offer potential downside protection against climate risk as well as related opportunity capture. Some investors have also adopted synthetic hedging strategies using derivatives<sup>12</sup>.</p> <p>To govern the use of such alternative investment approaches, it may be helpful to consider portfolio-level targets (e.g. level of decarbonisation or level of sector exposures), and reinforce these portfolio actions with related engagement actions. Going forward NYSCRF should show preference for managers that integrate climate analysis and active ownership in their investment process. More due diligence related to these various alternative climate risk management approaches and how they might fit into NYSCRF’s portfolio should be explored subject to available research and resources.</p>

<sup>12</sup> For a discussion of one approach, see: <http://www.corporateknights.com/channels/responsible-investing/make-killing-shorting-coal-companies-14279976/>. In addition to the Total Return Swap discussed in this article investors have also successfully used weather/catastrophe derivatives to protect weather/catastrophe-sensitive investments (often in renewable energy), credit default swaps to protect debt holdings and carbon markets.

<p><b>Identify Opportunities</b></p> 	<p><b>Status:</b> Through its Green Strategic Investment Program (GSIP) NYSCRF has identified and invested in a variety of opportunities across asset classes which capitalize upon climate change opportunities.</p> <p><b>Recommendation:</b> Beyond the GSIP, NYSCRF has an opportunity to develop a strategic total-fund approach to identifying and vetting sustainable investment opportunities across asset classes (e.g. beyond just those classified as green) and to monitoring them once they are in the portfolio. Defining a total portfolio approach to sustainable investing – including what criteria constitute a sustainable investment – and allocating strategic capital to such opportunities would be useful toward enabling portfolio ESG and climate change risk management practices.</p> <p>Opportunities arising from climate change fall broadly into both mitigation (green) and adaptation (resilience) themes. NYSCRF has a solid portfolio of green investments already but their role in the Fund’s overall asset allocation framework could be clarified (e.g. whether they are positioned for risk management, opportunity capture or both). Additional effort could also be made to engage in climate resilience investing, perhaps with a focus on alleviating New York’s specific potential vulnerabilities. This could entail strategies across asset classes that invest in resilient/sustainable infrastructure development/management, sustainable real estate, companies financing climate risk transfer innovation (e.g. ILS/microinsurance), etc.</p> <p>NYSCRF should continue to explore passive fixed income (e.g. green bond indices) and consider other methods of accessing and growing the Green Bond and other impact-oriented debt markets subject to availability. In private markets there are numerous examples such as clean-energy infrastructure, low-carbon transport, dedicated timberland funds, clean tech, unlisted infrastructure projects, etc. many of which NYSCRF has already accessed.</p>
<p><b>Engage Investment Managers</b></p> 	<p><b>Status:</b> NYSCRF utilizes a substantial and detailed compliance questionnaire to assess manager views with respect to a variety of ESG issues. This survey is supplemented by individual meetings focused on ESG issues.</p> <p><b>Recommendation:</b> While proxy voting practices are surveyed, engagement practices do not appear to be. It would also be beneficial to require investment managers to provide information on their engagement approach to climate-specific risks and opportunities. Once the information is being reported, additional steps can be considered accordingly. NYSCRF should also consider leveraging external ESG research/data to assess manager advancement with respect to ESG integration more generally.</p>
<p><b>Engage Companies</b></p> 	<p><b>Status:</b> NYSCRF has comprehensive proxy voting guidelines and a shareholder resolution strategy in place both of which identifies and emphasizes climate risk.</p> <p><b>Recommendation:</b> Continue focusing engagement efforts towards greater disclosure of climate risk information and strategies by opaque companies. To improve the impact of engagement activities NYSCRF might consider basing engagement priorities in part on quantitative measures of Fund exposure (largest holdings) and potential to influence change (e.g. % of company owned). Once reporting is in place, additional steps can be considered accordingly (e.g. if/when to underweight a position if a company is non-responsive). NYSCRF might also consider selecting/encouraging external managers based on their ability to engage on related issues.</p>

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## APPENDIX A – Study Participants

### Partners

- Allianz Climate Solutions GmbH – Germany
- Baillie Gifford & Company – UK
- BBC Pension Trust – UK
- British Telecom Pension Scheme (BTPS) – UK
- California State Teachers' Retirement System (CalSTRS) – US
- Church of England National Investing Bodies – UK
- Connecticut Pension Fund – US
- Construction and Building Industry Super (Cbus) – Australia
- Credit Suisse – US
- Environment Agency Pension Fund (EAPF) – UK
- Första AP-fonden (AP1) – Sweden
- Guardians of New Zealand Superannuation Fund (NZ Super) – New Zealand
- International Finance Corporation (IFC), a member of the World Bank Group – Global
- New York State Common Retirement Fund (NYSCRF) – US
- Queensland Investment Corporation (QIC) Limited – Australia
- State Super Financial Services (SSFS) – Australia
- The Department for International Development (DFID) – UK
- WWF-UK – UK

### Advisory Group

- Dr Rob Bauer, University of Maastricht – Netherlands
- Dr Barbara Buchner, Climate Policy Initiative – Italy/Global
- Sagarika Chatterjee, Principles for Responsible Investment (PRI) – UK
- Paul Dickinson, Carbon Disclosure Project – UK
- Nathan Fabian, Investor Group on Climate Change – Australia/Global
- Mark Fulton, Carbon Tracker Initiative/ CERES/ Energy Transition Advisors – US/ Australia
- Dr Noah Kaufman, WRI (formerly NERA) – US
- Sean Kidney, Climate Bonds Initiative – UK / Global
- Bob Litterman, Financial Analyst Journal/ Asset Owners Disclosure Project – US
- Nick Robins, UN Environment Programme – UK
- Mike Wilkins, Standard & Poor's Ratings Services – UK
- Dr Paul Wilson, RMS – UK
- Helene Winch, Low Carbon (formerly PRI) – UK

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## APPENDIX B – Low Carbon Indices

A number of low-carbon variants of broad market indices have become available over the recent past<sup>13</sup>. Benefits of these indices are that they are relatively straightforward and transparent (i.e. asset owners can point to a clear carbon reduction and impact) and inexpensive (albeit more expensive than broad market indices).

Beyond practical issues (such as cost, accessibility and performance), the key questions investors must consider is whether these indices will serve as downside protection in the face of rising carbon prices, and thus offer an effective hedge for passively managed equities. In a world where the cost of carbon is likely to rise then having less exposure to high carbon companies is intuitive, although it may not always be this straightforward. Two key points should be made here:

- A lower carbon footprint (including both current emissions as measured on CO2 emissions/sales and potential emission from fossil fuel reserves as measured on CO2 emissions/market cap), may not necessarily translate to lower operating cost (and thus relatively higher operating profits). Where demand is inelastic, suppliers may be able to push this cost to consumers, as may be the case for some utilities.
- Existing indices are based on Scope 1 and Scope 2 emissions (which cover direct emissions owned by the company and indirect emissions resulting from energy use by the company). In some cases, such as automotive, the critical measurement is actually Scope 3 (indirect emissions not owned by the company but related to the company's activities). Data on Scope 3 emissions is less prevalent, which may result in misrepresenting the actual net carbon benefit (or deficit) of a company. It should be noted that Scope 3 data is broadly available for the automotive sector and an improvement upon current indices could be to incorporate Scope 3 for this sub-sector.

Additional things to recognize about these indices are that:

- To date, they are based on market cap weighted methodology, and therefore bring with them the same concerns that core benchmarks have in this context (i.e. that investors end up with more exposure to overvalued companies as price fluctuates)
- They do not necessarily capture the opportunity side of the equation (i.e. by shifting from high carbon to lower carbon companies, investors may not necessarily gain exposure to companies leading on the development or provision of products/services best positioned to succeed in a lower carbon environment).

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<sup>13</sup> Low-carbon versions of numerous indices are available from the large passive index providers.

- Currently, index providers do not provide in-depth shareholder engagement on climate risk management as a supplement to index provision. This would be a welcome addition to the current offerings, and is likely to evolve based on client demand and feedback.

Given the above considerations, low-carbon indices may not necessarily bring an outperformance premia in the traditional sense – i.e. the premia is low carbon rather than performance. With a low tracking error to the benchmark, that should be ok; however clients should be aware that during periods of extreme stress or market dislocation that the performance of the low carbon indices could deviate significantly from the mainstream benchmark. For example, during 2014 when oil prices declined significantly, low carbon indices performed strongly relative to their parent indices; however, this performance could reverse during periods of strong energy sector performance and rebounding oil prices.

In closing, while low-carbon indices are not a perfect hedge against future uncertain carbon pricing, they do provide an interesting tool for long-term investors. We believe that NYSCRF should consider re-allocating some of its passive equities towards a low-carbon index variant, if it is aligned with one or more of the following statements:

- a) We believe that action towards climate change mitigation will occur, resulting in some (meaningful) higher price on carbon over the coming 5 year period
- b) We believe that climate change mitigation is beneficial to capital markets and System members over the medium to long run
- c) Our stakeholders would like to see us clearly manage climate risk, both in our investments and through our actions as a financial sector stakeholder.

We would be pleased to discuss low-carbon index options in further detail with NYSCRF.

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## APPENDIX C – Thematic managers

The opportunity set within listed equity sustainability themes is primarily focused on: water (such as water infrastructure, technologies, and utilities); renewable energy and energy efficiency; food and agriculture; and broad sustainability, capturing some or all of the aforementioned themes in addition to social demographics (such as health, education, and other goods and services).

The majority of the global sustainability-themed and pure-play strategies that we have reviewed currently fit more closely into the broad market or small cap categories within our portfolio construction framework. The following schematic depicts Mercer’s view on the role of thematic managers in portfolio construction.

**Figure 22: The role of sustainability in equity 2.0**



Potential diversification benefits from investing in sustainability themes can include the following, although not all “sustainability-oriented” strategies will necessarily reflect each of these themes:

- Long-term investment horizon — managers highlight that the risk/return trade-off for sustainability themes can be more compelling with a longer time horizon as the macro drivers take effect.

- Exposure to stocks with low coverage — many of the niche and broad sustainability-themed strategies tend to have low overlap with broad benchmarks, such as the MSCI World Index, ranging from 10%–30%.
- Emerging technologies — small cap stocks can offer exposure to emerging technologies as many companies tend to be new and pure play.
- Exposure to stocks with revenue opportunities identified as those typically under-appreciated or under-recognized by the market — for example, the impact of stranded carbon assets, the impact of “fat taxes” on the food and drink industry, and opportunities in healthy foods and healthy lifestyles.

We would be pleased to discuss the merits of including one or more sustainability-themed managers in NYSCRF’s Global Equity portfolio.

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