

# INVESTING IN A TIME OF CLIMATE CHANGE

GUARDIANS OF NEW ZEALAND  
SUPERANNUATION FUND (NZ SUPER)  
PORTFOLIO CLIMATE RISK ASSESSMENT

October 2015

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## 1

## Executive Summary

The Guardians of New Zealand Superannuation Fund (NZ Super) 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 impact in the long term. But to address it, and avoid dangerous temperature increases, change is needed now. The extent to which this change 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 banks. The Study also benefitted from the input of an advisory group comprised of renowned experts in the fields of investment and climate finance. Appendix C 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 report includes a short overview of the Study in Appendix D, but is focused on the key findings and implications for NZ Super.

### NZ SUPER – ACTIONS AND MOTIVATIONS

NZ Super has already taken a number of steps in managing environmental, social and governance (ESG) risks and opportunities. NZ Super has:

- A long-standing commitment to Responsible Investment, as outlined in the publically available Framework, which aligns with the UN Principles for Responsible Investment (PRI). This is a framework for integration throughout the investment process, including investment manager monitoring.
- Established a number of ESG-related investment beliefs.
- Added climate specific expertise to the team and begun an extensive climate change project to review climate integration across its activities.

The motivations for joining the Study were to:

- Gain a broader understanding of climate risk and opportunity, and how these interact with the asset classes and sectors to which NZ Super has exposure.
- Determine portfolio specific climate positioning for NZ Super, identifying relevant risks and opportunities.
- Develop a series of specific steps which NZ Super can take to evolve its investment approach in the context of climate change, in order to optimise risk-adjusted returns for members over the long term.
- Work collaboratively with others to progress an approach to climate risk and opportunity – a topic too rich and complex to solve as a single organisation.

NZ Super also has legislated guidelines to avoid prejudice to New Zealand’s reputation in the world community. Participation in this Study aligns with New Zealand’s climate change commitments and ambitious INDC’s ahead of the 21<sup>st</sup> Conference of the Parties in Paris in December.



## KEY FINDINGS FOR NZ SUPER

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 implications for NZ Super. Portfolio impacts are considered across the total fund, at the asset class and industry sector levels.

The four climate change scenarios and the four risk factors are explained in detail in Appendix D but can be summarised as follows:

### CLIMATE SCENARIOS:

1. *Transformation*: More ambitious climate-change mitigation action that puts us on a path to limiting global warming to 2°C.
2. *Coordination*: Policies and actions are aligned and cohesive, keeping warming to 3°C.
3. *Fragmentation (Lower Damages)*: Limited climate action and lack of coordination result in warming rising to 4°C.
4. *Fragmentation (Higher Damages)*: As above, coupled with assumed higher damages.

### CLIMATE RISK FACTORS (TRIP FACTORS):

1. *Technology*: Broadly defined as the rate of progress and investment in the development of technology to support the low-carbon economy.
2. *Resource Availability*: Defined as the impact on investments of chronic weather patterns (e.g. long-term changes in temperature or precipitation).
3. *Impact of Physical Damages*: Defined as the physical impact on investments of acute weather incidence/severity (i.e. extreme or catastrophic events).
4. *Policy*: Broadly defined as all international, national, and sub-national targets; mandates; legislation; and regulations meant to reduce the risk of further man-made or “anthropogenic” climate change.

The key findings from the NZ Super portfolio analysis were as follows:

1. Total portfolio climate impacts on return for NZ Super range from -0.10%p.a. to -0.37%p.a. for the current asset allocation and from -0.09%p.a. to -0.55%p.a for the reference portfolio, for different scenarios over 10 and 35 years.
2. The current approximately 65% exposure to developed markets, emerging markets, and New Zealand equities could be better positioned under a Transformation (2°C) scenario, although the current portfolio is better positioned than the reference portfolio.
3. The actual return impact on the approximately 8% private equity allocation will depend on the underlying exposures, particularly in the case of a Transformation scenario.
4. The return impact on the combined 9% current exposure to timber and agriculture will also depend on the underlying location exposures, with differing impacts expected for each of the four climate risk factors over various time periods.
5. NZ Super’s regional equity exposure has a significant overweight Energy position, which is expected to be the most negatively impacted by climate change, and an overweight position to the Health sector, which is expected to be positively impacted by climate change.

## RECOMMENDATIONS FOR NZ SUPER

The Study recommends integrating climate considerations to achieve sustainable growth within the investment process, following a Beliefs, Policies, Processes and Portfolio framework. The Recommendations section of this report, Table 3, captures which of the Study's action recommendations NZ Super has already addressed, and where, given the findings, NZ Super could focus its next actions alongside other portfolio considerations.

We understand that recent appointments, such as Justine Sefton who brings climate specific expertise to the NZ Super Climate Change Project (the CC Project), will continue to evolve NZ Super's progress in integrating climate considerations within the investment process.

Of the recommended actions, we expect the following should be given the greatest priority for NZ Super to consider, recognising that a number of these are already on the list as part of the CC Project:

- **Beliefs and Processes:** Recognising climate explicitly within: existing Investment Beliefs; the Responsible Investment Framework; voting and engagement; and stakeholder reporting. Also considering adding the Montreal Pledge to the current industry initiatives that NZ Super participates in.
- **Portfolio Risk Assessment:** NZ Super has already commissioned carbon analysis from MSCI for equities and is looking at other providers for other parts of the portfolio. We

recommend that this includes an environmental and climate resilience assessment of timber and agriculture holdings (directly, or by requesting external managers to undertake this), as well as real estate and infrastructure investments.

- **Portfolio Risks and Opportunities:**

- **Passive Equities:** Reallocate a portion of the significant passive equities exposure to a low-carbon alternative. See Appendix A.
- **Active equities:** Ensure the overweight Energy industry sector is understood within the regional equity exposure. Consider introducing a thematic strategy focused on sustainability. Opportunities cover both mitigation and adaptation themes, including low-carbon investments, clean energy, water, agriculture, and broad sustainability themes. See Appendix B.
- **Review whether current exposures to emerging markets could be increased.**
- **Niche exposures:** A potential increase in the current allocation to insurance-linked securities and catastrophe bonds, bearing current valuations in mind.

# 2

## Analysis & Key Findings

Mercer has reviewed the climate risk exposures for NZ Super using our TRIP factor framework and considering the portfolio impacts under the four climate change scenarios. Results and commentary specific to each asset allocation are provided in the following pages, focusing on the following levels:

1. Total portfolio
2. Asset class
3. Industry sector

### CURRENT STRATEGIC ASSET ALLOCATION

Asset allocation details were provided as below. Our analysis and commentary pertain primarily to the current asset allocation, with some comparative comments on the NZ Super reference portfolio.

TABLE 1: NZ SUPER ASSET ALLOCATIONS

Asset Class	NZ Super - Current	NZ Super - Reference
Developed Market Global Equity	50.66%	65.00%
Emerging Market Global Equity	10.29%	10.00%
Regional Equity (NZD)	3.90%	5.00%
Real Estate (NZD)	1.50%	
Timber	6.00%	
Agriculture	3.00%	
Private Equity	8.00%	
Infrastructure	2.50%	
Hedge Funds	7.50%	
Fixed Income	0.00%	20.00%
Private Debt	2.00%	
High Yield Debt	2.00%	
Multi-Asset Credit	2.65%	
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>

## KEY FINDINGS

1. Total portfolio climate impacts on return for NZ Super range from -0.10%p.a. to -0.37%p.a. for the current asset allocation and from -0.09%p.a. to -0.55%p.a for the reference portfolio, for different scenarios over 10 and 35 years.

For the purposes of quantifying potential total portfolio impact, we assessed the aggregate impact of the TRIP factors under each climate scenario. NZ Super is reasonably well positioned under the Coordination and Fragmentation scenarios, but is potentially vulnerable under a Transformation scenario over the coming decade – where there could be a -0.37% p.a. impact on returns. The portfolio is less adversely affected under the other scenarios, but even the Coordination scenario, which has the least impact, is still expected to be -0.19% p.a. over ten years.

Over a 35 year period, the Transformation impact is reduced to -0.17% p.a. and is no longer the highest impact scenario. Fragmentation (Higher Damages) is expected to have a -0.23% p.a. impact on median returns over the 35 year time period, which is expected to become more significant beyond 35 years (as physical impacts increase).

If a Transformation scenario eventuates, the cumulative impact over ten years for every \$1 billion could be a \$68 million reduction. \$1 billion could reach \$2 billion with a 7.17% p.a. expected return versus reaching \$1.93 billion with a 6.80% p.a. expected return (i.e. 7.17% minus 0.37%).

2. The approximately 65% exposure to developed markets, emerging markets, and New Zealand equities could be better positioned under a Transformation scenario<sup>1</sup>, although the current portfolio is better positioned than the reference portfolio.

Given the 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.

Under this scenario:

- Both global developed market equities and New Zealand equities are expected to be negatively impacted. NZ Super can seek to address these risks by
  - Re-allocating a portion of the more than 80% passive equities exposures towards lower-carbon indices
  - Allocating a portion of active equities towards thematic manager(s) focused on sustainability and the low-carbon economy
- NZ Super could also look to increase the weight of emerging market equities, which are expected to be positively impacted under a Transformation scenario, or take other steps to further diversify its growth assets.

3. The actual return impact on the approximately 8% private equity allocation will depend on the underlying exposures, particularly in the case of a Transformation scenario.

- The estimated climate impact on returns for private equity is negative under Transformation, and marginally negative under the other scenarios.
- However, our analysis assumes a diverse range of private equity exposures and does not break out clean tech or other environmentally driven strategies, which would have positive Policy and Technology responses.
- Reviewing the underlying exposures in light of the climate risk factors is recommended for NZ Super.

<sup>1</sup> This is the most ambitious climate policy scenario, which is intended to keep temperature increases to within 2 degrees above pre-Industrial levels by 2100.

4. The actual return impact on the combined 9% current exposure to timber and agriculture will also depend on the underlying location exposures, with differing impacts expected for each of the four climate risk factors over various time periods.

- The impacts of climate change would be region specific, but overall, we would expect positive Policy and Technology responses in a Transformation scenario. For timber this is based on an increase in the price of timber product prices, land values, and the premium attached to carbon trading-related activities, plus a shift towards more sustainable forestry products, although compliance and monitoring costs may increase. For agriculture, policies are expected to promote sustainable crop methods, reducing the risk of disrupted production and substantial capital is expected to be made available to assist emerging market countries with respect to adaptation in farming methods.
- Resource Availability and Impact are, however, expected to have negative impacts under the other scenarios, particularly Fragmentation (Higher Damages) over time, with drought having the greatest impact.

5. NZ Super's regional equity exposure has an overweight to Utilities, Materials, and Industrials which are expected to be the most negatively impacted by climate change, and an overweight position to the Health sector, which is expected to be positively impacted by climate change. Underweight positions are held in other sectors expected to have negative climate change impacts, such as Energy in particular.

- NZ Super should ensure that the underlying holdings within sectors expected to have negative impacts are well understood internally and discussed with appointed investment managers, given the potential risk in this sector.



1. TOTAL PORTFOLIO RETURN IMPACTS BY SCENARIO

For the purposes of quantifying total fund impact, we have assessed the aggregate impact of each scenario on the NZ Super current allocation and reference portfolio, as shown below. This highlights NZ Super’s vulnerability under a Transformation scenario over 10 years, given the current allocation is dominated by equities and growth oriented assets, but a consistent return drag is expected across all scenarios, with the greatest impact over 35 years under a Fragmentation (Higher Damages) scenario.

FIGURE 1: ANNUAL MEDIAN RETURN IMPACT OVER 10 (TO 2025) YEARS

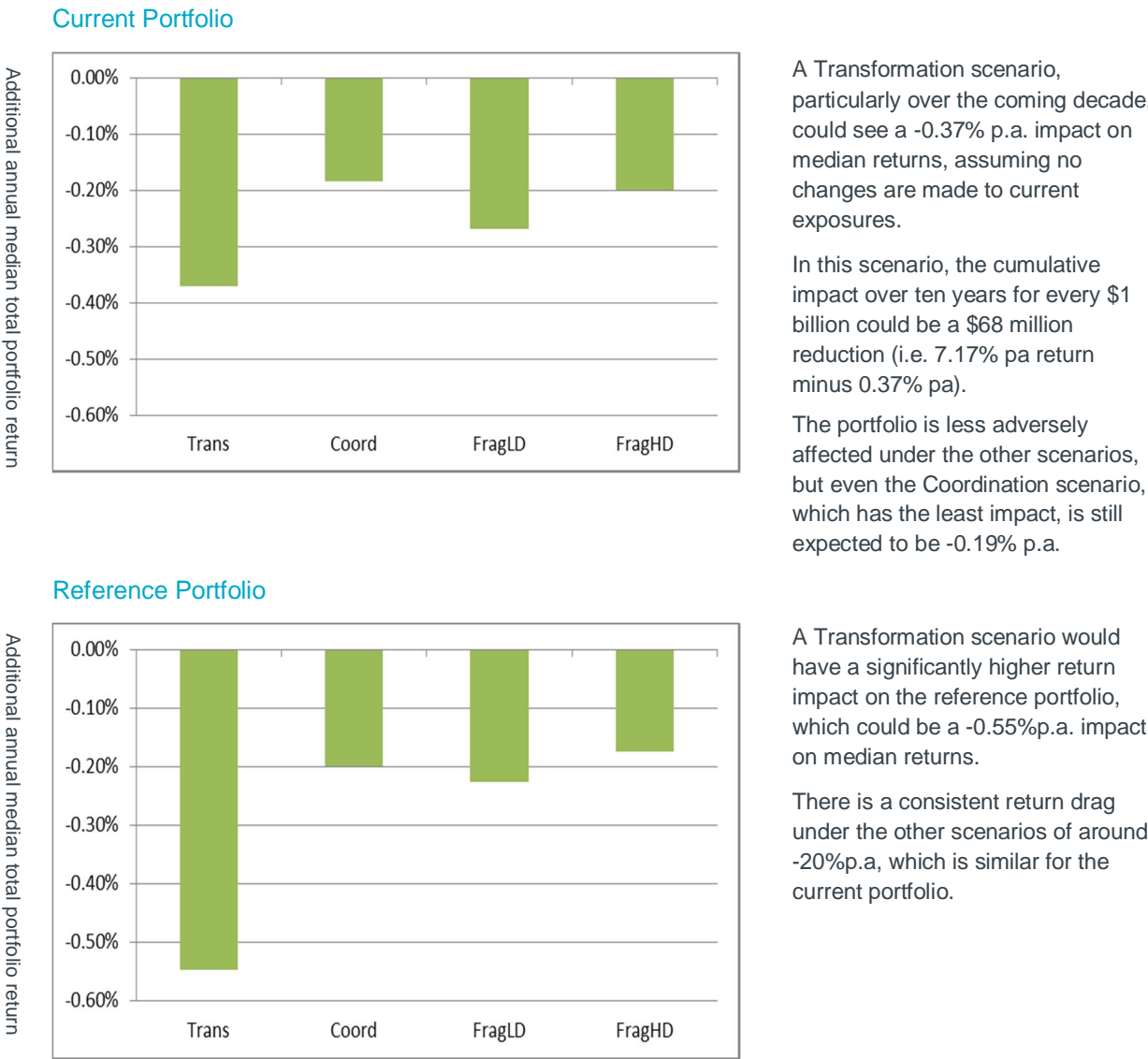
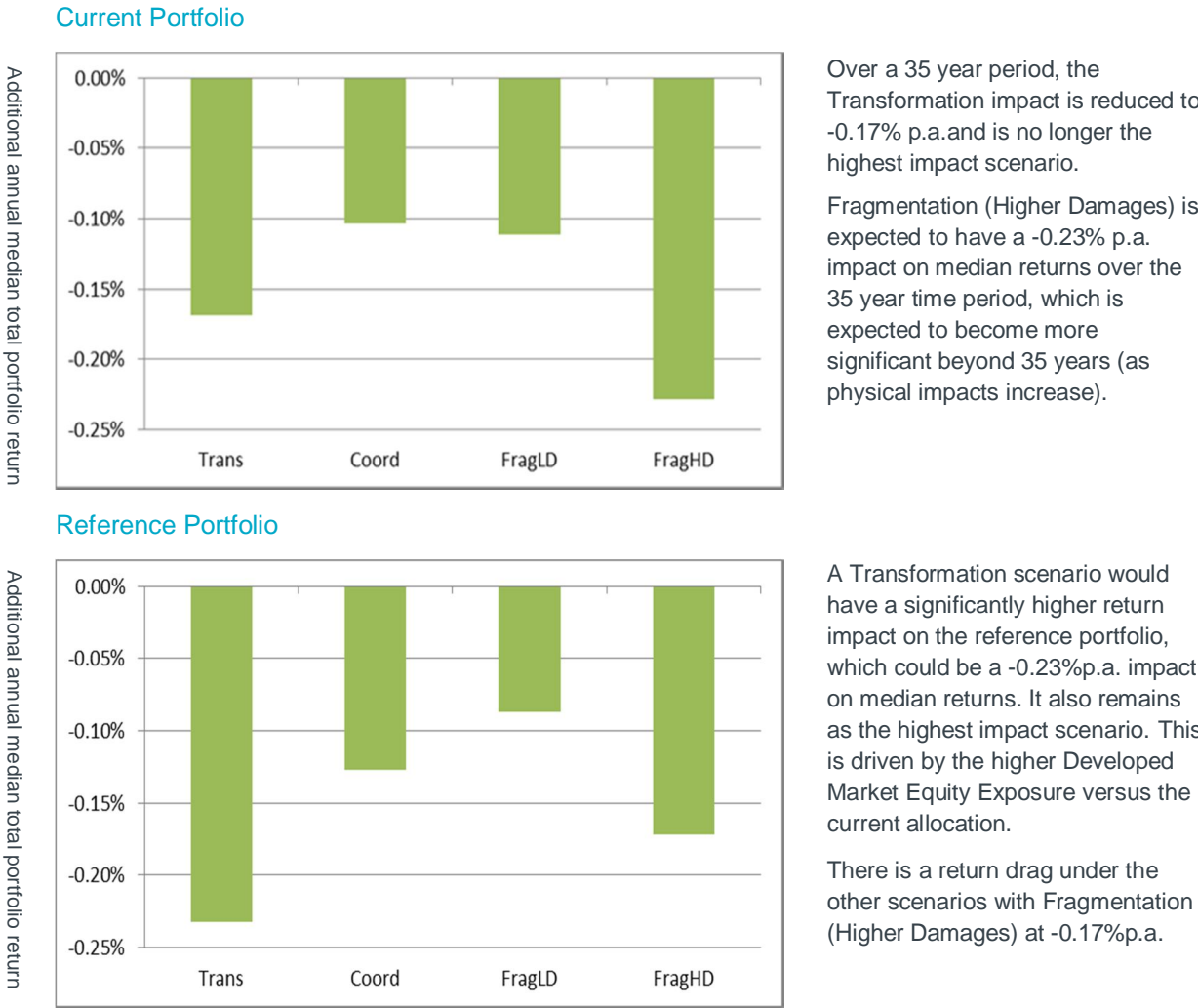


FIGURE 2: ANNUAL MEDIAN RETURN IMPACT OVER 35 (TO 2025) YEARS



## 2. ASSET CLASS IMPACTS

The circle charts on the following pages illustrate where asset classes are expected to experience a gain or reduction in returns, when considering climate risk, for the current portfolio.

The black circle represents a total portfolio, with the width of each asset class section representing the respective percentage weighting.

Asset class sections that are expected to experience a reduction in returns under a specific scenario will move towards the centre of the circle, and asset class sections that are expected to experience additional returns will move outwards from the circle.

### ASSET CLASS IMPLICATIONS – NZ SUPER CURRENT PORTFOLIO (DATA OVER 10 & 35 YEARS)

- NZ Super could be better positioned for a Transformation scenario. This is driven by the combined approximately 50% exposure to New Zealand and developed market global equity. These losses will be partly offset by potential annual gains in emerging market equity and real assets under this scenario. It should be noted, the more diversified current portfolio is better positioned than the reference portfolio would be.

#### Negative return impacts at the asset class level – Transformation Scenario

Asset Class	10 year – median annual returns	35 year – median annual returns
Global Equities	-0.82%	-0.42%
Regional (NZ) Equities	-0.72%	-0.44%
Private Equity	-0.83%	-0.48%

- The negative returns on the above asset classes will be partly offset under the same scenario (**Transformation**) by potential increased returns in the following asset classes:

#### Positive return impacts at the asset class level – Transformation Scenario

Asset Class	10 year – annual returns	35 year – annual returns
Emerging Market Global Equities	+0.50%	+0.43%
Real Estate (NZD)	+0.45%	+0.35%
Infrastructure	+0.76%	+0.62%
Timber	+0.49%	+0.61%
Agriculture	+0.66%	+0.83%

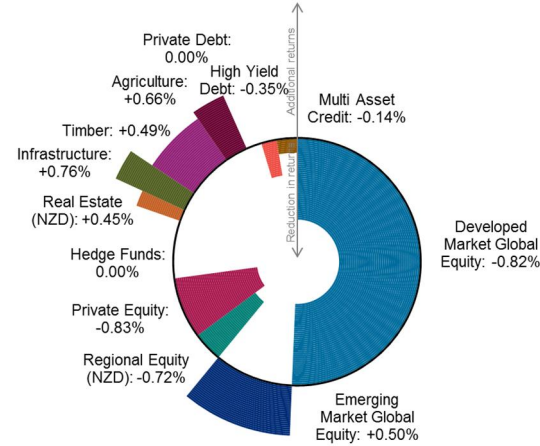
- The Coordination scenario sees less significant annual reductions, with global equities (still - 0.30%p.a.) impact on average 10 year returns more negatively exposed to return reductions than New Zealand equities under this scenario. This is because the global and regional equity figures were built from their bottom up sector exposures and New Zealand equities have substantially lower exposure to Energy in particular.
- The Fragmentation scenarios are both negative across all asset classes, with the Higher Damages variant resulting in more negative impacts over the 35 year period, particularly for timber and agriculture, as the Resource Availability impacts become more apparent.

- Under the Fragmentation (Higher Damages) scenario, in the early couple of decades, there will be gains to yields given temperature changes in some regions. To account for this the Resource Availability scripts are actually lower than in Fragmentation Lower Damages through to 2040. This means the combined negative effect of R and I factors are smaller in Fragmentation (Higher Damages) than Fragmentation (Lower Damages) for timber and agriculture for the ten year numbers.
- No climate impact on return is expected for the current 7.5% allocation to hedge funds and minimal impacts to the remaining smaller allocations. This is based on a generic reading of hedge funds. However, given NZ Super has some exposure to Natural Catastrophe Reinsurance, these would be expected to have positive climate sensitivity. More on this is captured in pages 21 and 22 for potential additional opportunities.

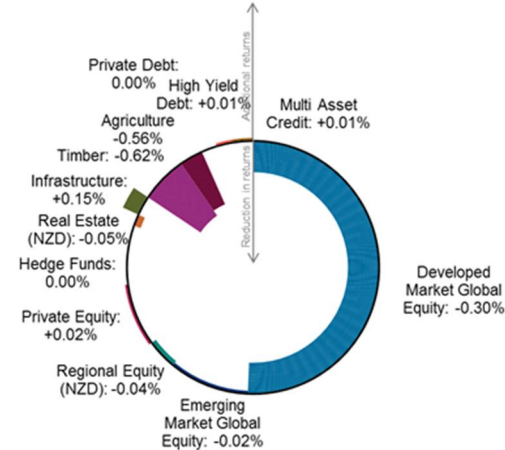
Refer to the Figure 3 and 4 circle charts on the following page.

FIGURE 3: NZ SUPER CURRENT ASSET ALLOCATION (data over 10 years)

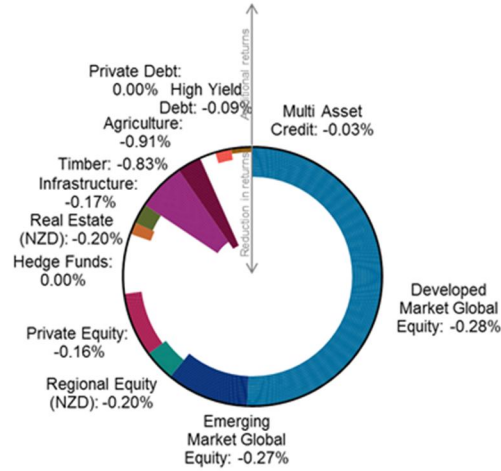
Transformation



Coordination



Fragmentation – Lower Damages



Fragmentation – Higher Damages

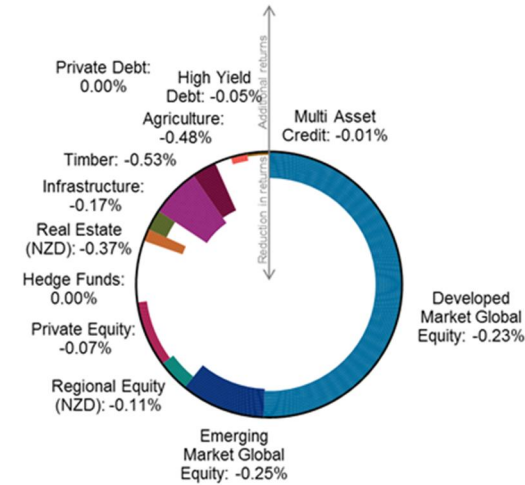
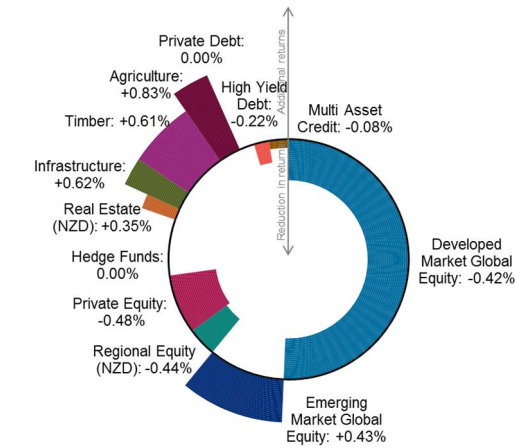


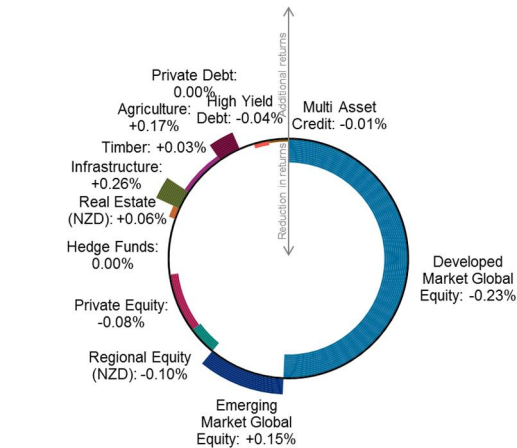


FIGURE 4: NZ SUPER CURRENT ASSET ALLOCATION (data over 35 years)

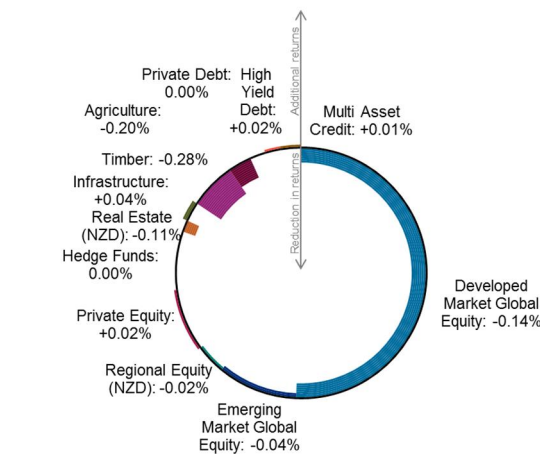
Transformation



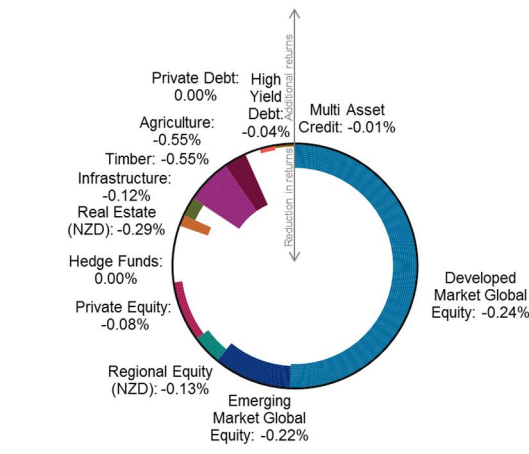
Coordination



Fragmentation – Lower Damages



Fragmentation – Higher Damages



## 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 NZ Super 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 the Technology risk factor:
  - If NZ Super is anticipating a **Transformation** scenario, equal focus should be placed on managing Policy risk in domestic and global equities.
  - 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 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 results in an appropriate focus on environmental risk management versus policy risk management from an equities perspective. The Fragmentation scenarios would also more heavily impact real estate and infrastructure holdings, which warrant increased risk assessment.

Further detail is provided in the recommendations and next steps re managing the potential risks, particularly under a Transformation scenario.

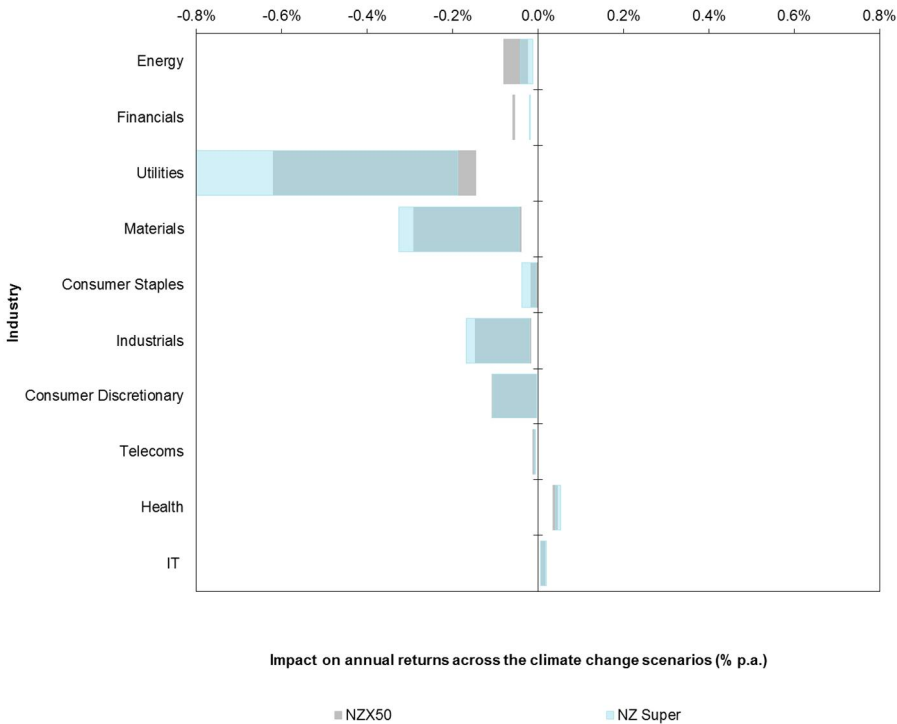
3. INDUSTRY SECTOR IMPLICATIONS

Consistent with the findings in the public report, the impact on different sectors varies widely but can be significant.

NZ Super has around 85% exposure to passive and 15% exposure to active equities across the international and regional (New Zealand) developed market equities exposure. Charts for the regional active manager exposures are below.

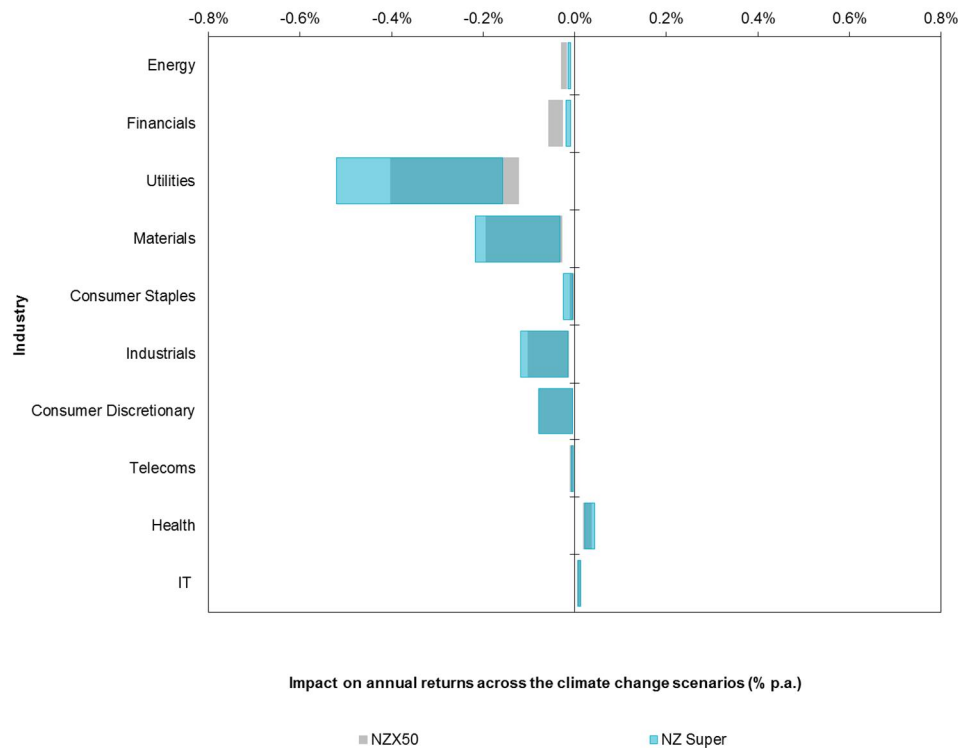
The charts show the range, across the four climate change scenarios, of the potential impact on annual median sector returns against benchmark over both 10 years and the 35 year time-frame of the study. The impact figures in these charts reflect a combination of the climate return impact and the weighting for each industry sector. The darker blue shows the overlap between the portfolio sector exposure in light blue and the benchmark exposure in grey.

FIGURE 5: ACTIVE REGIONAL MARKET EQUITIES: INDUSTRY LEVEL ANALYSIS  
Median annual return impact over 10 years (to 2025)



NZ Super's active regional market equity managers have significantly higher exposure to Utilities, Materials, and Industrials which are expected to be negatively impacted by climate change. An underweight position to Energy, which is also expected to be the most negatively impacted, is positive from a climate perspective.

**FIGURE 6: ACTIVE REGIONAL MARKET EQUITIES: INDUSTRY LEVEL ANALYSIS**  
Median annual return impact over 35 years (to 2050)



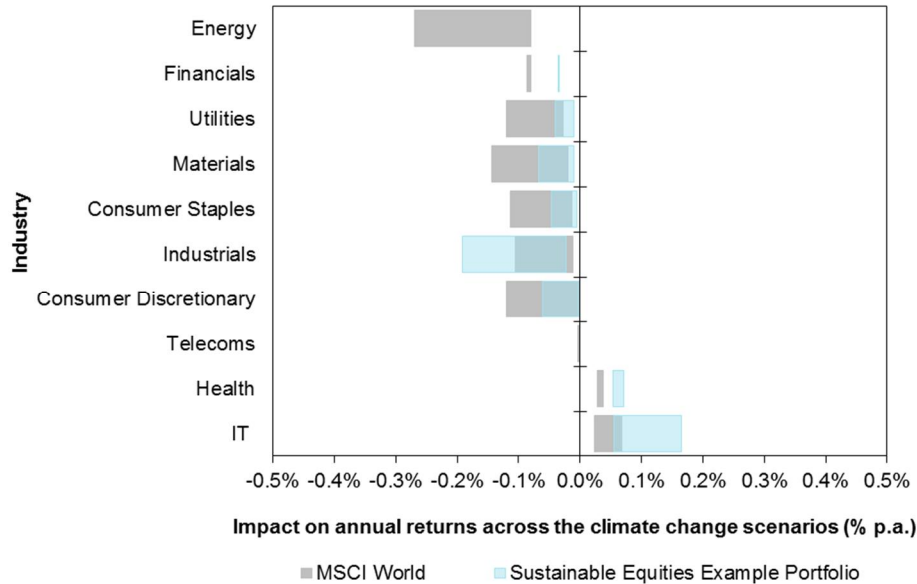
The potential sector impacts narrow over the 35 year time period, but Utilities and Materials are still the largest possible return loss versus benchmark. NZ Super should ensure that the underlying holdings within this sector are well understood.

## SECTOR EXPOSURE OF SUSTAINABILITY THEMED MANAGERS

The following chart displays the sector exposure of a group of three global equity sustainability-oriented thematic managers versus the MSCI World. As is apparent, the climate sensitivity of the combined sector weights of these managers is lower than the benchmark, as well as than the combined profile of NZ Super's actively managed equity holdings. 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 NZ Super's equity exposure.

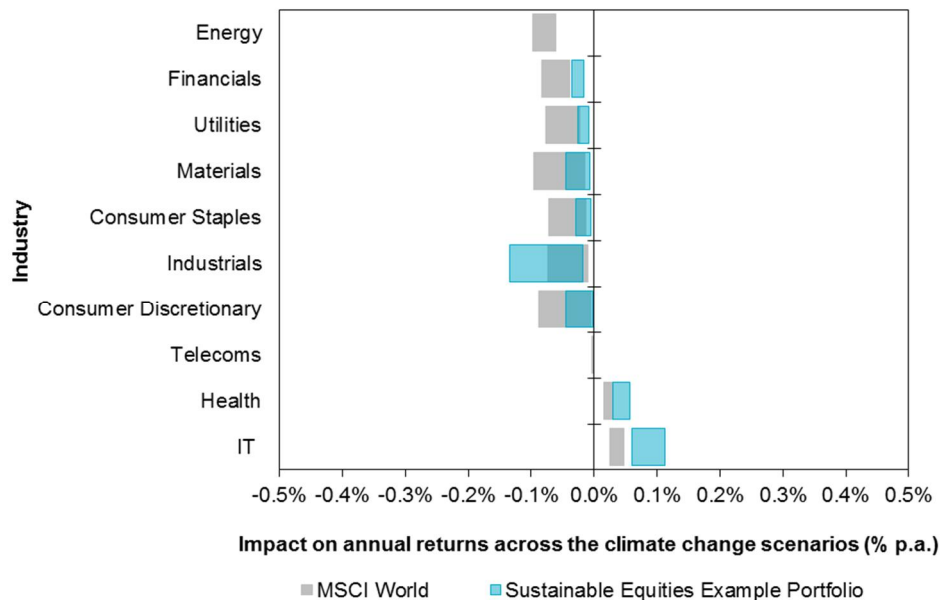
FIGURES 7 & 8: SAMPLE SECTOR PROFILE OF THREE SUSTAINABILITY-THEMED GLOBAL EQUITY MANAGERS

10 years



As is apparent, this group of sustainability themed global equity managers have lower exposure to the sectors that would be 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 will focus on companies providing solutions to the low-carbon economy.



## REAL ASSETS INVESTMENTS – SUPPLEMENTARY ASSET ALLOCATION DETAIL

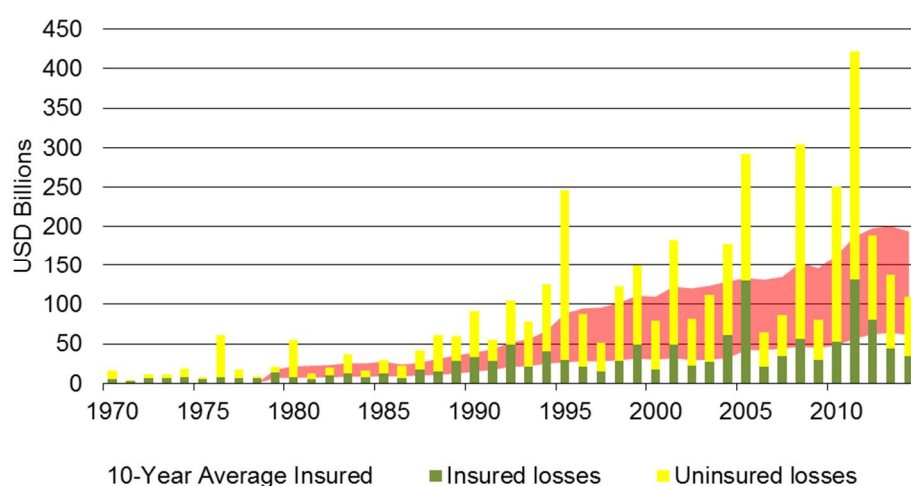
Real asset investments offer investors a variety of attractive attributes, such as a higher return profile than typical fixed income options and a relatively low correlation to broader fixed income and equity markets. However, by virtue of their direct and tangible exposure to the physical manifestations 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. On the other hand their exposure to climate policy action and resultant investment flows into low-carbon technology is largely positive. Agriculture and timber have the widest-ranging impacts, dependent on the scenario, as they have negative sensitivity to Impact and Resource Availability factors as well as positive Policy sensitivity.

FIGURE 9: REAL ASSET CLASSES – TRIP FACTOR SENSITIVITY

ASSET CLASS SENSITIVITY	T	R	I	P
GLOBAL REAL ESTATE	<0.25	0.00	-0.75	<0.25
INFRASTRUCTURE	0.25	>-0.25	-0.50	<0.25
TIMBER	<0.25	-0.75	-0.50	0.25
AGRICULTURE	0.25	-1.00	-0.50	0.25

Such push and pull results in large return variability across climate scenarios for real assets as depicted by the positive influence of the climate risk factors on Real Estate, Infrastructure, Timber and Agriculture performance under the two mitigation scenarios (Transformation and Coordination), and detraction of returns under the Fragmentation scenarios (as seen in the circle charts). This range of outcomes demonstrates a greater need for monitoring of real asset exposures at the portfolio level to ensure climate change risks – which are in this case largely location dependent – are being monitored and managed.

FIGURE 10: 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.

Source: Swiss Re Sigma 02/2015

The manner and method of monitoring these exposures and related protections will differ depending on the manner and method of investment utilised (e.g. direct investment vs. outsourcing to a fund manager and unlisted vs. listed exposures). These real 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.

NZ Super focuses its real asset investments as per the table below. We have provided further commentary on timber and agriculture, as the highest exposures. Further detail on the others is provided in the public report in the Asset Sensitivity chapter.

**TABLE 2: NZ SUPER ASSET ALLOCATION**

Asset Class	NZ Super
Real Estate (NZD)	1.50%
Infrastructure	2.50%
Timber	6.00%
Agriculture	3.00%
<b>Total</b>	<b>13.00%</b>

#### **Timber:**

The expected return drivers typically comprise three main components: the strategic risk premium, changes in timber prices, and active management. We would expect timberland investments to benefit from favourable climate policy shifts, based on an increase to the penalties for deforestation and increase in the price of timber product prices, land values, and the premium attached to carbon trading-related activities. Therefore, we would expect existing timberland assets to appreciate in value, whereas new assets will become more expensive to invest in.

With enhanced policy, we would also expect a shift towards more sustainable forestry products, as demanded by customers. We would anticipate compliance and monitoring costs to increase, with additional policy offsetting some of the beneficial price rises. More stringent climate policy would be expected to create incentives to reduce deforestation and protect native forests via initiatives such as the UN's Reducing Emissions from Deforestation and Forest Degradation Programme (REDD and REDD+), and we would expect the demand for sustainably harvested forest resources to increase.

Shifts in long-term temperatures will impact typical timberland growing patterns and locations, causing significant disruption to the sector. Climate change may also lead to increased incidences of timberland pestilence and disease, which have already started to manifest (most notably in Canada). Although timberland is largely insulated from coastal-related catastrophes, drought could have significant impacts, as could wildfire.

#### **Agriculture:**

The impacts of climate change on agriculture would be country specific, but at an overall asset class level, we would expect positive Policy and Technology responses in a Transformation scenario, with Resource Availability and Impact driving the negative impacts under the other scenarios.

Transformation policies are expected to promote sustainable crop methods. We would expect agriculture investments to benefit from technological development with respect to more productive and resilient crop varieties, and we would anticipate that more heat and drought tolerant crops would be introduced in order to improve the climate resilience and reliability of production.

Reducing the risk of disrupted production and substantial capital is expected to be made available to assist emerging market countries with respect to adaptation in farming methods. However, there is a risk that protectionist policies in response to food shortages could create unrest and additional geopolitical risk premium for agriculture investments.

Agriculture production is heavily susceptible to long-term shifts in regional weather patterns and water stress. In addition, the capacity of farmers to adapt is difficult to predict and strains on the value chain are likely to arise as a result of climate shifts. Similarly to timberland, agriculture is largely insulated from coastal-related catastrophes, but drought could have significant impacts.

#### FURTHER DETAIL ON POSITIVE POLICY RISK FACTOR SENSITIVITY

Agriculture is somewhat complex, particularly in relation to potential policy impacts. According to the Agriculture, Forestry and Other Land Use (AFOLU) mitigation chapter in the IPCC's Fifth Assessment report AFOLU represents 20-24% of global emissions making it the second largest sector emitter behind energy. Some forms of agriculture are indeed carbon intensive (especially beef/dairy), although this is less visible in our carbon intensity analysis since agriculture isn't included in the GICS taxonomy or given special attention by MSCI. Also, agricultural emissions (those not generated from fossil fuel combustion) are not always covered by proposed climate laws.

Additionally, the agriculture value chain is very different from the energy value chain:

- The agriculture distribution system differs from the energy distribution system meaning food shortages are typically less frequent (though more severe in terms of human costs) than power outages for instance.
- Consumers can more readily choose between different foodstuffs at the store whereas they cannot typically choose what type of energy they buy. This makes the agriculture sector much more susceptible to demand-side shifts (e.g. buy local, go vegan) than the energy sector.
- People can live without electricity but not without food.
- Farming is a key source of income for many low-income families.

All of these factors make predicting the influence of climate regulations on agriculture more difficult. Here is a summary of Policy factor pros and cons for agriculture:

- + Reduced climate uncertainty allows for proportionally more confidence/less volatility in agriculture investment, which is of course highly location dependent.
- + If temperatures change more dramatically so will growing patterns imposing a very high adaptation cost burden. Strong policy diminishes this cost burden.
- + Strong policy should be expected to increase the R&D budget for sustainable crop methods. This is especially true if a carbon pricing regime encapsulates the agriculture sector as it should precipitate the current trend toward less carbon intensive farming techniques.
- + Strong climate policy results in greater flows of Foreign Direct Investment (FDI) into emerging markets either in the form of mandated "reparations" from developed economies or because emerging markets become more attractive investment locales with the threat of heightened risk from CC lifted and necessary adaptation costs diminished. Since agricultural output represents a much larger portion of overall economic output in emerging markets this regional sector stands to gain substantively from these greater investment flows.
- + While cost-benefit analyses are mixed, over a long enough time horizon agriculture performs much better under transformation-like scenarios than under fragmentation-like scenarios since the payback from mitigation is more dramatic and happens quicker in this sector which is really on the front lines of the physical impacts of climate change. Some analyses show a low cost/benefit ratio as soon as 2030.

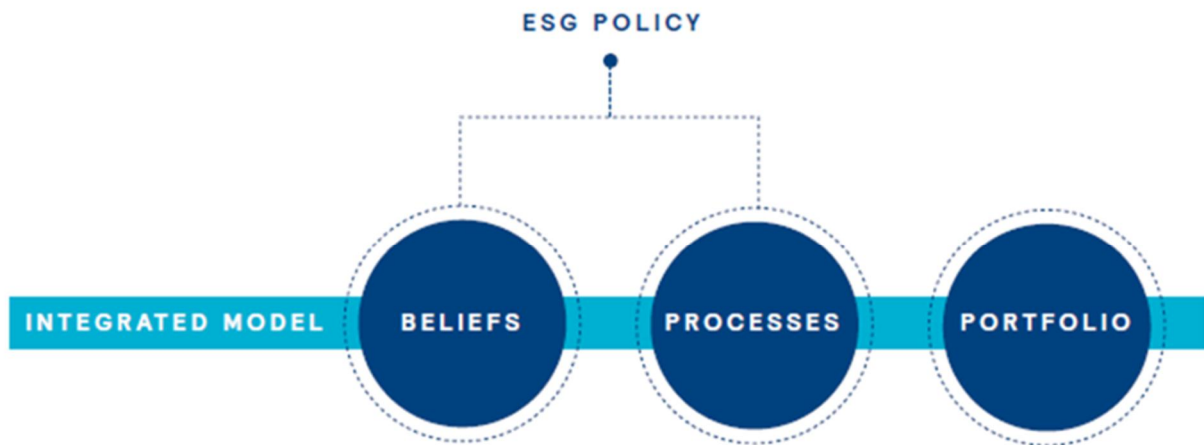
Offsetting these positives would be that the relatively high carbon emissions of the sector could be subject to a carbon tax under a strong policy scenario and increase costs. Any legislation would, however, need to consider agricultural emissions separately since the sector differs in many ways from the energy sector and it is unclear the form this legislation may take i.e. any additional cost would need to be offset to account for issues of social equity (e.g. smallholder farmers should not be unduly burdened).

# 3

## Recommendations for NZ Super

Consistent with a key finding of the public report, our NZ Super specific findings suggest that climate risk is inevitable 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 11: INTEGRATED MODEL FOR ADDRESSING ESG CONSIDERATIONS







Source: Mercer, An Investment Framework for Sustainable Growth<sup>2</sup>

<sup>2</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.

## RECOMMENDATIONS AND NEXT STEPS

The following table provides recommendations for NZ Super, categorising actions by Beliefs, Policy, Processes and Portfolio as in the public report. A dashboard indicator provides a visual summary of the accompanying comments as follows:

No Action	
Under Review	
In Progress	
Best Practice	







The table captures NZ Super's status and the recommended actions, given the findings in the previous section. We understand that recent appointments, such as Justine Sefton who brings climate specific expertise to the NZ Super Climate Change Project (the CC Project), will continue to evolve NZ Super's progress in integrating climate considerations within the investment process.





Of the recommended actions in the following pages, we expect the following should be given the greatest priority for NZ Super to consider, recognising that a number of these are already on the list as part of the CC Project:

- **Beliefs and Processes:** Recognising climate explicitly within existing Investment Beliefs; the Responsible Investment Framework; voting and engagement; and stakeholder reporting, together with adding the Montreal Pledge to the current industry initiatives that NZ Super participates in.
- **Portfolio Risk Assessment:** NZ Super has already commissioned carbon analysis from MSCI for equities and is looking at other providers for other parts of the portfolio. We recommend that this includes an environmental and climate resilience assessment of timber and agriculture holdings (directly, or by requesting the manager undertake this), as well as real estate and infrastructure investments.
- **Portfolio Risks and Opportunities:**
  - Passive Equities: Reallocate a portion of the significant passive equities exposure to a low-carbon alternative. See Appendix A.
  - Active equities: Introduce thematic strategies focused on sustainability. Opportunities cover both mitigation and adaptation themes, including low-carbon investments, clean energy, water, agriculture, and broad sustainability themes. See Appendix B.
  - Niche exposures: A potential increase to the current allocation to insurance-linked securities and natural catastrophe bonds.







TABLE 3: OVERVIEW OF NZ SUPER ACTIONS WITHIN A FOUR-STEP PROCESS

Activity type	Recommendation	NZ Super Status
1. BELIEFS	<p><b>Update Investment Beliefs</b> to expand on the current ESG reference to include a reference to climate change.</p> <p>Climate considerations are implicit in the ESG statement but are not explicit. It is not yet clear whether the CC Project will result in an explicit statement at the beliefs level.</p>	<p>To be considered as part of the CC Project.</p> 
2. POLICIES	<p><b>Enhance current Responsible Investment Framework</b> to explicitly reference climate integration throughout the investment process, particularly for manager expectations to manage climate risks, and how these will be monitored.</p>	<p>In progress as part of the CC Project.</p> 
3. PROCESSES	<p><b>Establish resourcing needs</b> and incorporate climate risk within current investment procedures. Justine Sefton's appointment to work with Anne-Maree O'Connor and lead the CC Project has set NZ Super up well to review whether any further process support e.g. additional ESG data requirements, is required.</p> <p><b>Work towards incorporating climate risk in reporting and communication to stakeholders</b>, to disclose annual climate metrics and actions.</p>	<p>In progress as part of the CC Project.</p>  <p>To be considered as part of the CC Project.</p> 
	<p><b>Join relevant collaborative industry initiatives</b> to engage with policymakers, access ongoing education and share best practices. NZ Super is a signatory to or member of the Investor Group in Climate Change (IGCC); the Principles for Responsible investment (PRI); Carbon Disclosure Project (CDP); International Corporate Governance Network (ICGN); Responsible Investment Association Australasia (RIAA); Australian Council of Superannuation Investors (ACSI); and leverages the UN Global Compact for monitoring frameworks.</p> <p><b>Include some focus</b> on climate in relation to equity voting and engagement, given NZ Super's significant exposure to this area, acknowledging the sensitivities for NZ Super in relation to policy advocacy.</p>	<p>Best Practice</p>  <p>The Montreal Pledge may also be added as part of the CC Project.</p> <p>To be considered as part of the CC Project.</p> 

4. PORTFOLIO	<b>Risk Assessment</b>	<p><b>Assess climate risks/exposures</b> at the portfolio, asset and industry sector level.</p> <p><b>Undertake carbon footprint analysis</b>, which could lead to setting portfolio decarbonisation targets. Signing the Montreal Pledge<sup>3</sup>, involves committing to undertaking the results of an annual carbon footprint exercise for at least a portion of NZ Super's equity portfolio. This would signal that NZ Super is proactively measuring its carbon risk exposure.</p> <p>NZ Super has already commissioned carbon analysis from MSCI for equities and is looking at other providers for other parts of the portfolio.</p> <p><b>Undertake environmental and climate resilience assessment</b> of timber, agriculture, real estate and infrastructure holdings (directly, or by requesting the manager undertake this). Consider reviewing the underlying location exposures, with differing impacts expected for each of the four climate risk factors over various time periods. Policy related impacts and the increased potential for drought over time would be the top priorities. FarmRight could have specific climate policies for rural dairy exposure added.</p>	<p>Best Practice (this report)</p>  <p>In progress as part of the CC Project.</p>  <p>Not yet considered, but potential for inclusion in the CC Project.</p> 
	<b>Risk Reduction, Transfer, Hedging</b>	<p><b>Passive Equities:</b> Reallocate a portion of the significant passive equities exposure to a low-carbon alternative. See Appendix A.</p> <p>NZ super are also actively reviewing the divestment debate, speaking with sell side analysts and peers to better understand what is driving various decision makers.</p>	<p>To be considered as part of the CC Project.</p> 

<sup>3</sup> See <http://montrealpledge.org/> for more information.

	<b>Identify Opportunities</b>	<p><b>Active equities:</b> Introduce thematic strategies focused on sustainability. Opportunities cover both mitigation and adaptation themes, including low-carbon investments, clean energy, water, agriculture, and broad sustainability themes. See Appendix B.</p> <p><b>Private markets:</b> Consider small allocation to sustainability-themed private equity (low-carbon solutions), and/or renewable energy infrastructure.</p> <p>NZ Super has an alternative energy strategy that sits within high level macro themes of resource sustainability and emerging market segmentation. This thematic and opportunistic approach is a driver for looking for new opportunities within private equity and infrastructure.</p> <p>NZ Super could consider increasing existing exposure to <b>niche investment areas which provide additional diversification</b>, and are also linked to climate resilience, such as insurance -linked securities (ILS), catastrophe bonds, and firms driving innovative solutions to climate-related risks (e.g. micro-insurance).</p> <p>*See below for more detail.</p>	<p>To be considered as part of the CC Project.</p>  <p>In progress.</p>  <p>To be considered as part of the CC Project.</p> 
	<b>Engagement with investment managers</b>	<p><b>Require investment managers</b> to provide information on their voting/engagement approach to climate-specific risks and opportunities. Once the information is being reported, additional steps can be considered accordingly.</p> <p>NZ Super should expect managers to focus on: encouraging corporate disclosure of climate/carbon exposure and the development of GHG-reduction plans (mitigation); address corporate lobbying; and, seek companies with large exposure to weather or resource risks to develop climate-risk management plans (adaptation).</p> <p>NZ Super has already appointed BMO Global Asset Management to execute on engagement for global equities. NZ Super decides on the company priorities, plus input to their collaborative engagement, which will include climate, noting the sensitivities around policy advocacy for NZ Super.</p> <p>Voting is also part of the CC Project to review what may be best managed in-house.</p>	<p>In progress.</p> 

\*We also understand that returns are not deemed attractive by many potential ILS investors presently due to an overabundance of capital chasing a limited amount of demand for such capital. Though some investors continued to enter the ILS market even as rates were softening, due to the diversification benefit this asset class provides and the low interest rate environment, which makes alternative bond yields of even mid-single-digits appear attractive. There is also a limited window of opportunity for investors in ILS to capitalise on price corrections, should there be any after major catastrophe events, thus some would argue you need to be in the market now and for the long term to access this return boost (the timing of which is of course uncertain).

All this said, investing today in a market where the supply/demand dynamics are causing risk/return challenges only makes sense if you believe in the merits of long term investing and if you think the supply/demand gap will resolve itself in future either by virtue of greater loss activity and/or greater demand for catastrophe risk transfer, both of which could be influenced by climate change. Responsible investors of course have the ability to influence the market and address a significant environmental and social issue (catastrophe un(der)insurance) through their engagement activity which can be used to encourage more disclosure and ultimately transfer of catastrophe risk by companies, countries and municipalities. This is starting to happen a bit now with initiatives like "Aiming for A" but a lot more is needed before anything like a market correction is to occur.

While the above commentary and the ILS market focus on catastrophe risk we should also keep in mind there are other ways to invest in the weather, such as through weather derivatives which provide exposure to longer term weather shifts (e.g. Our Resource Availability factor). While this segment of the ILS market is presently much smaller even than the catastrophe segment the exposure base is actually much larger. If weather hedging takes off in the investment industry the same way currency or interest rate hedging has then this market would be significant.

## 4

## Looking ahead: Future Taker or Future Maker?

Through its participation in this study, NZ Super has already demonstrated its commitment to be a 'climate aware' investor, and determine how different futures will influence potential investment outcomes.

A key question remains, which is – does NZ Super want to adopt a more proactive approach, whereby it seeks to encourage the future climate pathway the world adopts?

Figure 14:  
From future taker to future maker



There is growing pressure for financial institutions to articulate their position on climate change, and given that Transformation is expected to better protect long-term returns beyond 2050, we expect to see a growing number of investors align their investment behaviour to align with a 2°C outcome.

Beyond assessing the position of your investments in order to protect and enhance returns to the extent possible in a time of climate change, a strategic question remains: Does NZ Super want to develop a proactive strategy – with associated resource – towards seeking to make a contribution towards limiting global warming to 2 degrees?

We look forward to discussing this opportunity with you.



# 5

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## Appendix A – Low-carbon Indices

A number of low-carbon variants of broad market indices have become available over the recent past<sup>4</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 recognise 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).
- 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.

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<sup>4</sup> Low-carbon versions of numerous indices are available from the large passive index providers.

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 NZ Super 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 NZ Super 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 NZ Super.

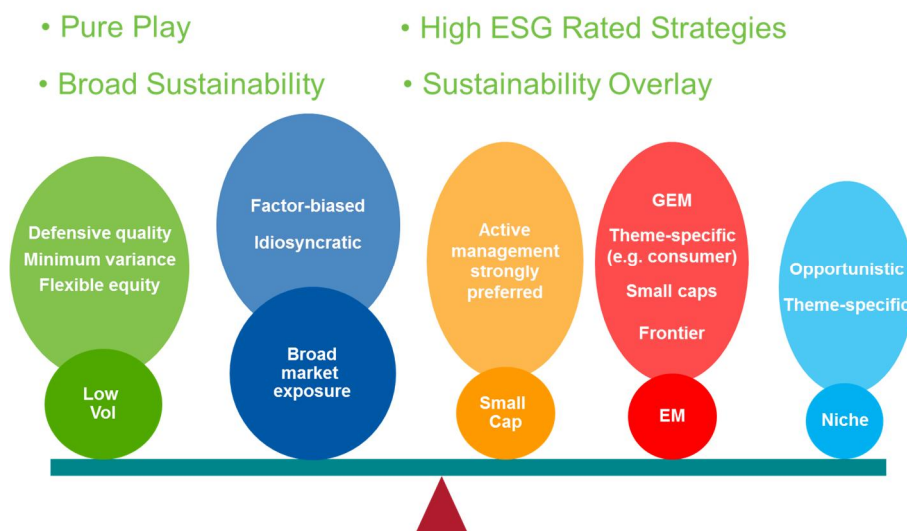
# 6

## Appendix B – 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 12:  
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-recognised 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 NZ Super’s equity exposure.

## 7

## Appendix C – 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 (CRF) – 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

## 8

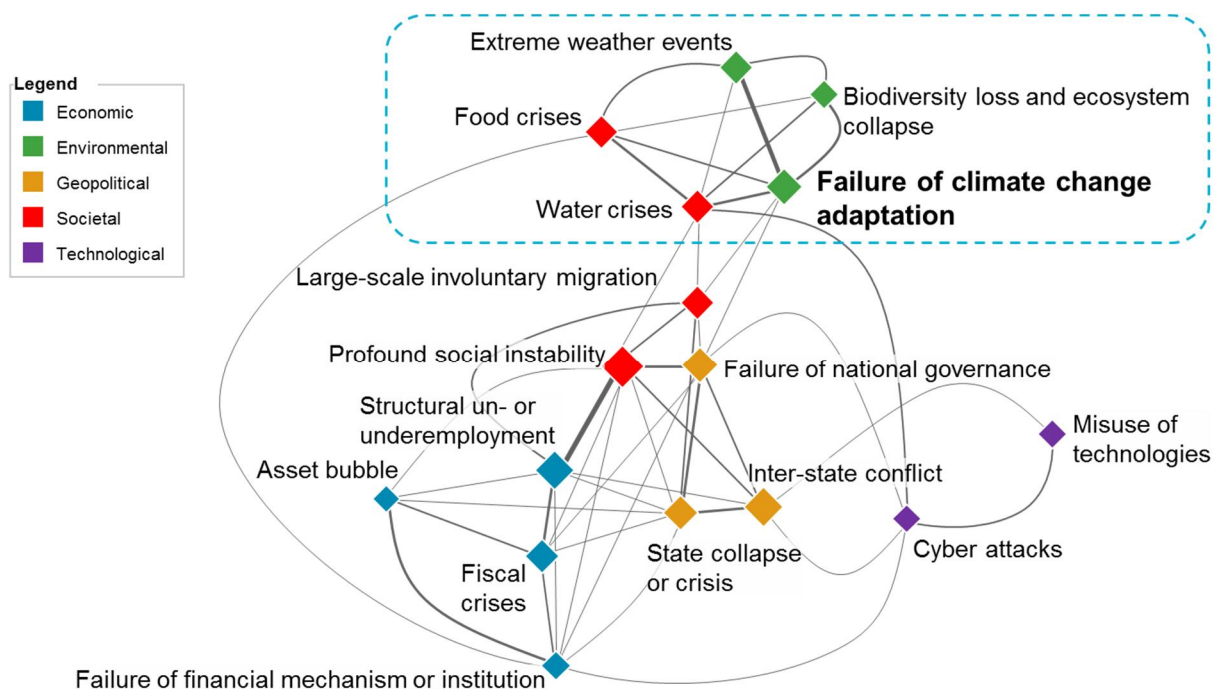
## Appendix D – Study Synopsis

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

While climate change, 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? What are the implications for weather patterns, food and water security and global demographics?
- Will a global climate change agreement be reached later this year? If not, who will the winners and losers be? Can we 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?

Figure 13:  
Global Risks: Interconnections Map 2015



Source: World Economic Forum, Global Risks Report 2015

The complex world between future global economic development and climate change is an extremely difficult minefield to navigate. However, with economic growth being the lifeblood of investments, this is a challenge that long-term investors need to take. To help, we have used scenario analysis and adapted Mercer's 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.

## 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 that of investors and that of climate change impacts.

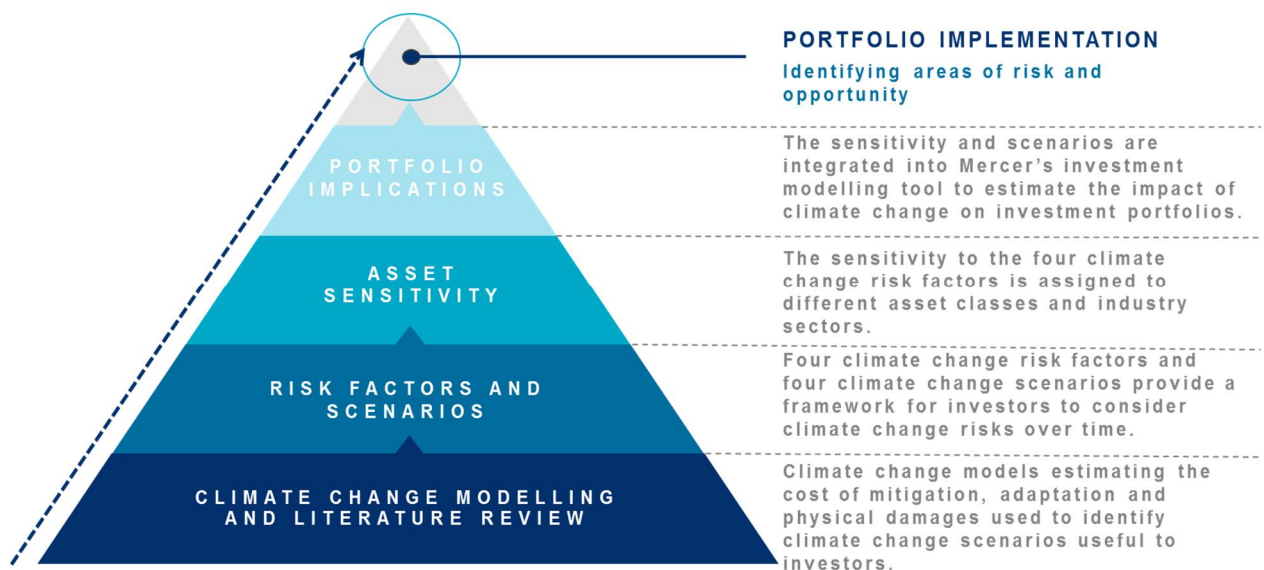
Mercer's study focuses on a 35 year timeframe from 2015 to 2050. This is very long term from an investment perspective; typically, strategic investment advice is based on a modelling period of 10 years and investment managers take investment decisions on a 3-5 year time-frame, or less. However, climate 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. As such, the post 2050 implications cannot be ignored. However, the further forward we look, the greater the uncertainty and it is difficult to justify investment modelling beyond our 35 year time-frame.

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: CLIMATE MODELLING - 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.



Source: Mercer

## CLIMATE CHANGE SCENARIOS

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. Four climate change scenarios have been developed in the study, each reflecting different climate change policy ambitions that result in varying CO<sub>2</sub> emissions pathways and levels of economic damages related to climate change. These have been developed using existing climate change models and through an extensive literature review.

### 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.

**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.



Four scenarios, Transformation, Co-ordination, Fragmentation (Lower Damages) and Fragmentation (Higher Damages) were identified as being useful for investors to consider a range of climate change outcomes and these are summarised below.

## 1. TRANSFORMATION

**Ambitious and stringent climate change policy and mitigation action puts the world on a path to limiting global warming to 2°C above pre-industrial temperatures by the end of this century.**

<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 (e.g. months and years until 2020). Investors that have considered the risks and opportunities posed by climate change should be well positioned relative to those that have not considered such risks and would be expected to benefit from first-mover advantage relative to peers.

## 2. CO-ORDINATION

**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>Climate perspective</b>	While not as ambitious as Transformation, this scenario assumes a co-ordinated 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. While shorter-term, this 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)

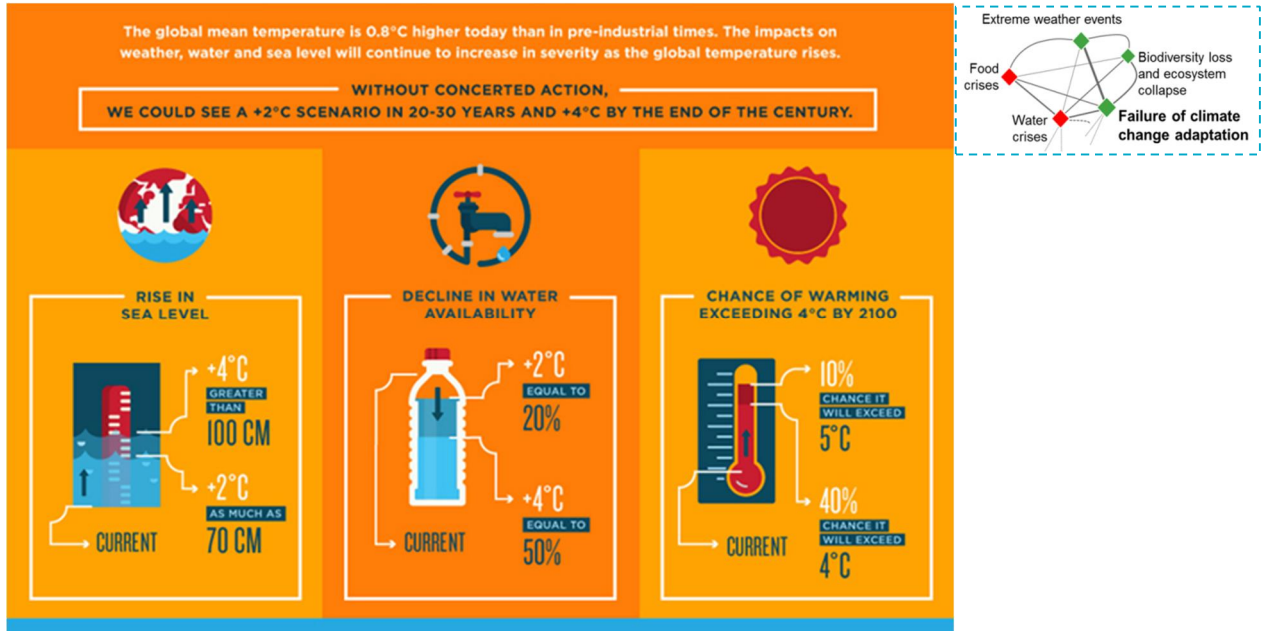
**Limited climate action and lack of co-ordination result in warming rising to 4°C or above from pre-industrial temperatures by the end of this century. The physical impacts of this warming are felt more severely.**

<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 favourable (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 higher level of warming than 4°C).

The following diagram (Figure 17) 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 17:  
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.

**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 into 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.

Table 4:  
Key signposts for investors by climate change scenario (to 2050)

SIGNPOST FOR INVESTORS	TRANSFORMATION	CO-ORDINATION	FRAGMENTATION LOWER DAMAGES	FRAGMENTATION HIGHER DAMAGES
<b>Potential changes to the energy mix</b> 	Significant change to the energy mix: fossil fuels represent less than half of the energy mix at 2050.	Fossil fuels represent c.75% of the energy mix at 2050.	Fossil fuels continue to be the dominant energy source, representing 85% of the energy mix at 2050.	
<b>Rate of investment in technologies supporting the low carbon economy</b> 	Cumulative investment of US\$65 trillion in energy supply and efficiency (ex-fossil fuels) required over 2015–2050.	Cumulative investment of US\$47 trillion in energy supply and efficiency (ex-fossil fuels) required over 2015–2050.	Total energy investments increase to US\$3.13 trillion in 2050.  Limited investment into low carbon energy	
<b>Potential shifts in long-term weather patterns and impact on resource availability</b> 	Limited impact by 2050.	Limited impact by 2050.	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.	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.
<b>The level of physical damages caused by catastrophic events, such as floods and hurricanes</b> 	Limited impact by 2050; driven by losses from (extra) tropical storms and coastal flood.	Limited impact by 2050; driven by losses from (extra) tropical storms and coastal flood.	Estimated net loss as a percentage of global GDP of 0.4% at 2050.  Driven by losses from (extra) tropical storms and coastal flood.	Estimated net loss as a percentage of global GDP of 0.7% at 2050.  Primarily represents losses from wildfire, coastal flood, and extreme temperatures.
<b>Global policy response</b> 	Most effective from a climate change mitigation perspective, Aggressive introduction of carbon pricing and related policy/regulation likely to result in shock to financial markets.	Existing policy pledges with respect to carbon emissions are implemented with mitigation efforts extended to 2030.	Divergent with limited efforts beyond existing pledges. Although a reduction in emissions of 10% (versus 2010 levels) is achieved by 2050 in developed markets, this is outweighed by increases in emissions in emerging markets.	
<b>Expected cost of carbon (\$US2013/t CO<sub>2</sub>)</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 recognised by the market.	
<b>Global greenhouse gas emissions at 2050</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.
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## 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.

## 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 investments.





Mercer has developed climate change sensitivity heat maps that summarise 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 NZ Super understands where risks and opportunities might lie and to ensure that investment managers are fully considering these risks when building portfolios, particularly when investing in asset classes, industries and sectors with the highest sensitivity.





Table 5:  
Sensitivity to the climate change risk factors: asset class level

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

Negative  Positive

- 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 debt and high yield debt are the most sensitive to the climate change 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 climate change risk factors.

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

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

Negative  Positive

- 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.

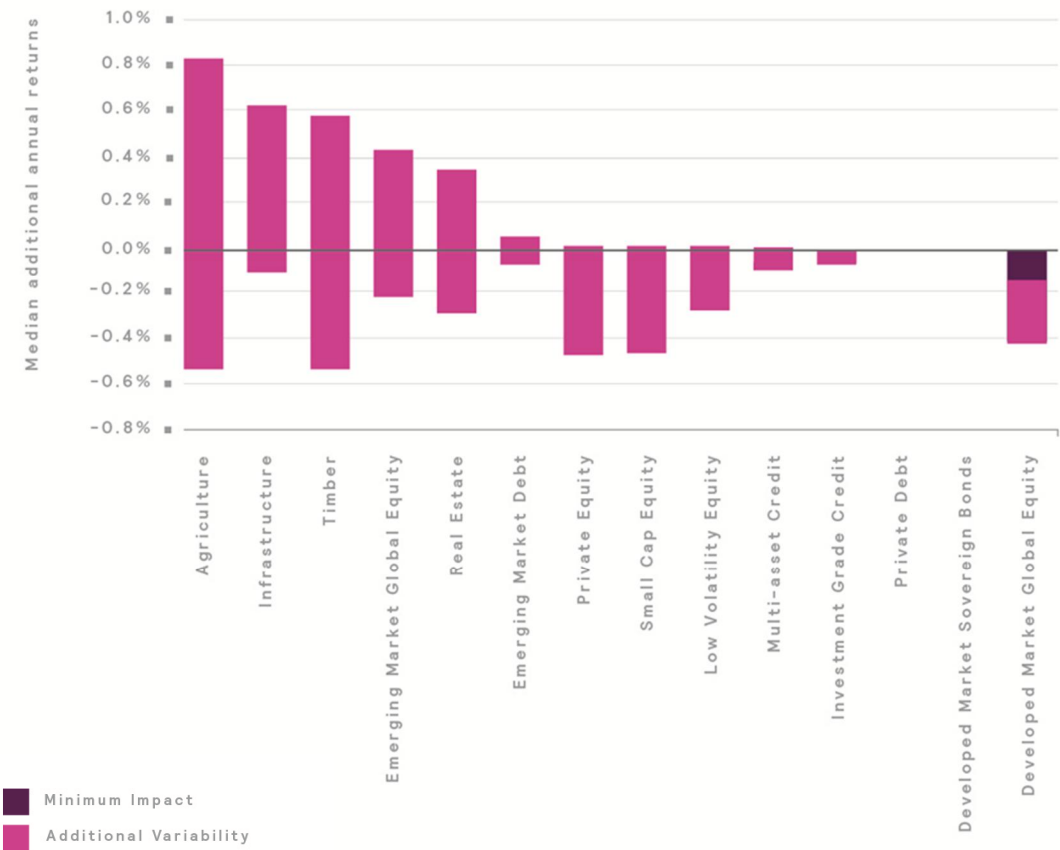
## STUDY HIGHLIGHTS: COMBINING THE SCENARIOS AND RISK SENSITIVITY

- Over the long term (35 years), for a well-diversified portfolio, a Transformation scenario does not jeopardise financial returns, which has been a common misconception.
- The Fragmentation (Higher Damages) scenario is increasingly detrimental to returns over time and the Transformation scenario becomes increasingly favourable 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 favourable opportunities.

Figure 14:  
Climate impact on return by industry sector (35 years)



Figure 15:  
Climate impact on return by asset class (35 years)



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## NOTES

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## NOTES

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