Attachment B

To: SFERS Board and Staff

From: Allan Martin, Sam Austin, Daniel Hennessy, and Michael Miranda

Date: January 24, 2018

Subject: Fossil Fuel Divestment Commentary

Background

In response to the motion placed before the SFERS Board on May 17, 2017, to divest the Plan's holdings in the Carbon Underground 200, NEPC has prepared the following analysis detailing our recommendation on this matter. We do not advise the Board to accept the motion to divest for the reasons we will discuss herein. Because climate change will likely become an increasingly important risk factor in investment decisions, we do strongly encourage SFERS to consider other actions we believe will be more effective and less costly to Plan participants and beneficiaries.

Climate change poses significant risk to the environment, to the economy and, therefore, to investment portfolios. In IPCC (2014), the Intergovernmental Panel on Climate Change flatly asserts that "Warming of the climate system is unequivocal...The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850" (p. 2). Dahlman (2017, September 11) provides context on the long term historical pace of warming. "Since 1880, surface temperature has risen by 0.13°F (0.07°C) every 10 years for a net warming of 1.69°F (0.94°C) through 2016." As NASA looked at the period since 2000, they report in "Global Climate Change: Vital Signs of the Planet," (2018, January 2) "Sixteen of the 17 warmest years in the...record all have occurred since 2001." Bringing the data forward to the most recent year, "U.S. had 3rd warmest year to date" (2017, December 6, 2017) finds that the January-November 2017 period was the third warmest such period in the 138-year record for the world's land and ocean surfaces with an average temperature that was 0.84°C above the 20th century average.

Rising ocean levels are another indicator of climate change. By cobbling together land-based tide gauge measurements, Australia's Commonwealth Scientific and Industrial Research Organization has produced a historical reconstruction of global mean sea level (GMSL) change since January 1880. Church and White (2009) calculate a 210 millimeter rise in ocean levels for the 130 years ending in December 2009. And based on satellite altimeter data compiled by the NASA Goddard Space Flight Center, the recent pace of sea level change seems to be accelerating, with a cumulative rise of 81 millimeters between January 5, 1993, and August 20, 2017. The satellite data indicates GMSL is currently rising at a rate of 3.2 millimeters per year, according to "Global Climate Change: Vital Signs of the Planet," (2018, January 2).

The same NASA source cites shrinking coverage of glaciers and ice sheets, which contribute to rising ocean levels. The space agency's Gravity Recovery and Climate Experiment found that "Greenland lost 150 to 250 cubic kilometers of ice per year between 2002 and 2006".

On the topic of human contribution to climate change, IPCC (2014) concluded that "Total anthropogenic GHG [greenhouse gas emissions] have continued to increase over 1970 to 2010 with larger absolute increases between 2000 and 2010...It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations and other anthropogenic forcings together...Anthropogenic influences have likely affected the global water cycle since 1960 and contributed to the retreat of glaciers since the 1960s and to the increased surface melting of the Greenland ice sheet since 1993" (p.5).

The future direction of climate change is likely to have an impact on long-term investors such as SFERS, although the scope and timing of this impact is difficult to forecast. Mercer (2015), in collaboration with 18 project partners and an international study group, published a landmark study, *Investing in a Time of Climate Change*. Mercer and their partners developed sophisticated climate models, defined four risk factors (Technology, Resource Availability, Impact and Policy) and applied these models and factors to "four relevant scenarios for investors" envisioning "several views of the way the next 35 years might play out" (p.10)

Mercer (2015) describes four possible pathways climate change may follow:

A. **Transformation** is characterized by strong climate change mitigation that puts us on a path to limiting global warming to 2°C above pre-industrial-era temperatures this century. This scenario has:
    - Strong climate-mitigation action: emissions peak by 2020, then fall by 56%, relative to 2010 levels, by 2050.
    - Fossil fuels representing less than half of the energy mix by 2050
    - Estimated annual emissions of 22 gigatons of equivalent carbon dioxide ($GtCO_2e$) by 2050.

B. **Coordination** is a scenario in which policies and actions are aligned and cohesive, limiting global warming to 3°C above pre-industrial-era temperatures this century. The Coordination scenario has:
    - Substantial climate-mitigation action: Emissions peak after 2030, then fall by 27%, relative to 2010 levels, by 2050.
    - Fossil fuels representing around 75% of the energy mix by 2050.
    - Estimated annual emissions of 37 $GtCO_2e$ by 2050.

C. **Fragmentation (Lower Damages)** sees limited climate-mitigation action and lack of coordination, resulting in a 4°C or more rise above pre-industrial-era temperatures this century. This sees:

- Limited climate action: emissions grow another 33% over 2010 levels, peaking after 2040.
- Fossil fuels representing 85% of the energy mix by 2050.
- Estimated annual emissions of 67 $GtCO_2e$ by 2050.

D. **Fragmentation (Higher Damages)** sees the same limited climate-mitigation action as the previous scenario, but assumes that relatively higher economic damages result.[7]

The Mercer (2015) study is included in its entirety as *Attachment 1* to this report. It reaches a number of detailed conclusions, including that

> [C]limate change presents a series of risks to institutional investors...For the fiduciaries overseeing investments, climate change poses portfolio risks but also opens up new opportunities. This is because the necessary reduction in carbon emissions will require a fundamental change in the energy mix that underpins, to some extent, every investment in a portfolio (p.2)...
>
> Asset class return impacts could be material – varying widely by climate change scenario. For example, a 2°C scenario could see return benefits for emerging market equities, infrastructure, real estate, timber and agriculture. A 4°C scenario could negatively impact emerging market equities, real estate, timber and agriculture. Growth assets are more sensitive to climate risks than defensive assets. A 2°C scenario does not have negative return implications for long-term diversified investors at a total portfolio level over the period modelled (to 2050) and is expected to better protect long-term returns beyond this timeframe (p.7).

Executive Summary

We agree that long-term portfolio diversification should be a key element as prudent investors grapple with climate change as an increasingly important risk factor. The challenge is to determine the most efficient tools that SFERS can utilize to diagnose the impact of climate change, mitigate potential negative consequences and capitalize on potential positive outcomes. An integrated ESG approach can encourage the active investment managers engaged by SFERS to disclose the role that climate change plays in their investment process. An optimal set of tools can help leverage resources with like-minded institutional investors to pressure the worst carbon emitters and to encourage new green technologies that may flourish during the transition to a cleaner energy infrastructure over the next several decades.

The array of tools available to address the potential impact of climate change on SFERS can include, but are not limited to:

* ***Proxy voting to endorse transparent corporate disclosure regarding their carbon footprint and the risk that environmental factors pose to their business***

* ***Active engagement alongside other large investors to influence egregious carbon emitters***

* ***Investment in technologies and industries expected to benefit from change in energy mix***

* ***Integration of ESG principles throughout the investment process at the Plan level and at the asset manager level***

* ***Selective reduction of exposure to impacted industries via passive management with screens***

* ***Broad divestment from industries expected to be most impacted***

It is NEPC's opinion that divestment is the least efficient of these tools and a potentially costly option for SFERS. Removing a significant portion of the investable universe of securities that active money managers can invest in is, by definition, a restriction on diversification of the SFERS portfolio. Academic research (Adler and Kritzman 2014) has found that divestment decreases the return of active management and past studies (MacAskill, 2015, October 20) of other security exclusion initiatives have confirmed the negative effects of divestment.

Less diversification is undesirable, because it moves the investor's risk-adjusted return below what that investor would be expected to enjoy on the efficient frontier. The efficient frontier represents the mix of investments that offer the highest return at a given level of risk. Or, said another way, any point on the efficient frontier represents the lowest volatility at a given level of return. Financial theory is clear that a more diversified portfolio offers superior risk-adjusted returns than a portfolio that is significantly less diversified.

The amount by which a restricted portfolio will suffer from reduced expected return (or higher expected risk) depends on the size of the restriction. Approximately 4.5% ($523 million) of SFERS' public equity portfolio was in shares of Carbon Underground 200 (CU200) companies held in separately-managed accounts as of September 30, 2017. By another measure of fossil fuel exposure, Global Industry Classification Standard (GICS) Energy Sector stocks made up approximately 4.1% ($471 million) of the SFERS total public equity portfolio at 9/30/2017. See summary in Exhibit 1. It is noteworthy that this divestment would exceed the size of prior divestment campaigns such as tobacco and Sudanese investments.

Exhibit 1: SFERS fossil fuel holdings

SFERS Assets Under Management as of 9/30/2017

	Total Fund	Public Equities	Fixed Income	CU200 Equity Holdings	CU200 Fixed Income Holdings	GICS Energy Equity Holdings	GICS Energy Fixed Income Holdings
Total AUM	$23,439,593	$11,529,066	$4,317,863	$523,372	$36,254	$470,877	$47,265
% of Total Fund	100.00%	49.19%	18.42%	2.23%	0.15%	2.01%	0.20%
Separate Account Holdings		$9,115,806	$3,000,011				
% of Total Equity				4.54%		4.08%	
% of Equity Separate Accounts				5.74%		5.17%	
% of Fixed Income					0.84%		1.09%
% of Fixed Income Separate Accounts					1.21%		1.58%

Throughout this analysis, we compare the impact of divestment from the CU200 with an analogous restriction on GICS Energy Sector holdings. The reason we compare restrictions based on both the CU200 and the GICS Energy Sector is that many of SFERS' investment managers do not currently have access to the Carbon Underground 200 list, which is available by license from its sponsor, Fossil Free Indexes. Therefore, the GICS Energy Sector is the only common database on which we can aggregate forward-looking projections from each manager. Since NEPC has a license to use the CU200, we were able to run historical analyses based on both the CU200 and GICS Energy Sector restricted lists.

Neither restriction list avoids unintended consequences for an investor seeking to avoid securities of environmentally challenged companies. Some energy companies that might be excluded from investment have made very large investments in green technologies. Some technology companies that might not be restricted are heavily reliant on the global extraction of rare metals. Utilities, auto makers, chemical companies, airlines and even many consumer product companies are deeply dependent on carbon-based inputs.

THE CASE FOR ACTIONS OTHER THAN DIVESTMENT

While we advise SFERS to consider integration of ESG principles, proactive engagement and market competitive green investing within its Investment Policy, we recommend against adopting the blunt instrument of active management divestment for the following reasons.

1. There will be significant costs associated with divestment

Institutional fiduciaries considering fossil fuel divestment must contemplate that they are trading a sure cost to the pension plan and its participants in exchange for an unlikely impact on climate change. The estimated costs of divestment can be broken down into the one-time transaction expense and the ongoing annual performance shortfall due to a loss of portfolio diversification.

Transaction Costs

In Exhibit 2, we tally the expected transaction cost for excluding the CU200 stocks or GICS Energy Sector stocks in SFERS' public equity separate account portfolios as of September 30, 2017. The amount to be divested based on a CU200 restricted list is $523 million. Using the GICS Energy Sector names, SFERS would divest $471 million of stock holdings. We included the cost of selling the existing carbon-related stocks and using the cash raised to replace these positions with a like dollar amount of unrestricted stocks.

Exhibit 2: Divestment Transaction Costs – Public Equity Separate Accounts

	Mkt Val ($000)	(%)	T-Cost Est (%)	Incremental T-Costs ($000)
Total	9,115,806			
Total CU200	523,372	5.7%	0.09%	980
Total GICS Energy	470,877	5.2%	0.06%	785

As of 9/30/2017, source: NEPC calculations, Russell Investments for t-cost commissions only estimate. Incremental costs represent a round trip trade.

After considering the cost to divest from fossil fuel equities, we also estimated the cost for SFERS to divest from the bonds of carbon-related companies. The total exposure to fixed income securities is smaller than the pension plan's stock exposure as of 9/30/2017 at approximately $36m for CU200 bonds and $47 million for GICS Energy Sector bonds. Again, using industry standards for institutional fixed income trading, we calculate in Exhibit 3 the total cost of fixed income divestment to be $232,000 if using the CU200 list or $302,000 if using the GICS Energy Sector list. While we used the Russell estimates for fixed income trading, the 32 basis point estimate here includes spread and market impact costs. Estimating trading costs for fixed income securities is less precise than for equities due to the somewhat subjective nature of bond spread assumptions.

Exhibit 3: Divestment Transaction Costs – Public Fixed Income Separate Accounts

Account	Mkt Val ($000)	(%)	T-Cost Est	Incremental T-Costs ($000)
Total	3,000,011			
Total CU200	36,254	1.2%	0.32%	232
Total GICS Energy	47,265	1.6%	0.32%	302

As of 9/30/2017, source: NEPC calculations, Russell Investments for t-cost commissions only estimate. Incremental costs represent a round trip trade.

So, in summary, we estimate the one-time transaction cost of divesting from CU200 securities is $1,212,000 versus an estimated $1,087,000 to replace GICS Energy Sector stocks and bonds.

There are other difficult-to-quantify costs (monetary and time-related) to SFERS and its managers to administer and monitor divestment. We did not include the cost of licensing to SFERS if the proprietary CU200 list is chosen to define the restricted securities. If licensing specific to each manager were necessary to pursue CU200 divestment, then this also would require each SFERS equity manager to pay an annual licensing fee to Fossil Free Indexes along with the possible need to pay additional security identification (CUSIP) license fees to properly administer the portfolio restrictions.

Lower Risk-Adjusted Return

Although widely accepted financial theory, beginning with Markowitz (1952), predicts a lower risk-adjusted return from a restricted portfolio, it is impossible to precisely calculate this expected performance shortfall. Historical data alone is insufficient to accurately forecast future returns of a portfolio divested of energy stocks. Fischel, Fiore & Kendall (2017, June) may set an upper bound by predicting a 0.22% per annum cost of divestment from energy and utility stocks (p. 10). Applied to the $7,078.109 million portion of the SFERS equity portfolio that was studied, Fischel et al (2017, June) calculate a performance shortfall cost of $15.771 million per year (p.14). NEPC cannot fully endorse this 22 bps divestment cost estimate as definitive for two reasons:

a. Past returns do not guarantee future results. The presumed future shortfall is based on historical sector returns, using an imprecise proxy for only a subset of the SFERS public equity portfolio as of an unidentified date we believe to be in the 2nd half of 2016.
b. The report, prepared by senior staff at the economic consulting firm, Compass Lexecon, must be viewed through the lens that it was commissioned by the Independent Petroleum Association of America (p.1)

Fischel et al (2017, June) map 79% of SFERS actual equity holdings to a similarly weighted sector portfolio before analyzing 50 years of performance data, both with and then excluding carbon-related sectors (pp.3-11).

NEPC conducted its own examination of long-term historical data to see if we could confirm whether risk-adjusted returns have indeed been lower for portfolios without energy stocks, as predicted by financial theory. To this end, we analyzed historical returns of the S&P 500 large cap U.S. equity benchmark, broken down by sector returns from October 1989 through September 2017 (the longest time period over which comparable S&P 500 sector data is available). We used monthly returns and sector weightings to compare performance of the S&P 500 Index (which includes energy stocks) versus a hypothetical S&P 500 portfolio that excludes GICS energy sector stocks. Over this 28-year period, the portfolio that included energy stocks had almost identical returns (approximately 9.7%) compared to the performance of the portfolio that excluded energy stocks. But, as expected, the standard deviation of the portfolio without energy stocks (14.57%) was more volatile than that of the S&P 500 with its energy stocks included (14.29%). As we have stated previously, a significant reduction in diversification should lead, by definition, to a lower risk-adjusted return over time for Plan participants and beneficiaries.

Moving away from history, we are perhaps more interested in the risk-adjusted return forecasts of the investment firms that currently manage SFERS' public equity portfolio. To that end, NEPC surveyed all of SFERS' separate account equity managers regarding their ability to continue to manage their portfolios under their current performance objectives, benchmarks, and contractual obligations, but subject to a restriction on buying and holding energy stocks. While all the responding managers indicated they forecast similar expected returns, five out of the 11 responding managers indicated that the tracking error of the restricted portfolio would be higher. Among the five managers forecasting higher volatility, the expected increase in tracking error was 11% higher than in the portfolios these firms currently manage for SFERS.

Higher tracking error at the same level of expected return will result in a lower return for SFERS over time. This is a result of the impact of compounded returns over time and the volatility of the return stream. For example, if we assume the average arithmetic return assumption is unchanged for the SFERS US equity portfolio following the exclusion of energy stocks, an increase in portfolio level volatility will then reduce the geometric return of the portfolio. Thus, the expected return of the SFERS US equity portfolio will be lower based on the assumption that the tracking error of the US equity portfolio will be 11% higher than the historical level of 1% and the volatility of the index ex energy, as stated above, will be higher than the S&P 500 Index over the long-term. Accounting for the increase in volatility levels and assuming no change in the average arithmetic return assumption results in a range of expected return of 5-20 bps per annum lower over the long-term compared to the US equity portfolio. We believe it is fair to assume a similar negative performance impact of 5-20 bps from restricting fossil fuel stocks from the SFERS international equity portfolio. When applied to SFERS' total equity portfolio of $11,529.066 million as of 9/30/2017, we expect a performance shortfall due to fossil fuel divestment within a range of $5.765 million to $23.058 million per annum. The annual performance impact to the SFERS portfolio on ($23,439.593 million on 9/30/2017) is estimated to be 2.5bps to 9.8bps per year, in addition to the one-time transaction cost impact of 0.5 bps.

We do not attempt to estimate a performance impact on equity commingled funds or fixed income accounts.

2. There are still costs (although lower) to limited options like fossil-free passive management and ESG integration

Per manager projections, the incremental management fee for running a $1.171 billion fossil-free index fund would be 4-7 bps ($468,400 - $819,700) per year. The one-time transaction cost of excluding CU200 stocks from the existing US large cap value passive portfolio would be 2-4 bps ($234,200 - $468,400). The fossil-free index fund ex-ante tracking error is estimated to be 50-60 bps higher than the tracking error of an index fund that includes energy stocks.

IF SFERS were to integrate ESG principles throughout its investment process, there will be implementation and oversight cost in terms of staff time. Much larger funds like CalPERS and CalSTRS have hired dedicated staff to oversee their ESG programs. Without knowing the scope and granularity of reporting envisioned for such a program, it is impossible for NEPC to quantify a cost.

3. Divestment reduces the opportunity set for SFERS' active managers to earn excess returns.

Restricting managers from the opportunity to invest across sectors can meaningfully impact performance over different time periods. Because the S&P 500 energy sector exhibits one of the lowest correlations of any sector to the overall S&P 500 (0.61 from October 1989 through September 2017), it is an important part of a diversified opportunity set for active managers. The S&P 500 energy sector ranked in the top half of all S&P sectors in terms of performance in three of the most recent five year periods. Unless one believes that energy prices will monotonically decrease to zero, depriving value style managers of their ability to

exercise their investment judgement on a significant portion of their opportunity set could be the one of the highest costs of divestment. Exhibit 4 (below) illustrates S&P 500 sector returns over different rolling time periods.

Exhibit 4: Relative performance of each S&P 500 sector

S&P Sector	5 Years Ending 9/30/1997	Rank	5 Years Ending 9/30/2002	Rank	5 Years Ending 9/30/2007	Rank	5 Years Ending 9/30/2012	Rank	5 Years Ending 9/30/2017	Rank
S&P 500 Consumer Discretionary (GTR)	14.90	8	2.60	2	11.22	8	6.82	2	15.93	5
S&P 500 Consumer Staples (GTR)	17.99	6	2.18	4	9.72	9	8.15	1	11.46	7
S&P 500 Energy (GTR)	19.58	5	-0.38	5	29.95	1	0.99	7	1.02	10
S&P 500 Financials (GTR)	28.58	2	2.43	3	13.48	7	-12.69	10	17.62	1
S&P 500 Health Care (GTR)	22.06	4	5.68	1	8.56	10	4.77	4	17.30	3
S&P 500 Industrials (GTR)	22.48	3	-1.21	6	17.51	6	-0.58	9	16.20	4
S&P 500 Information Technology (GTR)	34.61	1	-9.05	9	18.64	5	4.81	3	17.44	2
S&P 500 Materials (GTR)	15.84	7	-4.75	8	21.76	3	-0.05	8	11.29	8
S&P 500 Telecommunication Services (GTR)	14.67	9	-10.86	10	21.89	2	2.72	5	5.60	9
S&P 500 Utilities (GTR)	8.90	10	-2.33	7	20.89	4	2.42	6	11.92	6
5 Year Annualized Change in Headline CPI	2.67		2.34		2.87		2.11		1.30	

The following Exhibit 5 illustrates the relative size of the GICS Energy Sector for US Large Cap equities in total, and for the growth and value subset. As should be intuitive, energy stocks reside predominantly in the value space.

Exhibit 5: Relative weight of sectors in Russell large cap indices

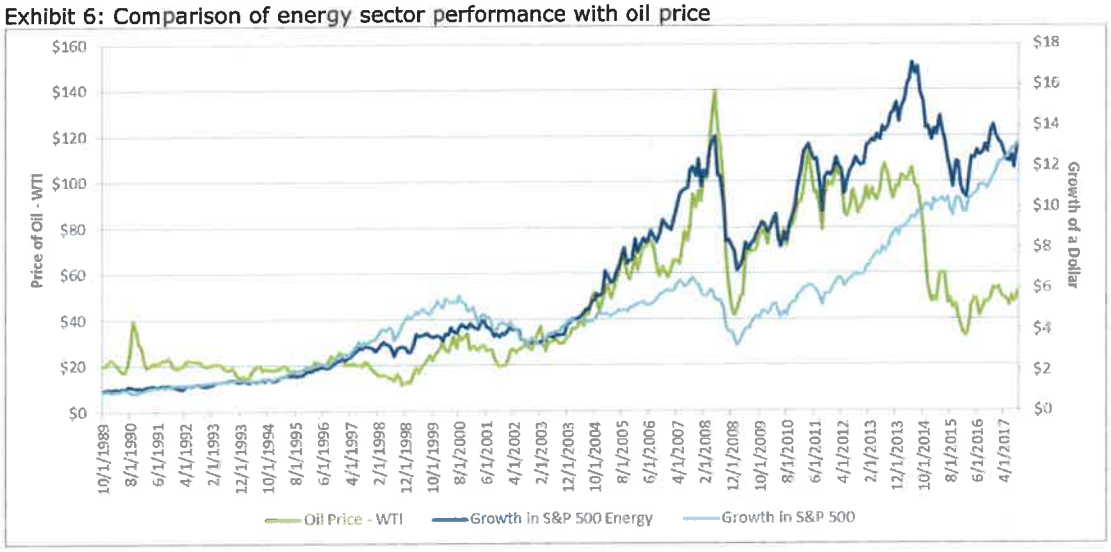
	Ending Sector Weights 9/30/2017		
	Russell 1000	Russell 1000 Growth	Russell 1000 Value
Energy	5.92%	0.90%	10.89%
Materials	3.32%	3.82%	2.83%
Industrials	10.52%	12.49%	8.58%
Consumer Discretionary	12.22%	17.74%	6.76%
Consumer Staples	7.72%	6.74%	8.69%
Health Care	13.83%	13.76%	13.89%
Financials	14.77%	3.42%	26.00%
Information Technology	22.80%	37.56%	8.19%
Telecommunication Services	2.09%	0.99%	3.17%
Utilities	3.10%	0.01%	6.15%
Real Estate	3.71%	2.56%	4.84%

It is important to note that energy stock returns have demonstrated significant cyclicality. Cyclical industries represent the best opportunity set for SFERS' active managers with a value style bias. The five out of 11 managers surveyed by NEPC that predicted higher tracking error for a portfolio divested of energy stocks are mostly value style investors,

since they have more to gain than growth style managers by investing in energy stocks at certain times in the economic cycle.

The energy sector is heavily influenced by oil and gas prices which exhibit cyclicality, as well as sensitivity to the economy as a whole. Increases in macroeconomic factors such as employment, vehicles sales, and disposable income are expected to positively influence the energy sector. Exhibit 6 illustrates the results over time of the S&P 500 energy sector versus the broader S&P 500 Index along with oil prices over the same time period. Periods of high or increasing oil prices have provided energy stocks with outsized growth relative to the market as a whole. Divestment deprives asset managers (particularly value style managers) of the opportunity to buy certain energy sector securities when prices have dropped and valuations are favorable. Reducing the opportunity set of investments available to value style managers has the potential to diminish SFERS returns in the future.

Exhibit 6: Comparison of energy sector performance with oil price



4. Divestment can reduce expected performance of the SFERS portfolio in periods of high inflation.

Each large cap equity investable sector exhibits characteristics that serve specific roles in the SFERS portfolio. Some of these characteristics are particularly useful at certain times in the economic cycle. Inflation protection has historically been among the desirable diversification benefits the energy sector has historically contributed to the large cap equity space.

Shroders (2010) tells us that energy equities are one of a limited set of assets which perform well in higher inflation environments. For example, during the most recent period of high inflation from 1973 to 1981, the S&P 500 Index returned a cumulative -26% in real terms whereas equities in the energy sector returned +154% in real terms. Exhibiting strong performance in high inflation environments is an important feature for a portfolio investment, since SFERS' liabilities are likely to increase with inflation due to the impact of

wage growth on future benefits for active members and potential cost of living adjustments for retired members.

NEPC and other forecasters anticipate an increased level of inflation over the medium term (5-7 years) and long term (30 years). Salzman (2018, January 1) provides us context, "Inflation as measured by the core CPI has risen at an average rate of 1.76% since 2009" (p. 17), but the "producer price index, which measures the prices that goods and services producers get, rose 3.1% on a year-over-year basis in November, the fastest rate since January 2012 (p. 18)." The chief economist of GAM Investments, Larry Hatheway, said "An unanticipated accelaration in inflation is probably the biggest risk for markets in 2018 (p. 17)." Certain sectors can be expected to provide some protection from unexpected inflation. "...[F]inancial, energy and materials stocks could ride a wave of accelerating growth in prices. (p. 17) ". Salzman (2018, January 1) continues:

> Already, prices are rising in some quarters, although not in a sustained fashion. Restaurants have been increasing prices over the past year or so to deal with new city and state minimum-wage laws and higher food prices. Apple clearly feels comfortable charging higher prices, as evidenced by its $1,000 iPhone X. And Netflix raised its monthly streaming fee for the first time in two years.
>
> Fiscal policy also points in an upward direction. The tax cut passed at the end of December should spur business investment and, potentially, employment...President Donald Trump's aggressive posture on trade raises the possibility of trade restrictions that boost prices. Lumber prices have already spiked in part because of new U.S. duties. 'Trade wars are inflationary,' (p. 18) [said Lloyd Khaner, president of Khaner Capital Management].

Interestingly, concern about sufficient portfolio diversification to weather inflationary periods was an important driver in the evolution toward today's concept of a fiduciary standard for institutional investors. ("Prudent Investor Rule – Compliance in California," n.d.) points out that damage to trust portfolios four decades ago due to a lack of preparation for unexpected inflation was central to today's concept of fiduciary duty.

> The surprising acceleration in inflation during the late 1970s and its impact on 'safe' investments created an ongoing concern for long-term pension and trust investors. Thereafter, their fiduciary responsibilities would always include a consideration of inflation risks and the protection of the portfolio's purchasing power. To meet this standard of care, it was recognized that fiduciary investors would need to take higher levels of risk in their portfolios to preserve purchasing power...
>
> The nonexclusive list of circumstances in the prudent investor rule that are appropriate for trustees to consider in investing and managing trust assets details the extent of their duties of care and skill. Economic conditions and the possible effect of inflation or deflation require an in-depth analysis and active surveillance by trustees. These circumstances are always relevant to the trust and its beneficiaries, because economic conditions determine portfolio growth and expected total returns, inflation reduces the real value of returns and the purchasing power of the trust estate, and deflation endangers trust income and principal.
>
> The arguments in this compliance guide are that the prudent investor rule requires trustees...to distinguish between speculative-demand economic conditions based on

excess liquidity and asset price inflation that significantly increase volatility and liquidity risks, from real, sustainable economic growth that supports long-term investments. And the possible effect of inflation or deflation should be viewed as not only relating to broad price trends in the overall economy, but also to the growth and adjustment price cycles in stocks, bonds, real estate, and commodities.

5. SFERS active manager returns in the energy sector are dependent on macroeconomic trends as well as manager skill

In response to a specific query from Commissioner Makras regarding SFERS portfolio gains or losses attributable to CU200 stocks over the last 10 years, we have listed the data below. Energy holdings provided a net gain to SFERS in six of the last 10 fiscal years, ending June 30, 2017.

Exhibit 7: SFERS recent annual gain or loss due to CU200 securities

	Fiscal Year Ending June 30									
	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
Change In Unrealized Gain/Loss	$6,409,176	$6,949,222	-$81,486,016	$19,641,348	-$685,959	-$28,878,978	$42,491,212	-$2,890,118	-$29,899,738	$16,648,385
Realized Gain/Loss on Security Sales	-$8,758,115	-$41,954,514	-$11,827,390	$2,904,950	$3,837,635	-$5,284,913	$18,303,029	$18,249,814	-$20,052,161	$49,879,807
Additional Receipts and Distributions	$5,878,180	$8,179,174	$8,574,739	$8,002,266	$7,438,390	$7,301,829	$6,050,303	$5,320,654	$5,460,187	$5,062,613
Total Gain/Loss from Fossil Fuel Holdings	$3,529,241	-$26,826,118	-$84,738,668	$30,548,565	$10,590,067	-$26,862,062	$66,844,544	$20,680,350	-$44,491,712	$71,590,805
1 Year %Change In Oil Price	-4.66%	-18.85%	-43.92%	10.08%	13.31%	-10.77%	26.07%	8.26%	-50.11%	98.61%
1 Year %Change in CPI	1.63%	1.00%	0.12%	2.07%	1.75%	1.66%	3.56%	1.05%	-1.43%	5.02%

It must be noted, however, that these results in isolation do not answer the question of whether energy stocks are a good investment. It is apparent that in every period when oil prices rose, SFERS enjoyed gains from fossil fuel securities. Conversely, in every period (except FY2017) when the price of crude fell, the portfolio experienced a net loss. Furthermore, inflation was quiescent during the entire 10-year period. As we demonstrated in Sections 3 and 4, above, energy stocks have historically outperformed during periods of rising oil prices and/or rising inflation. If we had chosen, instead to study a period of high inflation, the returns attributable to carbon-related stocks would look quite different.

Exhibit 8: Energy sector performance in last inflationary period

	1973-1981	
	Real Return	Annualized CPI
S&P 500	-26%	9.22%
S&P Energy	154%	

Despite the strong correlations between energy stock prices, oil and inflation, active manager skill does matter. SFERS hires active managers with an implied assumption that the managers have skill in stock selection. As an actual example of good stock selection by one of SFERS' active managers, Causeway invested in a CU200 stock, Arcelor Mittal, at several entry points starting in July 2016. The net gain (+$1,116,634.91) of the position

divided by the investment cost basis ($4,995,893.23) was 22.35% between 7/5/2016 and 6/9/2017.

6. Divestment campaigns have often resulted in economic losses for investors and have not driven down the share price of targeted companies

Broadly, there is a large body of academic work on the historical outcomes of divestment. Overwhelmingly, studies such as MacAskill (2015, October 20); Kritzman (2013), Hong and Kacperczyk (2008); Adler and Kritzman (2008); Teoh, Welch and Wazzan (1999); Love (1985); Wagner, Emkin and Dixon (1984); as well as Rudd (1979) have shown that investment decisions to sell and permanently exclude portions of an investment universe have not been accretive to investors. Several other studies, such as Parwada (2013); Kurtz and DiBartolomeo (Fall 2011); Statman and Glushkov (2009); and Guerard (1997) have shown a mixed impact of social investing.

One of the strong arguments against the effectiveness of divestment is that the shares sold by divesting institutions are usually not diminished in value solely as a result of the sell-off. MacAskill (2015, October 20) illustrates the expected lack of impact on share price,

> (I)f the aim of divestment campaigns is to reduce companies' profitability by directly reducing their share prices, then these campaigns are misguided. An example: suppose that the market price for a share in ExxonMobil is ten dollars, and that, as a result of a divestment campaign, a university decides to divest from ExxonMobil, and it sells the shares for nine dollars each. What happens then?
>
> Well, what happens is that someone who doesn't have ethical concerns will snap up the bargain. They'll buy the shares for nine dollars apiece, and then sell them for ten dollars to one of the other thousands of investors who don't share the university's moral scruples. The market price stays the same; the company loses no money and notices no difference. As long as there are economic incentives to invest in a certain stock, there will be individuals and groups—most of whom are not under any pressure to act in a socially responsible way—willing to jump on the opportunity. These people will undo the good that socially conscious investors are trying to do.

The divestment of shares in companies doing business in South Africa during the 1980s still stands as, by far, the largest and most studied example of shareholder pressure against a perceived social evil. Therefore, it is instructive to learn from the economically measurable impact of this action, which was augmented by contemporary American consumer boycotts against these same companies and U.S. governmental sanctions against the South African economy. A statistically rigorous study, Teoh, Welch and Wazzan (1999), carefully analyzed

> ...the financial effects of shareholder pressure in what activists consider to have been the most visible and successful instance of social activism in investment policies, the boycott of South Africa designed to speed the end of the apartheid regime...The announcement of legislative or shareholder pressure had no discernible effect on the valuation of banks and corporations with South African operations or on the South African financial markets... One explanation may be that the boycott primarily reallocated shares and operations from 'socially responsible' to more indifferent

> investors and countries. Our findings are consistent with the view that demand curves for stocks are highly elastic and so have little downward slope. In all, the evidence from both individual and legislative actions, taken together, suggests that the South African boycott had little valuation effect on the financial sector.

But the South African example is by no means the only action that failed to produce substantial financial damage against the target in question. We learn from MacAskill (2015, October 20) that

> Studies of divestment campaigns in other industries, such as weapons, gambling, pornography, and tobacco, suggest that they have little or no direct impact on share prices. For example, the author of a study on divestment from oil companies in Sudan wrote, 'Thanks to China and a trio of Asian national oil companies, oil still flows in Sudan.' The divestment campaign served to benefit certain unethical shareholders while failing to alter the price of the stock.

As an important element that must go along with any divestment, CalPERS tracks their ongoing cost of divestment from tobacco-related securities. In the Foresti and Ingram (2017, October 24) letter to CalPERS, Wilshire Associates calculated the potential impacts related to tobacco divestment, including foregone performance and transaction costs, at $3,887mm since 2001, an amount equal to 1.2% of plan AUM at June 30, 2017. As we stated earlier, the size of the proposed fossil-fuel divestment for SFERS would be larger than prior exclusions of tobacco and Sudan-related stocks.

7. Fiduciary responsibility requires U.S. public pensions to act solely in economic interest of Plan participants

Due to the aforementioned expected costs of divestment and the historical futility of divestment campaigns in accomplishing their stated objective, a prudent public pension plan should take great caution before approving an action such as broad divestment that intentionally and meaningfully reduces portfolio diversification.

Government sponsored pension plans in the United States are subject to the so-called "Prudent Investor Rule" which incorporates the concept that a meaningful reduction in portfolio diversification will result in a less than optimal risk-adjusted return for said portfolio. This principle is one of the central tenets of Modern Portfolio Theory ("MPT"). MPT is the name given to a set of efficient portfolio construction principles that have evolved over the six decades since Markowitz (1952). Markowitz was awarded the 1990 Nobel Memorial Prize in Economic Sciences for his conceptual framework for building optimal portfolios. Bill Sharpe shared the 1990 Nobel Prize for expanding on Markowitz' work by developing important tools (such as the Capital Asset Pricing Model) to aid in investment decisions.

The Prudent Investor standard that investment decisions for assets held in trust should be made based on overall portfolio risk (which is lowered by combining weakly correlated asset classes) was a break from the prior "reasonable person" approach to the stewardship of trust assets. The standard prior to the Prudent Investor Rule discouraged institutional investors from investing in any specific security or asset class (such as private equity) that

was perceived to be "risky" by a reasonable person. The Prudent Investor standard was first embedded in the Employee Retirement Income Security Act of 1974 ("ERISA"), which governs American corporate pension funds. The American Law Institute in its 1992 Third Restatement of the Law of Trusts applied the Prudent Investor standard and the MPT concept of efficient portfolio construction to all U.S. fiduciaries overseeing assets held in trust. In 1994, the Uniform Law Commission codified the new standard of fiduciary care into the Uniform Prudent Investor Act (UPIA), also known as the Prudent Investor Rule. "ERISA and UPIA admonish fiduciaries to embrace the principles of Modern Portfolio Theory" according to p. 3 of Anke, Ong & Ong (n.d.).

California's version of the Prudent Investor Rule, was adopted into the state Constitution in 1995. Article XVI, Section 17 of the California Constitution lays out three fiduciary premises:

> **A. Primary Loyalty Rule**
> The members of the retirement board of a public pension or retirement system shall discharge their duties with respect to the system solely in the interest of, and for the exclusive purposes of providing benefits to, participants and their beneficiaries, minimizing employer contributions thereto, and defraying reasonable expenses of administering the system. A retirement board's duty to its participants and their beneficiaries shall take precedence over any other duty.
>
> **B. Exclusive Benefit Rule**
> The assets of a public pension or retirement system are trust funds and shall be held for the exclusive purposes of providing benefits to participants in the pension or retirement system and their beneficiaries and defraying reasonable expenses of administering the system.
>
> **C. Prudent Investor Rule/Duty to Diversify Investment**
> The members of the retirement board of a public pension or retirement system shall discharge their duties with respect to the system with the care, skill, prudence and diligence under the circumstances then prevailing that a prudent person acting in a like capacity and familiar with these matters would use in the conduct of an enterprise of a like character and with like aims...(They) shall diversify the investments of the system so as to minimize the risk of loss and maximize the rate of return, unless under the circumstances it is clearly not prudent to do so.[19]

In the Monaco (2017, July 13) legal opinion (included in its entirety as *Attachment 2* to this report) prepared in reference to the consideration of fossil fuel divestment by the Seattle City Employees Retirement System (SCERS), ERISA Attorney Michael Monaco wrote:

> *In accordance with the directions of the Board at its meeting on April 13, 2017, we have conducted a comprehensive reexamination of whether there has been any expansion or change in the legal rules determining the legality of ESG investment proposals. Following a review of relevant legal authorities in Washington State, throughout the United States, and internationally, we conclude that there has been no change in the legal standards that SCERS must follow in considering ESG*

proposals. Indeed, the ESG legal standards relevant to SCERS have only been reaffirmed by relevant court decisions, legal articles and treaties, model laws, and opinions by other law firms regarding the fiduciary responsibility standards governing retirement plans...

Particularly in the wake of financial services scandals and the economic crisis of 2008-2009, some advocates of broader ESG investment have argued that ordinary methods of valuation of stocks and other securities are missing the mark and should be supplemented - simply for the benefit of the retirement fund and the beneficiaries, to protect them from overvaluations. In particular, advocates of divestment from fossil-fuel companies have suggested that the financial markets are overvaluing them, and that alternative analyses of the alleged weaknesses of these companies require consideration of fossil fuel divestment.

However, in the last few years, the U.S. Supreme Court has reaffirmed that it is generally 'implausible' for a fiduciary to believe that a retirement plan committee can predict the value of a publicly-traded company better than the financial markets have...

Thus we continue to believe that the legal hazards would be great if a fiduciary were to consider taking an ESG action based (in whole or in part) on a rejection of ordinary economic principles as explained by investment professionals. As stated above, U.S. Supreme Court expressly considers a fiduciary's acceptance (of) well-established economic principles like the "efficient markets" view of publicly-traded companies to be prudent. More generally, the decisions by the Supreme Court (and other federal courts throughout the country) on these issues demonstrate the legal safety of basing investment decisions on analysis by established professionals with unquestionable expertise, and following established and accepted modes of analysis as well as the great hazard of failing to do so.

Finally, NEPC's view is shared by our peers that a significant divestment decision may conflict with the fiduciary duty of a U.S. public fund. NEPC surveyed all ten of the largest U.S. institutional investment Public Fund consulting firms (and two others in addition) on the question of whether they have ever recommended full divestment from fossil fuel stocks for a U.S. defined benefit public pension plan. Eleven firms responded. All of these competitors state that, similar to NEPC's stance, they have not made such a broad divestment recommendation to a government sponsored pension plan in this country.

One such competitor, Pension Consulting Alliance (PCA), was commissioned by the Vermont Pension Investment Committee (VPIC) "to review potential divestment and its potential impacts on the VPIC portfolio". Bernstein (2017, February 8) summarized PCA's opposition to restricting active managers from investing in fossil fuel securities as follows.

We find that divestment from fossil fuels, thermal coal, or ExxonMobil could:

- *increase costs*
- *add diversification and technological change risks to VPIC's portfolio*
- *only effect potential stranded assets risk, not other material climate change risks and opportunities,*
- *leave unaffected the financial situation of companies offering alternatives to fossil fuels,*
- *conflict with VPIC's governance in its asset allocation, equity investment strategy, and proxy voting and direct corporate engagement, and*
- *introduce a slippery slope of potential for other restrictions on VPIC's investment universe whose potential benefits have not been shown to outweigh the potential harm to the VPIC portfolio (p.5).*

Pension Consulting Alliance essentially agreed with NEPC's summary in p. 1 of Moseley (2013, February 22) that "...we believe that the Energy divestment initiative, if enacted, will have significant implications for VPIC, including the generation of immediate transaction costs, increase in asset management fees, and most importantly a potential reduction in expected return...going forward". Bernstein (2017) – which is included as *Attachment 3* to this report - concludes that "Fossil fuel divestment does not reduce the global economic dependence on, or demand for, fossil fuels, or impact the financing of the targeted companies" (p. 5).

8. Divestment removes many options for SFERS to take positive action to impact climate change

As stated at the beginning of this paper, NEPC agrees that institutional investors are prudent to position their policies and portfolios in response to climate change as a risk factor. While consideration of divestment may promote an illusion of "doing something", it is one of the least effective tools available to impact climate change and protect the SFERS portfolio. In fact, divestment can reduce the influence the Plan will have on helping to create a cleaner environment, fund greener technologies and shape better climate policy.

As an alternative to a strategic exclusion of energy securities, the Board may wish to consider various positive investment actions to address the climate risk within the investment program, as envisioned in the SFERS ESG Procedures. The City and County of San Francisco has been a leader in shareholder activism by policy since 1988. Through its Social Investment Policy, later known as its ESG policy, the Plan has followed a tiered assignment system ascribing levels of engagement. These levels are defined as Level I - Shareholder Voting, Level II - Direct Engagement and Level III – Investment Restrictions (divestment). There is recent evidence that proxy voting and engagement strategies are starting to have a positive impact on major energy producers.

Some US public pension systems have expressed concern about the damaging effects of climate change and have pursued various positive actions that they believe will benefit the financial well-being of their systems and the environment. These actions include engaging with corporations, integrating environmental risks into their investment process and pursuing sustainable investments. This approach is consistent with the principles of investment theory while addressing investor concerns about climate change.

UN PRI and the Ceres Investor Network are among the prominent examples of institutional investors collaborating to take positive action on climate change. "Global Investors Driving Business Transition" (n.d.), identifies Climate Action 100+ as a five-year investor initiative launched in December 2017 "to engage with the world's largest corporate greenhouse gas emitters to curb emissions, strengthen climate-related financial disclosures and improve governance on climate change. Specifically, investors will request that companies reduce emissions consistent with the goal of the Paris Agreement, to keep global temperature rise well-below 2-degrees Celsius and align their disclosures with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations."

One of the most significant recent victories in shareholder activism was led by US public pension funds and money managers against Exxon Mobil and Occidental Petroleum, as chronicled in Mufson (2017, May 31), excerpted from the *Washington Post*:

> *ExxonMobil management was defeated Wednesday by a shareholder rebellion over climate change, as investors with 62.3 percent of shares voted to instruct the oil giant to report on the impact of global measures designed to keep climate change to 2 degrees centigrade.*
>
> *The shareholder rebellion at the ExxonMobil annual meeting in Dallas was led by major financial advisory firms and fund managers who traditionally have played passive roles. Although the identity of voters wasn't disclosed, a source familiar with the vote said that major financial advisory firm BlackRock had cast its shares in opposition to Exxon management and that Vanguard and State Street had likely done the same. All three financial giants have been openly considering casting their votes against management on this key proxy resolution.*
>
> *BlackRock and Vanguard are the biggest shareholders in ExxonMobil, owning 13 percent, or $43.6 billion worth, of the company's stock. State Street Global Advisers, another big financial advisory firm that has called for greater climate disclosures, is close behind with 5.1 percent of the stock. The vote by them against management marked an important step for groups that have been trying to force corporations to adopt greater disclosure and transparency about the financial fallout of climate change.*
>
> *BlackRock, which said that climate disclosure is one of its top priorities, had warned on its website that "our patience is not infinite."*

'This is an unprecedented victory for investors in the fight to ensure a smooth transition to a low carbon economy,' said New York State Comptroller Thomas P. DiNapoli, a trustee of the New York Common Retirement Fund which co-sponsored the proxy resolution. 'Climate change is one of the greatest long-term risks we face in our portfolio and has direct impact on the core business of ExxonMobil,' he said in a statement.

The resolution, which was co-sponsored by the New York City pension fund, says that the company 'should analyze the impacts on ExxonMobil's oil and gas reserves and resources under a scenario in which reduction in demand results from carbon restrictions and related rules or commitments adopted by governments consistent with the globally agreed upon 2 degree [Celsius] target.'

The resolution adds that 'this reporting should assess the resilience of the company's full portfolio of reserves and resources through 2040 and beyond, and address the financial risks associated with such a scenario.'

It notes that other major oil companies including BP, Total, ConocoPhillips and Royal Dutch Shell have endorsed the two degree analysis.

BlackRock's website injected a sense of urgency about the issue.

'As a long-term investor, we are willing to be patient with companies when our engagement affirms they are working to address our concerns,' it said.

However, it added, 'when we do not see progress despite ongoing engagement, or companies are insufficiently responsive to our efforts to protect the long-term economic interests of our clients, we will not hesitate to exercise our right to vote against management recommendations.'

Fidelity Investments said it was adopting the U.N.'s Principles for Responsible Investment, though a spokesman said that was just a 'formulization of what we've done for a long time.'

The prospect of major financial management firms joining pension funds such as California's and New York's that have backed social and environmental resolutions in the past is already putting some companies on the defensive.

This month similar resolutions demanding that management explain how climate change could affect their businesses were adopted at Occidental Petroleum and PPL, a large utility holding company. Occidental's shareholders backed the resolution with a 67 percent majority, including BlackRock in its first vote ever against a company's management over the climate issue.

SFERS can leverage joint action with a number of like-minded larger institutional investors. Engagement strategies by CalPERS and CalSTRS are reviewed below and serve as examples of how US public pension systems can strive to achieve positive environmental impact while meeting their investment objectives. In considering the applicability of these programs, the Board should keep in mind that CalPERS' and CalSTRS' resources far exceed that of SFERS. CalPERS has been engaged in ESG initiatives since the launch of their corporate governance reform program in 1984. They were also a founding member of Ceres in 1989 and of the Ceres-coordinated Investor Network on Climate Risk in 2003. Ceres is a non-profit organization that advocates for sustainability leadership. As cited in Towards Sustainable Investment & Operations (2014), CalPERS' approach includes:

- Integrating climate change risk into their investment process with the intent of preserving the long term financial integrity of the system as a prudent investor;
- Leading initiatives to understand and require disclosure of the risks associated with these companies;
- Engaging through proxy voting initiatives and organizations like Ceres to promote understanding of how management at these firms are incorporating climate risk into their decisions;
- Finding investment opportunities that have a positive environmental impact, such as public companies that derive a material portion of their revenues from environmentally friendly sectors (e.g. low-carbon energy production, energy efficiency management, carbon trading) and sustainable forestry;
- Supporting organizations such as the Urban Land Institute Greenprint Center for Building Performance, which is committed to reducing energy consumption and carbon emissions in the real estate industry;
- Promoting the adoption of ESG guidelines by investment managers; and
- Partnering with the academic community through the CalPERS-founded Sustainable Investment Research Initiative, a program launched to study how sustainability factors impact investment return and risk.

As captured in Green Initiative Task Force (2014), CalSTRS integrated environmental risk management and positive action into their investment process in 2004 with the launch of a mission to manage risks and capture opportunities associated with climate change to enhance the risk-adjusted return profile of the fund. The CalSTRS approach includes:

- Integrating climate change considerations throughout the investment process and working with other investors in order to broaden its engagement reach;
- Managing climate change risk by voting proxies and routinely submitting environmental-related shareholder proposals to companies held in the public equity portfolio;

- Measuring an investment's profitability from activities and exposure to air quality, water quality, land usage and climate change;

- Promoting the incorporation of ESG factors by their public equity managers by polling them on an annual basis to assess the level of climate change considerations in their investment processes;

- Engaging with management, such as a recent request of 44 energy companies that they confirm adherence to SEC rules on reserve valuation that it be contained to "reserves that are the basis for their share price values are expected to be produced and sold within the next five to 10 years, making sequestration unlikely";

- Finding investments that have a positive environmental impact, such as a public equity sustainability program, private equity clean technology and renewable energy infrastructure; and

- Requiring their real estate separate account managers to include a "conservation/sustainability assessment" in their annual planning/budgeting process.

It is important to note that CalSTRS has spent more than a decade carefully weighing and crafting investment policies that support its integrated approach to ESG. SFERS and other pension plans may want to review the CalSTRS 21 Risk Factors outlined in Investment Policy for Mitigating Environment, Social, and Geopolitical Risks (n.d.) that is included as *Attachment 4* to this report. "It is important to note that fiduciary standards do not allow CalSTRS to select or reject investments based solely on social criteria." (p.2)

Conclusion:

While there is likely an element of catharsis that comes with taking a broad divestment action, SFERS should carefully weigh the cost and likely impact of such a decision. NEPC believes that ESG integration is a far more effective step for SFERS to help improve our environmental future while remaining aligned with the fiduciary responsibility of a US defined benefit public pension system. In a website post, Divestment from Fossil Fuels is Not the Solution (2014), CalPERS states that "we all have a shared concern with climate risk, but our view is that the solution lies in tackling energy companies through an engagement process focused on finding solutions, rather than walking away."

In the words of one climate change activist, Krosinsky (2016, October 12), who believes the goal of a cleaner environment is not advanced by the feel-good rush of taking an ultimately empty action like broad divestment:

> As a Board Member of the Carbon Tracker Initiative myself, it is great to see our work continue to become accepted, and given recent scientific acceptance of climate change via the IPCC findings, the need for an energy transition through investment decisions couldn't be clearer.
>
> Divesting from a few producer companies is a personal choice, and which is fine (I have done that myself), but changing the energy mix to a more sustainable balance is much more challenging and important, as are the complications large investors

face especially as concerns fiduciary duty and the use of benchmarks through passive, low-cost indexed investments.

Fiduciary Duty calls for asset owners such as Pension Funds...to act prudently and for the best interest of their beneficiaries.

A movement could be fostered to transition passive investment into indexes which evolve over time to match the sort of energy transition that is desperately needed.

Such a movement makes more sense than a Divestment from Oil campaign.

Frank Wolak, Stanford professor of economics, perhaps sums up our argument best when Chandler (2015, April 10) quotes him as saying "We all could agree that divestiture is a symbolic gesture that, sadly, will have no measurable impact on global greenhouse emissions, or the behavior of companies that produce fossil fuels."

APPENDIX

Attachment 1: Mercer (2015)

Attachment 2: Monaco (2017, July 13)

Attachment 3: Bernstein (2017)

Attachment 4: CalSTRS ESG Investment Policy

References

Adler, Timothy and Mark Kritzman (2008). "The Cost of Socially Responsible Investing." *Journal of Portfolio Management*. 35(1): pp. 52-56.

Anke, Lee H., Ted H. Ong and Jared Ong (n.d.). "Prudent Investing Under the California Probate Code: What judges, estate planning attorneys, fiduciaries, and trustees should know". Prudent Investors Network. Retrieved from http://www.prudentnetwork.com/wp-content/uploads/2014/05/Prudent_Investment_Under_CA_Probate_Code.pdf

Bernstein, Sarah (2017, February 8). "Climate Risk Divestment Discussion". Pension Consulting Alliance.

CalPERS. Divestment From Fossil Fuels Is Not The Solution (2014). Retrieved from http://www.calpers.ca.gov/index.jsp?bc=/about/newsroom/for-the-record/investments/issues/divestment-fossil-fuels.xml

CalSTRS. Green Initiative Task Force, 2014 Annual Report period ending June 30, 2014. Retrieved from http://www.calstrs.com/sites/main/files/file-attachments/green_initiative_task_force_2014_annual_report.pdf

CalSTRS. Investment Committee Quarterly Activity Report: Corporate Governance. 2014. http://resources.calstrs.com/publicdocs/Page/CommonPage.aspx?PageName=DocumentDownload&Id=0bc15456-45e2-4445-8ed6-4cc105d60135

Chandler, David L. (2015, April 10). "Participants discuss a proposed elimination of oil, gas and coal companies from endowment portfolio". MIT News Office

Church, John A. and Neil J. White (2011, March 30). "Sea-Level Rise from the Late 19th to the Early 21st Century". *Surveys in Geophysics*, 32: pp. 585-602

Dahlman, LuAnn (2017, September 11). "Climate Change: Global Temperature" [Website article]. U.S. National Oceanic and Atmospheric Administration. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature

Fischel, Daniel R., Christopher R. Fiore and Todd D. Kendall (2017, June). "Fossil Fuel Divestment and Public Pension Funds". Compass Lexecon.

Foresti, Stephen and Ingram, Daniel (2017, October 24). "Financial Analysis of CalPERS' Divestment Programs". [Letter] Wilshire Associates.

Global Climate Change: Vital Signs of the Planet. (2018, January 2). National Aeronautics and Space Administration. Retrieved from https://climate.nasa.gov

"Global Investors Driving Business Transition" (n.d.) Climate Action 100+ website. Retrieved from http://www.climateaction100.org/

Grossman, Blake R. and William F. Sharpe (1986). "Financial Implications of Divestment of South Africa-Related Stocks". Stanford University.

Guerard, John B. (Winter 1997). "Additional Evidence on the Cost of Being Socially Responsible in Investing". *Journal of Investing*

Hong, Harrison and Marcin Kacperczk (2008). "The Price of Sin: The Effects of Social Norms on Markets". *Princeton University*

IPCC 2014, [IPCC Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], (2014), *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: Intergovernmental Panel on Climate Change.

Kritzman, Mark (2013, March). "What Fossil-Fuel Divestment Would Cost", *The Chronicle of Higher Education*

Krosinsky, Cary (2016, October 12). "The Problem with Divestment: An energy transition is what is needed, so we should ask for it", The Balance. Retrieved from https://www.thebalance.com/the-problem-with-divestment-3025393

Kurtz, Lloyd and Dan DiBartolomeo (Fall 2011). "The Long-Term Performance of a Social Investment Universe." *The Journal of Investing* 20(3): pp.95-102.

Love, Joseph L. (1985/1986). Harvard University, Divestment from South Africa Notes.

MacAskill, William (2015, October 20). "Does Divestment Work?", *The New Yorker*, October 20, 2015

Markowitz, Harry (1952). "Portfolio Selection", *The Journal of Finance*, 7(1): pp. 77-91

Mercer (2015). "Investing in a Time of Climate Change". Mercer LLC, International Finance Corporation and the UK Department for International Development.

Monaco, Michael. (2017, July 13). "Legal Permissibility of Environmental, Social and Governance Investment Proposals". [Legal opinion rendered to Seattle City Employees' Retirement System]. Mondress Monaco Parr Lockwood PLLC

Moseley, Doug (2013, February 22). "Preliminary Analysis of Potential Impact of Energy Sector Divestment". NEPC

Mufson, Steven (2017, May 31) "Financial Firms Lead Shareholder Rebellion Against ExxonMobil Climate Change Policies", *Washington Post*

Parwada, Jerry T. (2012). "When Does a Stock Boycott Work? Evidence from a clinical study of the Sudan divestment campaign". University of New South Wales.

Prudent Investor Rule – Compliance in California. (n.d.). Law Offices of Stimmel, Stimmel & Smith. Retrieved from https://www.stimmel-law.com/en/articles/prudent-investor-rule-compliance-california

Rudd, Andrew (1979). "Divestment of South African Equities: How risky?", *The Journal of Portfolio Management*, 3(3): pp. 5-10

Salzman, A. (2018, January 1). "What inflation could mean for the market", *Barron's*, pp. 17-19

Schroders. 2010. Investment Perspectives What are the inflation beating asset classes? http://www.schroders.com/staticfiles/Schroders/Sites/Americas/US%20Institutional%202011/pdfs/Inflation-Paper-US-Compliance.pdf

Statman, Meir and Denys Glushkov (2009). The Wages of Social Responsibility", *Financial Analysts Journal*, 65:4

Teoh Siew Hong, Ivo Welch and Paul Wazzan (1999). "The Effect of Socially Activist Investment Policies on the Financial Markets: Evidence from the South African boycott", *Journal of Business* 72: pp. 35-89

Towards Sustainable Investment & Operations (2014). [CalPERS Report]. Retrieved from https://www.calpers.ca.gov/eip-docs/about/pubs/esg-report-2014.pdf

Wagner, Wayne H., Allan Emkin and Richard Dixon (1984). "South African Divestment: The investment issues", *Financial Analysts Journal*, 40 (6): pp.14-2

Disclaimers and Disclosures

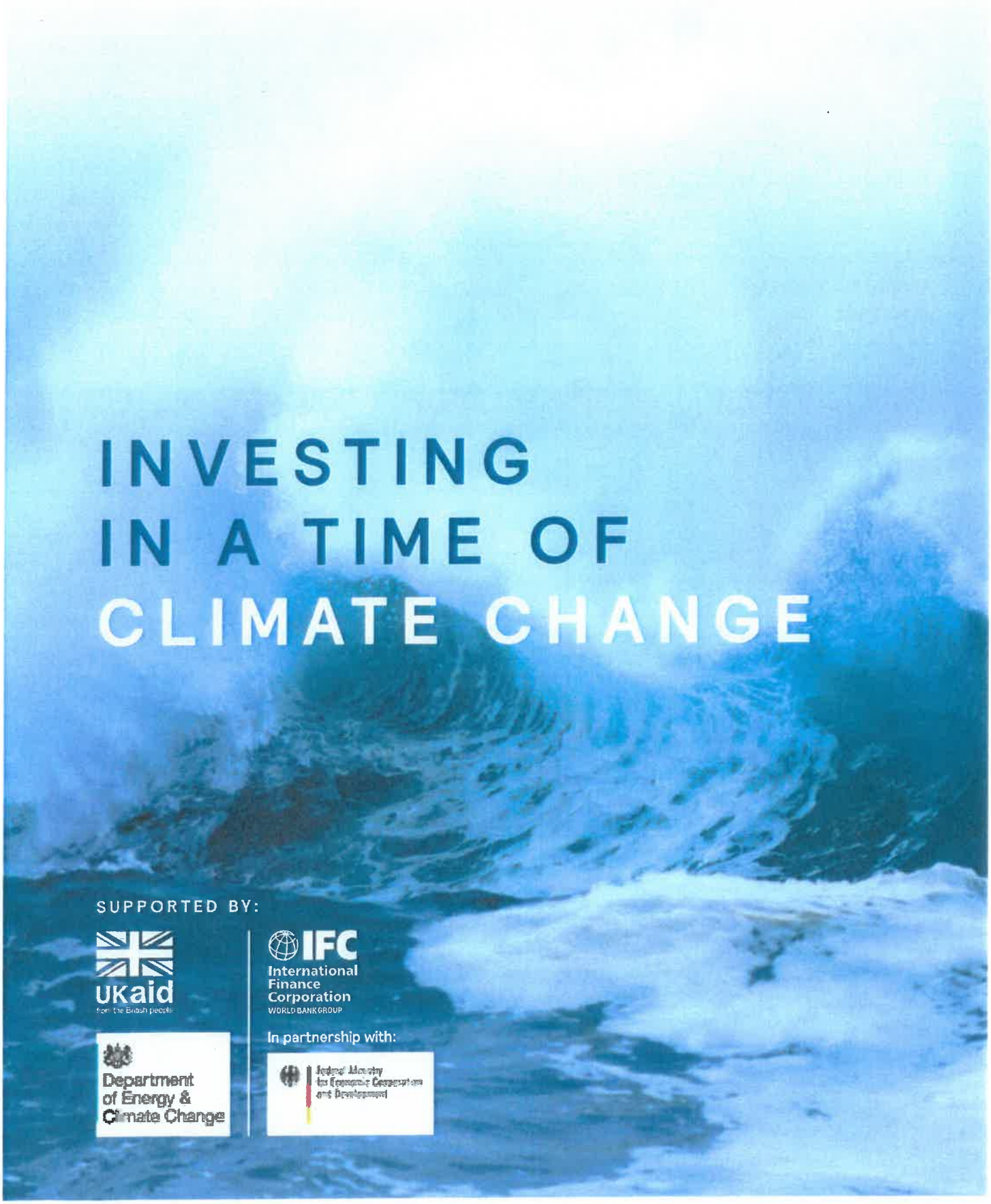
- Past performance is no guarantee of future results.
- All investments carry some level of risk. Diversification and other asset allocation techniques do not ensure profit or protect against losses.
- The information in this report has been obtained from sources NEPC believes to be reliable. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.
- The opinions presented herein represent the good faith views of NEPC as of the date of this report and are subject to change at any time.

NEPC Fossil Fuel Divestment Commentary
January 24, 2018

ATTACHMENT 1

Mercer (2015)
"Investing in a Time of Climate Change"
Mercer LLC, International Finance Corporation and the UK Department for International Development

HEALTH WEALTH CAREER



INVESTING IN A TIME OF CLIMATE CHANGE

SUPPORTED BY:

UKaid
from the British people

Department of Energy & Climate Change

IFC
International Finance Corporation
WORLD BANK GROUP

In partnership with:

Federal Ministry for Economic Cooperation and Development

MAKE TOMORROW, TODAY MERCER

CONTENTS

1

FOREWORD

Deb Clarke

Global Head of Investment Research, Mercer

We are excited to share this report with you. It builds on our commitment to revisit our groundbreaking 2011 study[1] and its follow-up paper, *Through the Looking Glass*,[2] and to accelerate the evolution of climate risk management.

The international community will negotiate a new global climate agreement at the end of 2015 in Paris. With this report, Mercer and our study partners aim to help asset owners and investment managers increase the sophistication with which they consider the impact of climate-policy changes and related factors on their portfolios. For investors who assume that the future will continue to mirror the past, the findings may hold some surprises. For climate-aware investors, this study provides information on risk and opportunity priorities to incorporate when building their total portfolios. For policymakers in the lead-up to the Paris negotiations, the findings reinforce the role of policy setting in mobilising capital for the low-carbon economy.

A similar approach to the first study has been followed: a collaboration focused on the impact of climate change, identifying the scenarios, risk factors, and investment modelling methodology. This allows investors to be better informed to identify, assess, and act on climate change within the investment process. However, a more dynamic modelling approach has been used this time to incorporate four climate scenarios and four climate risk factors to estimate the impact on returns for portfolios, asset classes, and industry sectors between 2015 and 2050.

This sector-level detail, together with updated scientific data points and an improved ability to quantify potential physical impacts, enhances the first study significantly.

---

[1] Mercer. Climate Change Scenarios — *Implications for Strategic Asset Allocation, 2011*, available at: http://www.mercer.com/content/dam/mercer/attachments/global/investments/responsible-investment/Climate-change-scenarios-Implications-for-strategic-asset-allocation.pdf , accessed 8 April 2015.

[2] Mercer. *Through the Looking Glass: How Investors Are Applying the Results of the Climate Change Scenarios Study*, 2012, available at: http://www.mercer.com/content/dam/mercer/attachments/global/investments/responsible-investment/Through-the-looking-glass-January-2012-Mercer.pdf, accessed 8 April 2015.

Many minds have been involved in this collaboration: Mercer's Investments team; our sister companies NERA Economic Consulting and Guy Carpenter; 16 asset-owner and asset-manager partners from around the world; two public partners connecting our industry to policy and development contexts; and 13 advisory-group members.

We have understood for a number of years that climate change presents a series of risks to institutional investors, who manage trillions of dollars in capital globally for pension fund members and individual savers, endowments, foundations, and insurers. For the fiduciaries overseeing investments, climate change poses portfolio risks but also opens up new opportunities. This is because the necessary reduction in carbon emissions will require a fundamental change in the energy mix that underpins, to some extent, every investment in a portfolio.

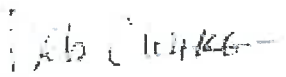
More than two centuries of economic development has been supported by access to cheap fossil fuels. The transition to a lower-carbon economy has begun, but we expect the speed of the process to increase. Evidence of the potential impacts that emissions-related temperature increases will have on resource availability, physical asset damage, and human health are driving the need for policy action.

This study has identified four scenarios deemed most relevant to investors, but we recognise that other scenarios may eventuate in the future. Although the timing and magnitude of potential climate impacts are uncertain, enough is now known to enable investment fiduciaries to incorporate better climate governance in their investment processes.

The key findings from this study can help investors to build resilience into their portfolios in a time of change — identifying the "what", the "so what", and the "now what" for asset owners and the wider investment industry.

Partners collectively representing over US$1.5 trillion participated in each stage of the study, gaining additional insights into an appropriate response to the findings, specific to their portfolios and organisations. The partner group intends to reconvene in the first half of 2016 to review developments and discuss how they have applied the recommendations in their portfolios.

In Mercer's Investments business, we place strategic priority on helping our clients become more effective long-term investors. Climate change fits naturally within this context, and we believe this study will contribute towards better preparing global investors for change.



Deb Clarke

WORDS FROM OUR PARTNERS

"Institutional investors require actionable information to adequately reflect climate risks and opportunities into asset allocation. While global warming is a fact, we face great uncertainty around policy measures and the financial impacts in the nearer term are little understood. The Mercer study is an important step in channelling scientific and regulatory insights on climate change into the investment process and could become a standard toolbox for the strategic asset allocation."

Karsten Löffler,
Managing Director,
Allianz Climate Solutions GmbH

"The multi-scenario, forward-looking approach to this study makes it unique. Investors will be able to consider allocation optimisation, based on the scenario they believe most probable, to help mitigate risk and improve investment returns."

Brian Rice,
Portfolio Manager, CalSTRS

"The Church of England National Investing Bodies have adopted a climate change policy which recognises climate change as an urgent ethical issue with important financial implications. In our policy we say that we want to be at the forefront of institutional investors addressing the challenge of transition to a low carbon economy. Our participation in this study has enabled us to grow our understanding of the investment implications of climate change and to consider ways in which, as investors working with others, we can help prevent dangerous climate change occurring."

Edward Mason,
Head of Responsible Investment,
Church Commissioners for England

"Cbus sees climate change as a significant issue for our investment portfolio over the longer term. We believe that participation in this study gives us insights into the range of impacts that climate change may have on our investments, and enable us to better prepare for the climate change-related challenges ahead."

Kristian Fok,
Executive Manager Investment Strategy, Cbus

"As a long-term investor, the Environment Agency Active Pension Fund recognises that climate change is a financially material risk. We have integrated the findings arising from the previous Mercer study in setting the Fund's current investment strategy, and participating in this update allows us to build on our existing approach to managing climate risk. By adopting a strategic asset allocation that is robust in incorporating both the risks and opportunities presented by climate change, we will continue to act in the best long-term interest of our members."

Dawn Turner,
Head of Pension Fund Management, EAPF

"The results from the 2011 climate change study that we participated in showed that climate change may have large impacts on our investment portfolio. Therefore, we have participated in the follow-up study to further develop our knowledge, our methods and our risk management regarding climate change."

Mikael Angberg,
CIO, AP1

"As a long-term, intergenerational investor, we need to understand the investment risks and opportunities associated with climate change. This study will help us calibrate our investment strategies accordingly."

Adrian Orr,
CEO, NZ Super

"State Super Financial Services recognises the importance of understanding climate change risks to our investment portfolios and we identified this study as an opportunity to meet this objective and further develop our broader ESG approach for our clients' benefit."

Jo Cornwell,
Investment Specialist,
State Super Financial Services

"Climate change forces investors in the 21st Century to reconsider our understanding of economic and investment risk. This study provides the New York Common Retirement Fund with valuable insights that will inform our efforts to manage climate risk and build out our portfolio in ways that protect and enhance investment returns."

New York State Comptroller
Thomas P. DiNapoli,
Trustee of the New York State Common Retirement Fund

"This report highlights that investors should see the opportunities in addition to the risks from climate change. The tides are turning toward a low carbon future and away from the unsustainable status quo. Investment is needed to accelerate this unavoidable trend and those who are ahead of this trend, the report shows, may in fact better secure their financial future. It is now time for us to make sure that our investments are safe for the long term, safe financially and safe for our precious planet."

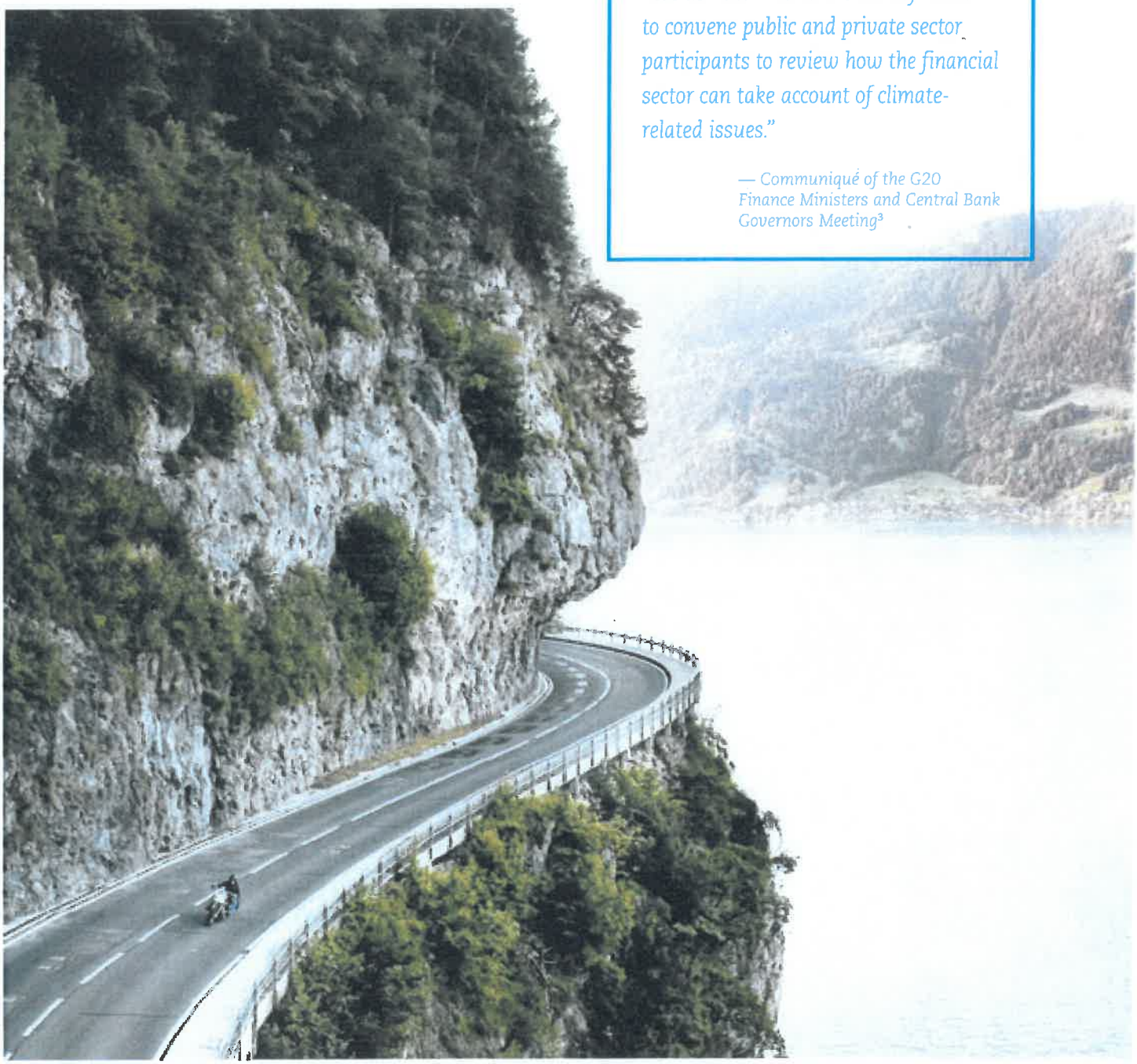
David Nussbaum,
Chief Executive, WWF-UK


8
9
10
11
12
13
14

2

EXECUTIVE SUMMARY

> *"We ask the Financial Stability Board to convene public and private sector participants to review how the financial sector can take account of climate-related issues."*
>
> — *Communiqué of the G20 Finance Ministers and Central Bank Governors Meeting*[3]



[3] April 2015. https://g20.org/wp-content/uploads/2015/04/April-G20-FMCBG-Communique-Final.pdf, accessed 20 May 2015.

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. Investors cannot therefore assume that economic growth will continue to be heavily reliant on an energy sector powered predominantly by fossil fuels. This presents asset owners and investment managers with both risks and opportunities.

Mercer's 2011 study on this topic established important foundations for investors, and its key findings still hold true. The study highlighted the importance of climate policies as a risk factor for investors, given their ability to incentivise meaningful changes in the energy sector. This policy risk was not found to be more important than equity or credit risk premiums, but was considered potentially more important than factors such as the illiquidity premium. This study estimates the impact of climate change on returns to demonstrate why climate-related risk factors should be standard considerations for investors.

This study helps address the following investor questions:

- How big a risk/return impact could climate change have on a portfolio, and when might that happen?
- What are the key downside risks and upside opportunities, and how do we manage these considerations to fit within the current investment process?
- What plan of action can ensure an investor is best positioned for resilience to climate change?

How big a risk/return impact could climate change have on a portfolio, and when might that happen?

Our investment modelling has demonstrated the following:

1. Climate change, under the scenarios modelled, will inevitably have an impact on investment returns, so investors need to view it as a new return variable.
2. Industry sector impacts will be the most meaningful. For example, depending on the climate scenario which plays out, the average annual returns from the coal sub-sector could fall by anywhere between 18% and 74% over the next 35 years, with effects more pronounced over the coming decade (eroding between 26% and 138% of average annual returns). Conversely, the renewables sub-sector could see average annual returns increase by between 6% and 54% over a 35 year time horizon (or between 4% and 97% over a 10-year period).
3. Asset class return impacts could also be material – varying widely by climate change scenario. For example, a 2°C scenario could see return benefits for emerging market equities, infrastructure, real estate, timber and agriculture. A 4°C scenario could negatively impact emerging market equities, real estate, timber and agriculture. Growth assets are more sensitive to climate risks than defensive assets.[4]
4. A 2°C scenario does not have negative return implications for long-term diversified investors at a total portfolio level over the period modelled (to 2050), and is expected to better protect long-term returns beyond this timeframe.

What are the key downside risks and upside opportunities, and how do we manage these considerations within the current investment process?

Key downside risks come either from structural change during the transition to a low-carbon economy, where investors are unprepared for change, or from higher physical damages.

In the first instance, under a 2°C, or Transformation scenario, investors could see a negative impact on returns from developed market equity and private equity, especially in the most affected sectors. On the flip side, this scenario would be likely to lead to gains in infrastructure, emerging market equity, and low-carbon industry sectors.

Under a 4°C, or Fragmentation (Higher Damages) scenario, chronic weather patterns (long-term changes in temperature and precipitation) pose risks to the performance of asset classes such as agriculture, timberland, real estate, and emerging market equities. In the case of real asset investments, these risks can be mitigated through geographic risk assessments undertaken at the portfolio level.

To embed these considerations in the investment process, the first step is to develop climate-related investment beliefs alongside other investment beliefs. These can then be reflected in a policy statement, with related investment processes evolved accordingly. The next step is portfolio-oriented activity, including risk assessments, new investment selection/weights and, finally, enhanced investment management and monitoring.

What plan of action can ensure an investor is best positioned for resilience to climate change?

Investors have two key levers in their portfolio decisions — investment and engagement. From an investment perspective, resilience begins with an understanding that climate change risk can have an impact at the level of asset classes, of industry sectors and of sub-sectors. Climate-sensitive industry sectors should be the primary focus, as they will be significantly affected in certain scenarios.

Investors also have numerous engagement options. They can engage with investment managers and the companies in their portfolio to ensure appropriate climate risk management and associated reporting. They can also engage with policymakers to help shape regulations.

[4] Growth assets include: listed equity, private equity, real assets (such as real estate, infrastructure, timber, and agriculture), growth fixed income, hedge funds, and multi-asset funds. Defensive assets include: cash, sovereign bonds and index-linked bonds (long dated), absolute return bonds, and investment-grade credit.

STUDY BACKGROUND

Scenarios provide helpful guides for prioritising actions when faced with uncertainty. Therefore, our study uses a scenario-based approach to inform investment strategy; this builds on our groundbreaking work in 2011. In the 2015 study, an extensive process has identified four climate risk factors and four climate scenarios most relevant to investors. To estimate the impact of climate change on expected returns, we have incorporated these into our investment model for setting asset allocation.

Our analysis estimates the potential impact of climate change on industry sectors, asset classes, and total portfolio returns, between 2015 and 2050.

2

CLIMATE MODELS

Climate models are technically referred to as integrated assessment models (IAMs). These provide quantitative projections, integrating both climate science and economic data, which represent the interactions of natural and human systems.

These are the best tools available to estimate a quantitative impact of climate change over the long term (many decades or centuries). There are, however, significant limitations in quantifying the linkages and feedbacks within and between these highly complex systems. There are also challenges in representing these in a simple numeric way. Typically, IAMs focus more on mitigation (measures to reduce net carbon emissions) and less on adaptation (actions that aid a response to new climate conditions). They have often been accused of underestimating physical damages.

This study began with a review by NERA Economic Consulting (NERA) of the climate models used to estimate mitigation costs and economic damages associated with physical impacts. NERA's scenario analysis combined two major models — one for mitigation, one for damages — with additional literature reviews. This provided global and regional results for the energy sector and the total economy.

To address gaps in physical-impact estimates, Guy Carpenter drew on its direct experience with catastrophe-risk modelling, as well as its analysis of climate change and its knowledge of current climate change research.[5] Analysis of additional perils, not quantified by the climate models used, was also included for perils believed to have the largest potential impact on the economy over the next 35 years — namely "Coastal Flood as influenced by Sea Level Rise" (Coastal Flood / coastal flooding), and Wildfire.

Further detail on the climate models can be found in Appendix 1.

RISK FACTORS — TRIP

Climate change has many dimensions. We have isolated four risk factors that indicate the future implications of climate change for investors.

The first is **Technology (T)**, broadly defined as the rate of progress and investment in the development of technology to support the low-carbon economy. Next is **Resource Availability (R)**, defined as the impact on investments of chronic weather patterns (for example, long-term changes in temperature or precipitation) and related physical changes. Thirdly, there is **Impact (I)**, defined as the physical impact on investments of acute weather incidence/severity (that is, extreme or catastrophic events). Finally, there's **Policy (P)**, 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.

[5] Guy Carpenter. *Global Warming: The Evolving Risk Landscape*. 2013.

SCENARIOS

Based on our research, we developed four relevant scenarios for investors, collaboratively with input from all 18 project partners and the study advisory group. Our scenarios are based on some of the most advanced climate modelling and scientific literature available.[6] They offer investors a range of what's possible, providing several views of the way the next 35 years might play out.

We have labelled these scenarios:

1. Transformation.
2. Coordination.
3. Fragmentation (Lower Damages).
4. Fragmentation (Higher Damages).

Transformation is characterised by strong climate change mitigation that puts us on a path to limiting global warming to 2°C above pre-Industrial-era temperatures this century. This scenario has:

- Strong climate-mitigation action: emissions peak by 2020, then fall by 56%, relative to 2010 levels, by 2050.
- Fossil fuels representing less than half of the energy mix by 2050.
- Estimated annual emissions of 22 gigatons of equivalent carbon dioxide ($GtCO_2e$) by 2050.

Coordination is a scenario in which policies and actions are aligned and cohesive, limiting global warming to 3°C above pre-Industrial-era temperatures this century.

The Coordination scenario has:

- Substantial climate-mitigation action: emissions peak after 2030, then fall by 27%, relative to 2010 levels, by 2050.
- Fossil fuels representing around 75% of the energy mix by 2050.
- Estimated annual emissions of 37 $GtCO_2e$ by 2050.

Fragmentation (Lower Damages) sees limited climate-mitigation action and lack of coordination, resulting in a 4°C or more rise above pre-Industrial-era temperatures this century. This sees:

- Limited climate action: emissions grow another 33% over 2010 levels, peaking after 2040.
- Fossil fuels representing 85% of the energy mix by 2050.
- Estimated annual emissions of 67 $GtCO_2e$ by 2050.

Fragmentation (Higher Damages) sees the same limited climate-mitigation action as the previous scenario, but assumes that relatively higher economic damages result.

Of these four scenarios, Transformation is the best and Fragmentation (Higher Damages) the worst for limiting the environmental and social implications of climate change.

For a long-term investor, Fragmentation (Higher Damages) is also the worst climate scenario over the very long term, with the greatest expected economic damages and uncertainty (albeit with substantially lower mitigation costs). During different time periods between now and 2050, however, different scenarios will be "best" or "worst", depending on whether investors have anticipated the changes that occur, and whether portfolio holdings are positioned accordingly.

[6] NERA developed detailed modelling information for three of the scenarios, with Guy Carpenter modifying and supplementing the climate-damage results. Mercer developed information for the Transformation scenario.

For context:

- The 2012 fossil fuel share of global primary energy demand was 82% (IEA WEO 2014).
- A recent report from the World Bank (Nov 2014), found that, globally, warming of close to 1.5°C above pre-Industrial times is already locked into Earth's atmospheric system by past and predicted greenhouse gas emissions.

2

SCENARIO PATHWAYS AND ASSET SENSITIVITY

To model the climate impact on returns, we adapted our investment model by adding two inputs. The first was a quantified representation of the future pathways for each TRIP factor under each of the four scenarios, and their relative impacts over time. The second was the sensitivity to the TRIP factor for different asset classes and industry sectors. We assigned sensitivities according to evidence that suggested the relative magnitude and whether the impact was positive or negative. This enabled us to consider the differing scale and direction of climate impacts on different asset class and industry sectors over time.

The range of climate impact on returns by asset class and industry sector are presented below, with further detail in the "Portfolio Implications and Investor Actions" section.

ASSET CLASS SENSITIVITY AND RETURN IMPACTS

There are material impacts at the asset-class level, with the outcome dependent on the eventuating scenario in many cases. Only developed market global equity has a minimum negative impact, regardless of the scenario, given its negative sensitivity to the Policy factor.

Infrastructure, emerging market equity and real estate are expected to benefit from climate policy and technology. Agriculture and timber have the widest-ranging impacts, dependent on the scenario, as they have negative sensitivity to Resource and Impact factors and positive Policy sensitivity. Agriculture also has positive sensitivity to the Technology factor.

Developed market sovereign bonds are not viewed as sensitive to climate risk at an aggregate level where they are driven by other macro-economic factors, although there are some exceptions.

Figure 1 on the following page shows the climate impact on returns by asset class over 35 years to 2050.

INDUSTRY SENSITIVITY AND RETURN IMPACTS

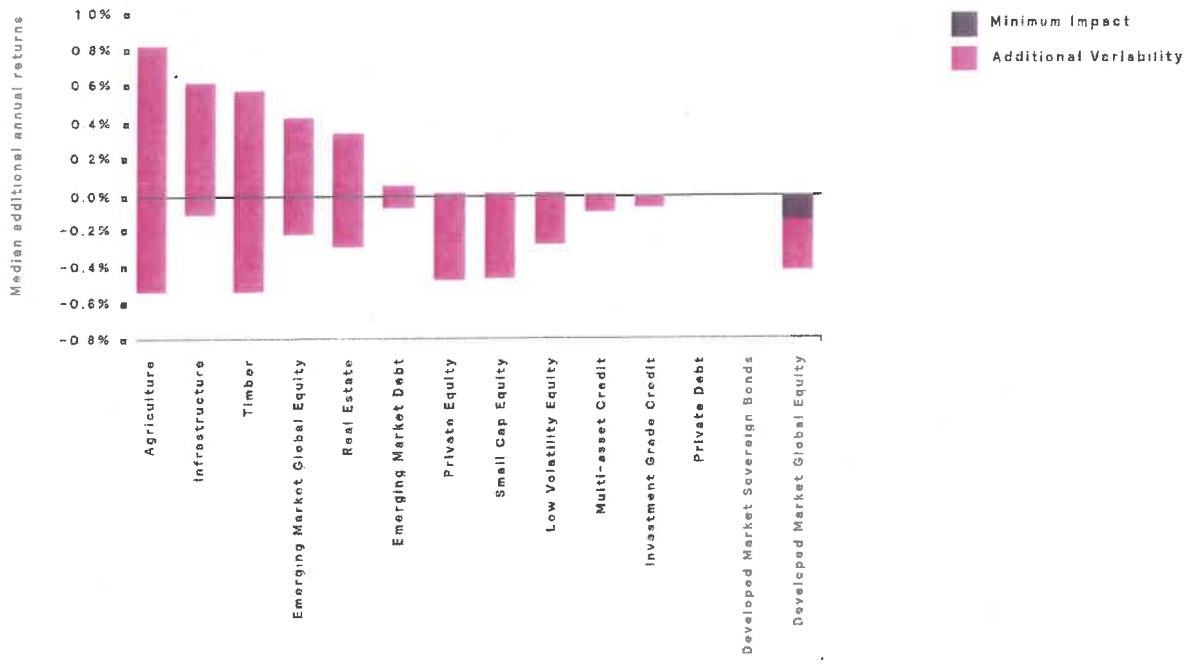
There are meaningful impacts on return at the industry-sector level. This is particularly evident for those industry sectors expected to be most sensitive to the Policy factor: energy and utilities. The sub-sectors with the highest negative sensitivity are coal and electric utilities. Renewables have the highest positive sensitivity, followed by nuclear.

Industry sectors and sub-sectors with the greatest positive sensitivity to the Technology factor include renewables, nuclear, materials, and industrials.

Energy and utilities have the greatest negative sensitivity to the Resource Availability and Impact factors, with industrials also sensitive to physical impacts.

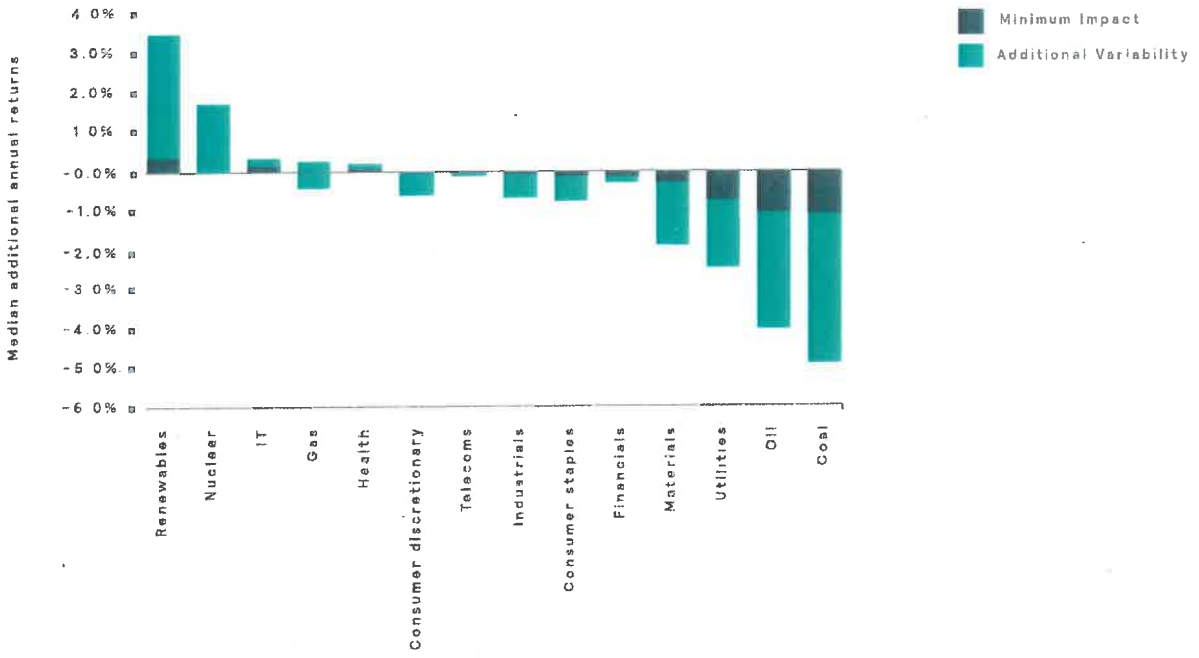
Figure 2 on the following page shows the climate impact on returns by industry sector over 35 years to 2050.

Figure 1: Climate Impact on Returns by Asset Class (35 Years)



Source: Mercer

Figure 2: Climate Impact on Returns by Industry Sector (35 Years)



Source: Mercer

2

PORTFOLIO IMPLICATIONS AND INVESTOR ACTIONS

Our approach to investment modelling analyses changes in return expectations in the 35 years between 2015 and 2050, driven by the four climate change scenarios reviewed. The results allow us to identify the potential climate impact on returns, including the minimum and maximum impact investors can expect when climate considerations are included (that is, the TRIP factors and four climate scenarios).

In the "Portfolio Implications and Investor Actions" section, we give further detail on the findings from our investment modelling. These are also captured below as the "**what?**", alongside why they matter to investors ("**so what?**"), and what can be done in response ("**now what?**").

Following the process indicated by these findings will lead to an evolution of the portfolio over time, from the asset allocation of the overall portfolio to exposures within asset classes. The process will also lead to an enhanced focus on monitoring and engaging with managers on sector exposures and company positions. The focus for investors will be on portfolio exposures to the asset classes and industry sectors most sensitive to the TRIP factors and those with the greatest potential for climate impact on returns. Investors should also consider the use of engagement as a tool for risk management, both with companies and from a market-wide perspective.

Asset owners will require a governance approach that enables them to build capacity to monitor and act on shorter-term (1–3 years) climate risk indicators, as well as longer-term (10-year plus) considerations. This will include engaging with investment managers whose focus will be on building capacity to address shorter-term climate considerations.

Consistent with our thinking on the best way to incorporate environmental, social, and governance (ESG) considerations into the investment process, we recommend an integrated approach that establishes investment beliefs and policy, enhances processes and then reviews the portfolio.[7]

[7] 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

PUTTING THE FINDINGS IN CONTEXT: SO WHAT?

Tables 1(a) to (e) below outline how our key findings ("**what?**") matter most to investors ("**so what?**"), and show what can be done in response ("**now what?**"). In summary, we find that all investors have action to take in response to climate change.

Table 1(a): Climate risk is inevitable — investors can improve outcomes by being prepared

WHAT?

Some impacts on investment returns are inevitable.

- Findings suggest that climate change risks will impact investment returns — regardless of which scenario unfolds. In a low-return environment, these numbers are particularly meaningful.

SO WHAT?

Some action will lead to better investment outcomes than no action.

- To optimise investment outcomes, investors should consider climate risks at the asset class, industry-sector, and industry sub-sector level. This will require changes in how they work with service providers.
- Uncertainty about the future should not be a barrier to action.

NOW WHAT?

Improve investor governance of climate risk.

- Attention to long-term issues often requires new or revised governance arrangements — in particular, to ensure that due attention is given to them even if the "so what" isn't next quarter.
- Developing related investment beliefs and policies is an important step.
- Investors should also revisit and review climate impacts and sensitivities as part of their regular monitoring processes.

See the "Beliefs, Policy, and Process" sections of the Actions tables (Tables 4 and 5).

2

Table 1(b): Sensitive industry sectors deserve focus that may be outside the typical remit of investment committees.

WHAT?

The impact on different sectors varies widely but can be significant.

- Energy sub-sectors, utilities, and materials will have the most meaningful impacts.
- The minimum impact for the coal sub-sector is likely to be a reduction in expected returns from 6.6% p.a. to 5.4% p.a. averaged over the next 35 years, and with additional variability average returns may fall as low as 1.7% p.a. Renewables have the greatest potential for additional returns: depending on the scenario, average expected returns may increase from 6.6% p.a. to as high as 10.1% p.a. Oil and utilities could also be significantly negatively impacted over the next 35 years, with expected average returns potentially falling from 6.6% p.a. to 2.5% p.a. and 6.2% p.a. to 3.7% p.a. respectively.
- The impacts are particularly apparent in annual returns, which are more significant in the shorter term (i.e. that is, over the coming 10 years).

SO WHAT?

Investment committees will be stretched to address this.

- Considering company winners and losers within industry sectors stretches the typical remit of investment committees and will require direct engagement with investment managers (be they internal or external), potentially requiring mandated guidance and longer-term incentives.
- This may require investors to invest in different vehicles or with different managers or to develop alternative benchmarks.

NOW WHAT?

Consider hedging and weighting changes.

- Policy-related risks are most significant in the near term and can be mitigated.
- For passive mandates, investors can consider low-carbon and more sustainable versions of broad market indices, which are evolving rapidly to provide investors with the means to hedge climate exposure.
- Within active mandates, managers have opportunities to manage portfolio exposure to climate change risks. Asset owners can track industry-sector exposure, and discuss approaches to climate risk assessment as part of the manager search and monitoring process. Numerous thematic strategies are also available, which can complement a core equity allocation. For investors with a strong long-term economic outlook, a change in benchmark may be warranted.
- Beyond equities, investors should consider industry sector exposure in private market and corporate bond investments.

See the "Portfolio" sections of the Actions tables, particularly the equities section (Tables 4 and 5).

Table 1(c): Certain asset classes deserve particular attention

WHAT?

Emerging markets, infrastructure, and real estate are positively aligned with a low-carbon scenario.

- There are also material impacts at the asset class level, with the outcome dependent on the particular scenario in many cases. Only developed market global equity equity is expected to experience a reduction in returns across all scenarios.
- Infrastructure and emerging market equities show positive additional returns under the Transformation and Coordination scenarios over 35 years, with further gains expected in real estate (due to its positive sensitivity to the Technology factor).
- Agriculture and timber are the asset classes with the widest-ranging potential impacts (positive or negative, depending on the scenario), given their negative sensitivity to Resource and Impact factors and positive Policy sensitivity (with agriculture also positive to the Technology factor).
- Developed market sovereign bonds are not viewed as sensitive to climate risk at an aggregate level (they are driven by other macro-economic factors), with exceptions, such as Japan and New Zealand.

SO WHAT?

Medium-term allocations should consider climate-oriented opportunities.

- Investors should consider increasing exposure to emerging market equities and sustainable real assets if they envision strong or very strong action on climate change.
- Physical risks must be managed in property, infrastructure, and natural resources, particularly if we see little action taken to reduce emissions.

NOW WHAT?

Focus on risks and opportunities across and within asset classes.

- Investors should consider climate risk — including a discussion of which scenario(s) they believe is most probable — when undertaking strategic asset-allocation exercises to prioritise key actions.
- Having clear investment beliefs about climate change will support this process.

See the "Portfolio" sections of the Actions tables (Tables 4 and 5)

2

Table 1(d): For a total portfolio, medium-term (multi-year) and 50+ year economic motivations are aligned towards a lowest-emissions scenario.

WHAT?

Investment impacts of different scenarios are not significantly different at the total portfolio level.

- Across a total portfolio, results are less significant because of the combination of positive and negative effects over the next 35 years.
- Comparing the Transformation scenario with the other three scenarios suggests that the economic transition implied by Transformation is not punitive from an investment perspective. A 2°C scenario does not have negative return implications for long-term diversified investors at a total portfolio level over the period modelled (to 2050).
- Extending modelled trends beyond 2050 — the end point for this analysis — we would expect the Fragmentation scenarios to have increasingly large negative impacts on returns at the total portfolio level. A Transformation scenario is expected to better protect long-term returns beyond this timeframe.

SO WHAT?

A "2°C" scenario (i.e. Transformation) doesn't jeopardise financial returns.

- This finding is counter to a relatively common view that a rapid transition towards a low-carbon economy would come at a significant financial cost to investors.
- This outcome could remove a barrier to more investors taking action to help achieve a 2°C outcome.

NOW WHAT?

Potential motivation for heightened investor focus on a 2°C outcome.

- The fact that the lowest emissions do not result in a drag on investment returns compared with the other scenarios means that fiduciaries can align short and long-term behaviour around investing and engaging for this outcome.
- Asset owners should discuss and determine their position.

See the argument in support of investors adopting "future maker" behaviour, as outlined in the Closing Reflections section "Investors as 'Future Makers' or 'Future Takers'".

Table 1(e): Climate risk is more complex and longer-term than most investment risks.

WHAT?

Climate risk is complex and has multiple dimensions.

- This is made clear through the TRIP (Technology, Resource Availability, Impact, and Policy) climate risk factors modelled in this study.

SO WHAT?

Managing climate risk is outside the average investor focus area.

- Traditional risks (such as market, inflation, or interest rate) are typically measured on an annual-plus (1 to 3 year) basis using familiar measures such as volatility or value at risk. Climate risks generally demand longer-term (>3 years) measurement, with risk metrics such as sea-level rise, carbon-price developments, and low-carbon investment flows outside the average investor's range of knowledge or experience.

NOW WHAT?

Climate risk deserves more attention on the long-term investment agenda.

- Long-term investors are rethinking the way they set priorities and define and measure risk. Climate change fits naturally into the "long-term investors' agenda", yet more must be done to bridge these timeframes.

See the Actions tables (Tables 4 and 5) to establish a short-term action plan to ensure immediate steps are taken.

CLOSING REFLECTIONS

All investors will be influenced by whichever global political and physical climate scenario emerges over the coming decades. In this sense, they are all "future takers" in the context of climate change, although investors will face this issue with different levels of resilience — with those investors that are unprepared for the minimum return impact expected to accompany any of the future scenarios effectively negating their best possible outcome.

On the other end of the spectrum is the emergence of a group of investors that we could term "future makers". These investors feel compelled by the magnitude of the longer-term risk of climate change to seek to influence which scenario comes to pass.

A key question for fiduciaries is, **"Which category best describes your approach?"**

3

KEY MOTIVATION FOR INVESTOR ACTION

> *"Climate change forces investors in the 21st Century to reconsider our understanding of economic and investment risk. This study provides the New York Common Retirement Fund with valuable insights that will inform our efforts to manage climate risk and build out our portfolio in ways that protect and enhance investment returns."*
>
> *—New York State Comptroller Thomas P. DiNapoli, Trustee of the New York State Common Retirement Fund*

This report's findings generate four key motivations for investor action on climate risk, spanning short and long-term concerns.

These motivations are:

1. Medium-term risk management (years).
2. Medium and long-term opportunities (years).
3. Short-term risk (months).
4. Long-term economic cost of inaction and concerns of beneficial owners (decades).

MEDIUM-TERM RISK MANAGEMENT (YEARS)

Long-term investors generally take a multi-year perspective when setting asset strategy. This is a vital component of investment oversight.

Capturing climate change in risk assessments and on the "risk register" will be important for understanding and managing the asset class and industry-sector risks and impacts on return identified in this study.

Yet our research suggests that few mainstream investors incorporate a detailed view on the policies that could underpin this change in investment analysis. Investors need to consider their equity asset class and industry-sector risks by asking questions such as:

- Do sector weights across the portfolio reflect anticipated structural change? And is there enough focus on this in our portfolio-construction process?
- Can investment managers articulate a clear perspective on the relevance (or otherwise) of climate risks to an investment mandate?
- Is engagement employed as a risk management tool, particularly for passive mandates?

Real assets, which include real estate, infrastructure, timber, and agriculture investments, are identified in the research as increasingly exposed to the risk of physical damage caused by climate change. These assets are typically held for over 10 years, yet few large investors with significant real-asset exposure are assessing or managing these risks at the portfolio level. A key question is:

- Can we undertake a total-portfolio risk assessment (including all real asset holdings) to identify exposure to potential physical damage risk under different climate scenarios?

MEDIUM AND LONG-TERM OPPORTUNITIES (YEARS)

Forecasting the future is inherently difficult — no one can predict which scenario will unfold, or how the industry weightings of stock-market indices will evolve. Under the climate scenarios explored in this study, there are potential "**first mover**" advantages in some asset classes and lower-carbon industry sectors, such as renewable energy, green building materials, and sustainable transport. To capture medium-term opportunities, investors need to ask:

- Which asset classes are positioned to benefit from future opportunities?
- What active and passive equity products exist to tilt towards these sources of growth?
- How can attractive industry sectors be accessed through each asset class, and particularly in private markets?

SHORT-TERM RISK (MONTHS)

Although our study has not focused on anticipating significant short-term volatility driven by unanticipated climate risks, one scenario does anticipate swift policy action on climate in the near term. This is expected to be an increasing cost on carbon, designed to reduce emissions and limit temperature increases. This increasing cost on carbon could erode expected gains in some sectors and produce annual losses. In considering this or other scenarios which may unfold, investors need to ask:

- What if climate change related policies are introduced at a level or within a timeframe unanticipated by the market, either globally or in regional blocks? Might this lead to a broad market correction, or could certain assets be left "stranded"?
- Could fossil-fuel subsidies be removed? Would this put major investments at risk?
- How quickly could the portfolio be repositioned if required, and what options exist today to hedge against future uncertainty?

LONG-TERM COST OF INACTION AND CONCERNS OF BENEFICIARIES (DECADES)

This study uses a 35-year timeframe to explore the potential impacts of climate risk, but the most significant physical impacts resulting from climate change will be felt after 2050. This is an example of a long- term downside risk that markets struggle to address. However, others with strategic focus are not ignoring this risk: US and UK reports suggest that climate change is likely to create strategic military risks as the physical impacts amplify fragile social and economic conditions (for example, by reducing access to vital resources such as water or food).

There is strong evidence that, if we follow our current trajectory, there will be a high risk of irreversible and severe impacts across the globe. Looking to 2100 and beyond sharpens the focus on whether to mitigate now, or to adapt later at potentially significantly greater cost. Refer to Appendix 2 for more on the 2100 timeframe.

Although adopting a long-term perspective is challenging in practice, it is not impossible. Investors need to ask:

- As a long-term investor, how long is my time horizon?
- Do we feel sufficiently knowledgeable about this topic? What are our investment beliefs?
- Do we have the governance framework to focus on strategically important long- term issues?
- What are the views of beneficiaries and clients?
- As asset owners, should we be more visible in calling for strong climate action by policymakers?

MAKE TOMORROW, TODAY

Investors face a number of barriers to action on climate change. It is a challenge to take a long-term view in the context of an increasingly short-term market environment; boards and investment committees face a range of competing priorities, and the average investor has little familiarity with climate-related risks.

Yet the investor implications of climate risk warrant a change in behaviour. This study provides investors with evidence of the likely impact on their portfolios of a range of relevant climate change scenarios, along with practical suggestions for mitigating and managing their exposure. In doing so, it contributes to the rapidly evolving knowledge and tools that are available to the investment industry to understand and manage climate risk.

It is now up to investors to evolve — taking a prudent view of risk demands it.

4

INTRODUCTION

> *"Past warnings of potential environmental catastrophes have begun to be borne out; yet insufficient progress has been made — as reflected in the high concerns about failure of climate change adaptation and looming water crises ..."*
>
> — *World Economic Forum*[8]

CLIMATE CHANGE IS AN INVESTMENT RISK

Failure of economies to adapt to climate change is among the top five risks globally, according to this year's report from the World Economic Forum (the Forum),[9] which ranks the risks of highest concern to the Forum's 900 global stakeholders.

Adaptation failure has now been ranked as one of the top five risks for likelihood or impact over the past five years.

Economic, environmental, geopolitical, social, and technological risks are grouped in the Forum report. Each risk is not isolated but interconnected, exposing investors to amplification of risk impacts.

Comparing the short-term view (18 months) with the view over 10 years, severe weather events are the only near-term environmental risk identified. Over the next decade, however, environmental and associated societal risks represent more than half of all global risks, as outlined in Figure 3 on the following page.

The Forum report is reinforced by other risk reports, such as Guy Carpenter's *Global Warming: The Evolving Risk Landscape* (2013),[10] which focused on hazards such as coastal flooding and wildfires, and the Risky Business project[11], through its US national (2014) and US regional reports on the economic risks in climate change.

In terms of investment risk, analytical work is increasingly being undertaken to quantify the potential damages from climate change to investors. A recent paper[12] has estimated that, in a plausible worst-case climate change scenario (a 4°C-increase outcome), the value at risk of an equity portfolio in 2030 may be between 5% and 20% versus a no-warming scenario.

[8] World Economic Forum. Global Risks 2015, available at http://reports.weforum.org/global-risks-2015/executive-summary/, accessed 11 May 2015.

[9] Ibid.

[10] Guy Carpenter. *Global Warming: The Evolving Risk Landscape*. September 2013, available at http://www.mmc.com/content/dam/mmc-web/Files/GRC_EmergingRisk_TheEvolvingLandscape.pdf, accessed 30 April 2015.

[11] Risky Business. *The Economic Risks of Climate Change in the United States*, June 2014, available at http://riskybusiness.org/uploads/files/RiskyBusiness_Report_WEB_09_08_14.pdf, accessed 30 April 2015.

[12] Covington H, Thamotheram R. *A Case for Forceful Stewardship Parts 1 & 2*, 2015.

Figure 3: Risks of Highest Concern by Time Period

RANK	NEXT 18 MONTHS	RANK	10-YEAR HORIZON
1	Inter-state conflict with regional consequences	1	Water crisis
2	State collapse or crisis	2	Failure of climate change adaption
3	High structural un- or underemployment	3	Profound social instability
4	Failure of national governance	4	Food crisis
5	Large-scale terrorist attacks	5	Extreme weather events
6	Large-scale cyber attacks	6	High structural un- or underemployment
7	Profound social instability	7	Large-scale cyber attacks
8	Rapid and massive spread of infectious diseases	8	State collapse or crisis
9	Extreme weather events	9	Major biodiversity loss and ecosystem collapse
10	Fiscal Crises in key economies	10	Failure of national governance

Economical Environmental Geopolitical Societal Technological

Source: World Economic Forum - Global Risks Report 2015.

4

THE TIMEFRAME CHALLENGE FOR INVESTORS

The problem of investor "short termism" is well documented.[13] The problem can be defined as a lack of adequate attention to issues that have the potential to create and destroy value over the long term. The outcomes include the misallocation of capital, excessive (manager and portfolio) turnover, and the erosion of returns.[14]

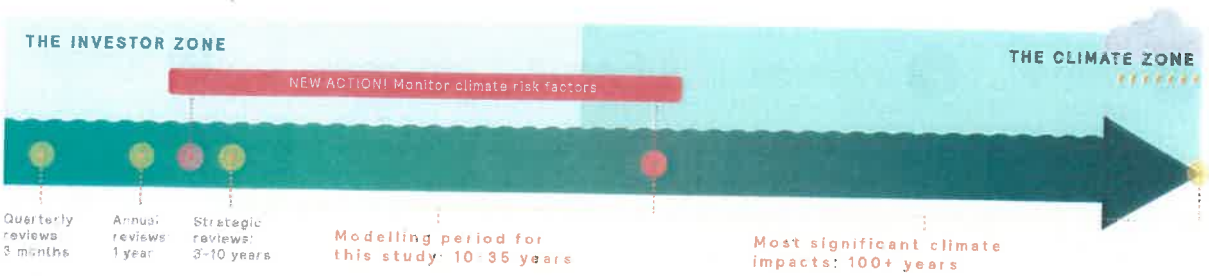
Another issue is in recognising that "risk" is not just about short-term volatility, but about the potential for permanent loss or impairment of capital.

The "long term" can be variously defined as a business cycle, the length of a typical mandate, or the timeframe of a pension fund's liabilities. Developing a longer-term mindset is challenging and requires a governance framework and a culture that appreciates the need to think long term. Such a culture should allow for, and ideally encourage, decision-makers to look to the horizon and consider issues that may be uncertain and currently have low probabilities attached to them.

In the UK, it is typical for fiduciaries to maintain a "risk register", addressing concerns around interest rate changes, trustee turnover, or market volatility. Historically, climate risk has not been included on the register, but we expect this will change.

Climate change presents long-term challenges to all of us, investors included. Figure 4 compares the timeframe of a typical investor with the timeframe of this study, and the horizon of climate change impacts. The red box highlights how an ongoing assessment of the TRIP factors can enable investors to "bridge the gap" by incorporating an assessment of climate risk considerations into ongoing investment processes.

Figure 4: The Timeline Challenge



Source: Mercer

[13] CFA Institute. *Visionary Board Leadership – Stewardship for the Long Term*, 2012; Mercer. *Building a Long-term Shareholder Base: Assessing the Potential of Loyalty-driven Securities*, 2013; Government of the UK. *The Kay review of UK equity markets and long-term decision-making*, 2011.

[14] Ambachtsheer J. et al. "Behaving Like An Owner: Plugging Investment Chain Leakages," *Rotman International Journal of Pension Management*, Volume 6:2 (2013), pp. 18-27; CFA Institute. *Breaking the Short-term Cycle*, 2006.

STUDY OBJECTIVES

Climate change and a transition to a more resilient, low-carbon economy are upon us. This presents uncertainty for financial systems, portfolios, and specific investments, due to the complex components and timeframes involved. These are all new risks for investors to manage.

Mercer and our project partners have adopted a scenario-based approach to incorporate four climate scenarios and four climate risk factors within strategic investment modelling to examine the potential magnitude of the risks and opportunities across industry sectors, asset classes, and a total portfolio, between 2015 and 2050.

Uncertainty surrounding the global approach to managing climate change can also be assumed to result in periods of volatility — when markets have not anticipated news, information, or physical impacts. Short-term "shock" events will impact investors' returns and can also be expected to accelerate and amplify a potential low-carbon transition — although these are very difficult to predict.

The balance that needs to be achieved is between driving economic outcomes and simultaneously limiting carbon emissions. In order to build portfolio resilience, investors cannot assume the future will mirror the past, particularly when economic growth is heavily reliant on an energy sector powered first and foremost by fossil fuels. The future may look very different, which means a fundamental impact on economies and investors.

Questions posed by such change are:

- How significant a risk/return impact could climate change have on a portfolio and when might that happen?
- Which are the key downside risks and upside opportunities, and how can these considerations be managed to fit within current investment process?
- What plan of action can ensure an investor is best positioned for resilience to climate change?

Three divisions of Marsh & McLennan Companies have collaborated with the project partners to find the answers to these questions, by modelling and considering the economics of energy and environmental policies in the context of climate-specific:

- **Risk factors —** isolated key market drivers that can be embedded into portfolio construction alongside more traditional risk factors, such as equity-risk premiums, liquidity, credit risks, etc. The four climate change risk factors referenced in this study are: Technology (T), Resource Availability (R), Impact of physical damages (I) and Policy (P) — the TRIP factors.
- **Scenarios —** grounded in climate modelling and related literature that are most pertinent to investors, with distinctive economic and physical impacts that can be considered in the strategic process alongside more traditional scenarios, such as high inflation, deflation, etc. The four climate change scenarios referenced in this study are: Transformation, Coordination, Fragmentation (Lower Damages), and Fragmentation (Higher Damages).

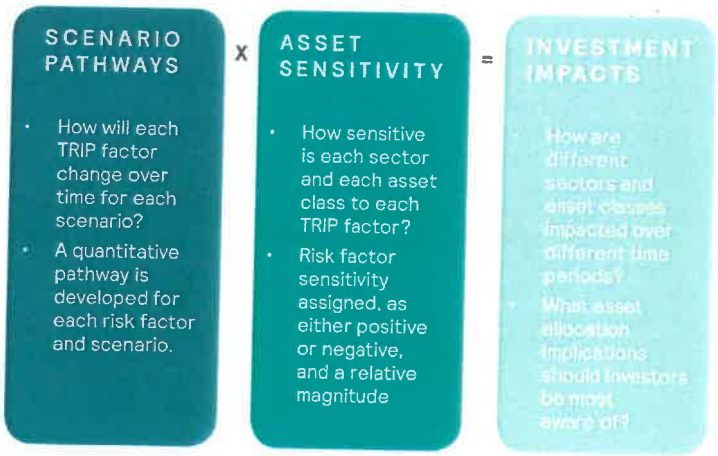
INVESTMENT MODELLING

This study has adapted an investment model used for setting asset allocation, to explicitly incorporate climate change considerations and isolate the estimated impact on returns. This required quantifying two new inputs, the scenario pathways and asset sensitivity, to the TRIP factors, and calculating an interaction between the two. Volatility adjustments have also been made.

The interaction of the TRIP factors will potentially increase volatility, thereby reducing compounded returns. Initial sector and asset class volatility assumptions, based on historical averages, were adjusted for each scenario based on the variance of the TRIP factor values at 2050. This method accounts for the degree to which investment returns might be "pulled" in different directions by climate change, with greater potential volatility. The adjustment resulted in increases to historical volatility measures by as much as 20% for the coal sector, down to 0% for the health sector.

The results estimate the impact on return expectations between 2015 and 2050 when climate considerations are included. Uncertainty surrounding the global approach to managing climate change can also be assumed.

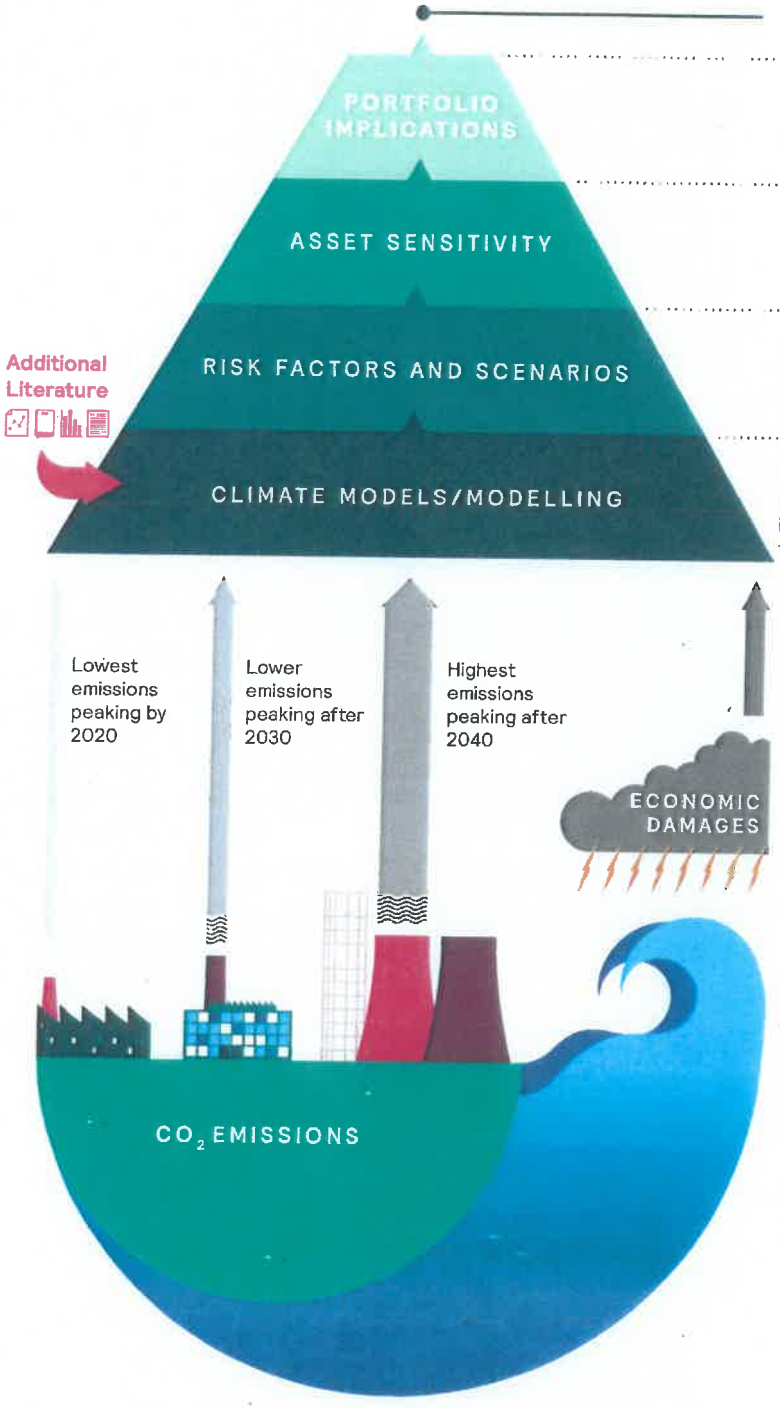
Figure 5: Calculating the Climate Impact on Return



Source: Mercer

The investment modelling outputs form a framework for investors to prioritise risks and opportunities during strategy setting, portfolio construction, and manager selection and monitoring. Figure 5 provides a conceptual map of the study's approach.

Figure 6: Getting to the Point: From Climate Modelling to Portfolio Implementation



PORTFOLIO IMPLEMENTATION

Modelling the investment implications helps investors identify the risks and opportunities posed by climate change in their portfolio, and then act accordingly (see page 59).

Numbers to represent the asset sensitivity and the scenario pathways are plugged into Mercer's investment modelling tool to estimate the climate impact on return (see page 59).

Sensitivity to the four climate risk factors is assigned to different industry sectors and asset classes (see page 41).

Four climate risk factors and four climate scenarios provide a framework for considering climate change risks and potential pathways over time (see pages 27 and 33).

Integrated Assessment Models estimating the cost of mitigation, adaptation, and physical damages to identify climate change scenarios most relevant to investors (see Appendix 1). This study has drawn on the FUND, DICE and WITCH models.

Source: Mercer

5

RISK FACTORS

In our seminal 2011 report, *Climate Change Scenarios — Implications for Strategic Asset Allocation*, we reported that climate change increases investment risk, with higher risk resulting from inefficient policy.

Part of the process of isolating risks for investors is to identify the factors that signpost drivers of change. In the 2011 report, we considered how Technology investment, Impact costs, and Policy (TIP) measures — each a separate risk factor in our investment modelling — might drive investors into a world of opportunity and sustainable growth, or into one facing higher expenses and ever-increasing uncertainty. To determine the quantum of costs falling under the Impact risk factor, a climate model that utilises a top-down approach to damage estimation (without any segmentation) was used.

Feedback on the 2011 report included an interest in adding a more detailed analysis on the estimation of impacts. To address this concern, a new approach was devised, adopting alternative climate models. This approach provides greater granularity with respect to impact estimation, allowing for more detailed treatment of damage possibilities across industry sectors and asset classes. It also leads to the acknowledgment that not all impacts from climate change result in costs over the short-term — economic gains are also possible.

Moreover, upon analysis of more detailed damage results, a dichotomy arises between two broad impact categories — those that manifest as a result of shifts in acute or extreme weather phenomenon and those that manifest as a result of shifts in chronic or long-term weather patterns.

Damages in the former category largely arise from destruction of physical property/ the built environment or loss of life from climatological events, whereas damages (gains) in the latter category largely arise from shifts to established economic systems in response to climate-driven changes in resource availability. Thus, to address this dichotomy appropriately in our investment modelling, the Impact risk factor included in the TIP framework was split into two separate risk factors — Resource Availability and physical Impact — resulting in TRIP. Our focus will now be on making sure investors do not "TRIP" over the risks associated with climate change and instead find ways to mitigate and profit from them.

We consider these four climate change risk factors as "lenses" through which we can sharpen our focus on the future investment implications of climate change for investors.

TECHNOLOGY (T)

Broadly defined as the rate of progress and investment in the development of technology to support the low-carbon economy.

RESOURCE AVAILABILITY (R)

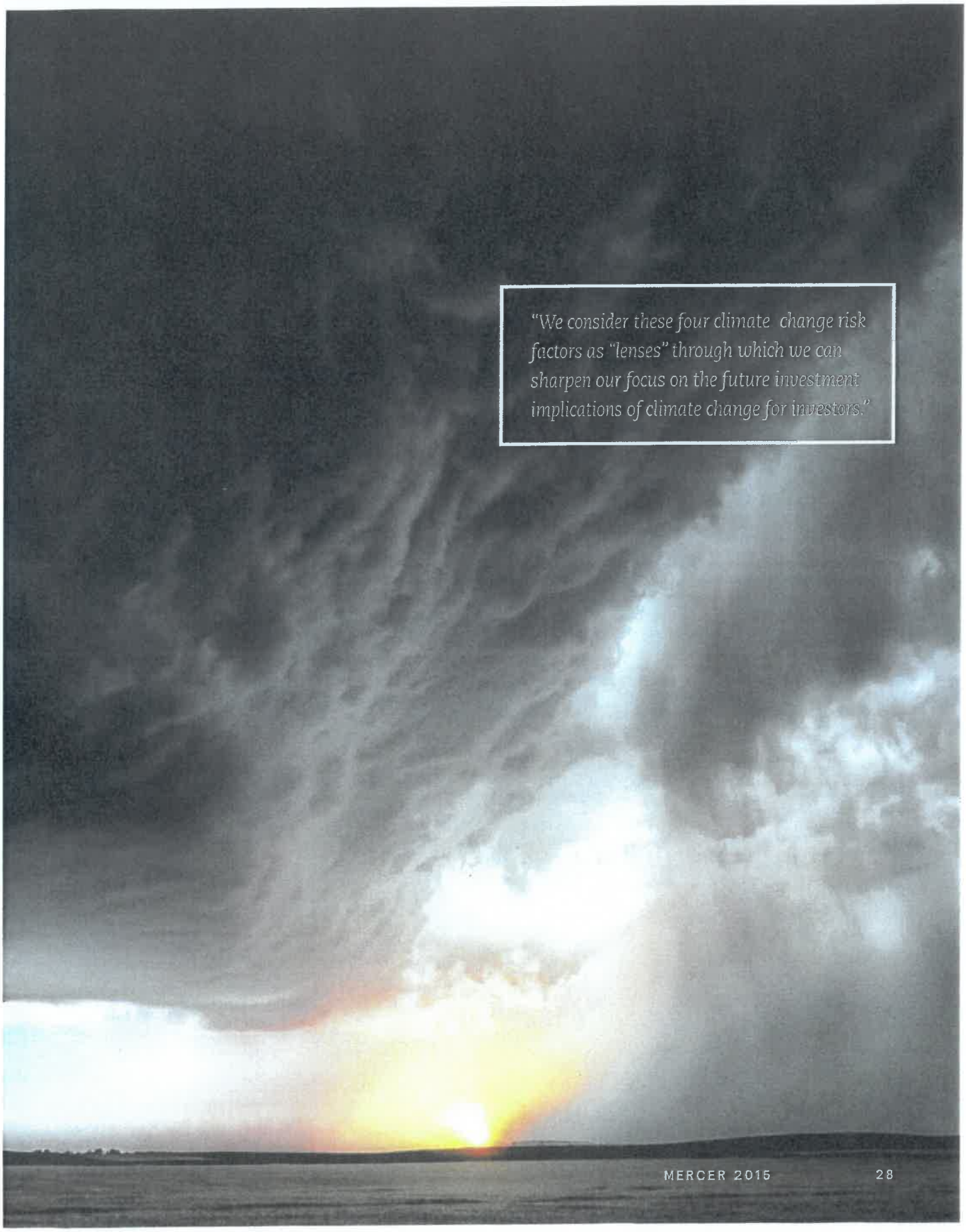
Defined as the impact on investments of chronic weather patterns (e.g. long-term changes in temperature or precipitation).

IMPACT (I)

Defined as the physical impact on investments of acute weather incidence/ severity (i.e. extreme or catastrophic events).

POLICY (P)

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.


"We consider these four climate change risk factors as "lenses" through which we can sharpen our focus on the future investment implications of climate change for investors."

TECHNOLOGY (T)

"Technology" is broadly defined as the rate of progress and investment in the development of technology to support the low-carbon economy.

It's all about technological advancement and the opportunity for increased efficiency through technological change. Speed, scale, and success of low-carbon technologies, coupled with the extent of transformation/disruption of existing sectors, or development of new sectors, are the key metrics of this factor.

Technology primarily refers to mitigation efforts to transform energy production, transmission, and use to reduce both the world's carbon intensity and energy intensity. It also refers to other technological developments for mitigation (in agriculture, land use, etc.) and adaptation (disaster risk management, resilient infrastructure, agriculture, etc.). The Technology factor can be interpreted as a measure of the future private-sector, low-carbon investment flows under different climate scenarios, for which a higher technology value indicates a higher level of investment.

It is important for investors to have a sense of the low-carbon investment flows across the climate scenarios as an indicator of the potential depth of the pool of investment opportunities and associated economic transformation.

The key metrics are the speed and scale of investment flows, which can be influenced by:

- Policy (for example, carbon pricing, low- carbon mandates, minimum efficiency standards).
- Availability of cost-effective, low-carbon alternatives (for example, absent subsidies and/or carbon pricing).
- Private-sector demand (for example, businesses with targets of becoming 100% renewable).
- Investor targets related to decarbonisation of portfolios (for example, divestment, clean tech commitments).

RESOURCE AVAILABILITY (R)

"Resource Availability" is defined as the investment impact of chronic weather patterns (for example, long-term changes in temperature or precipitation) and related physical changes.

This is a new aspect and is being added to the previous study's TIP framework to identify how changes to the physical environment might impact investments reliant on the use of resources (for example, air, natural materials and, of course, agriculture) that are at risk of becoming scarcer or, in some cases or at certain times, more abundant.

Agriculture and energy are resource sectors requiring special treatment given their direct linkage to large asset class sub-sectors for investment. Water is also a key resource, given its importance to many sectors of industry.

To summarise, this factor can be interpreted as the investment impact of climate change on natural and material resource distribution/availability caused largely by shifts in long-term (that is, one year or longer) weather patterns.

Chronic weather patterns can have positive or negative impacts that may evolve over time, such as:

- Higher average annual temperatures resulting in increases or decreases in crop yields.
- Lower average annual precipitation (or shifts in timing/duration of rainy seasons) resulting in reduced crop yields, livestock death, and water shortages, which can have negative effects on the energy and mining industries.

IMPACT (I)

"Impact" refers to the physical impact of climate change and is defined as the impact on investments of acute weather risk (that is, extreme or catastrophic events).

This factor can be interpreted as the investment impact of climate change on the physical environment caused largely by shifts in extreme weather incidence/severity.

Some prominent examples of physical impacts would be:

- Increased property damage and business interruption as a result of more volatile extreme flooding (coastal/inland).
- Coastal flooding and potential shifts in the distribution of hurricane activity towards less frequent and more severe events (with less scientific confidence in the latter).
- Wildfire, which causes all sorts of complex damages to various industries, though most directly affects forestry, residential real estate in the wildland/urban interface, and rural public entities.

To summarise, this factor can be interpreted as the investment impact of climate change on the physical environment caused largely by shifts in short-term extreme weather patterns.

POLICY (P)

"Policy" is broadly defined as all the international, national, and sub-national targets; mandates; legislation; and regulations meant to reduce the risk of further man-made or "anthropogenic" climate change. It refers to developments in climate policy to reduce carbon emissions by increasing the cost of carbon; and/or incentivise low-carbon alternatives.

This factor can be interpreted as the level of coordinated ambition of governments to adopt and adhere to policies and regulations to reduce greenhouse gas (GHG) emissions.

Climate-related policy consists of various elements and, in this context, includes:

- Reduction targets: specifically, the goal to reduce GHG emissions by a given amount and by a set date.
- Fiscal policy: carbon pricing and subsidies.
- Energy supply: restrictions on coal, renewable energy mandates, fuel switch, carbon capture storage (CCS), etc.
- Energy efficiency: building codes, appliance standards, fuel-efficiency standards, etc.
- Land use: reducing emissions from deforestation and forest degradation (REDD) programs.
- Methane reduction: reduction of short-lived climate pollutants (primarily agriculture and energy).

The degree to which climate-related policy action takes place and its anticipation by investors will be the crucial factors to consider when evaluating the investment impacts of climate policy.

A key feature of any climate policies that are meant to reduce emissions should be assigning a cost to CO_2 emissions, and increasing the cost sufficiently over time to shift behaviours towards a zero-carbon economy.

Climate policy will generally include a combination of:

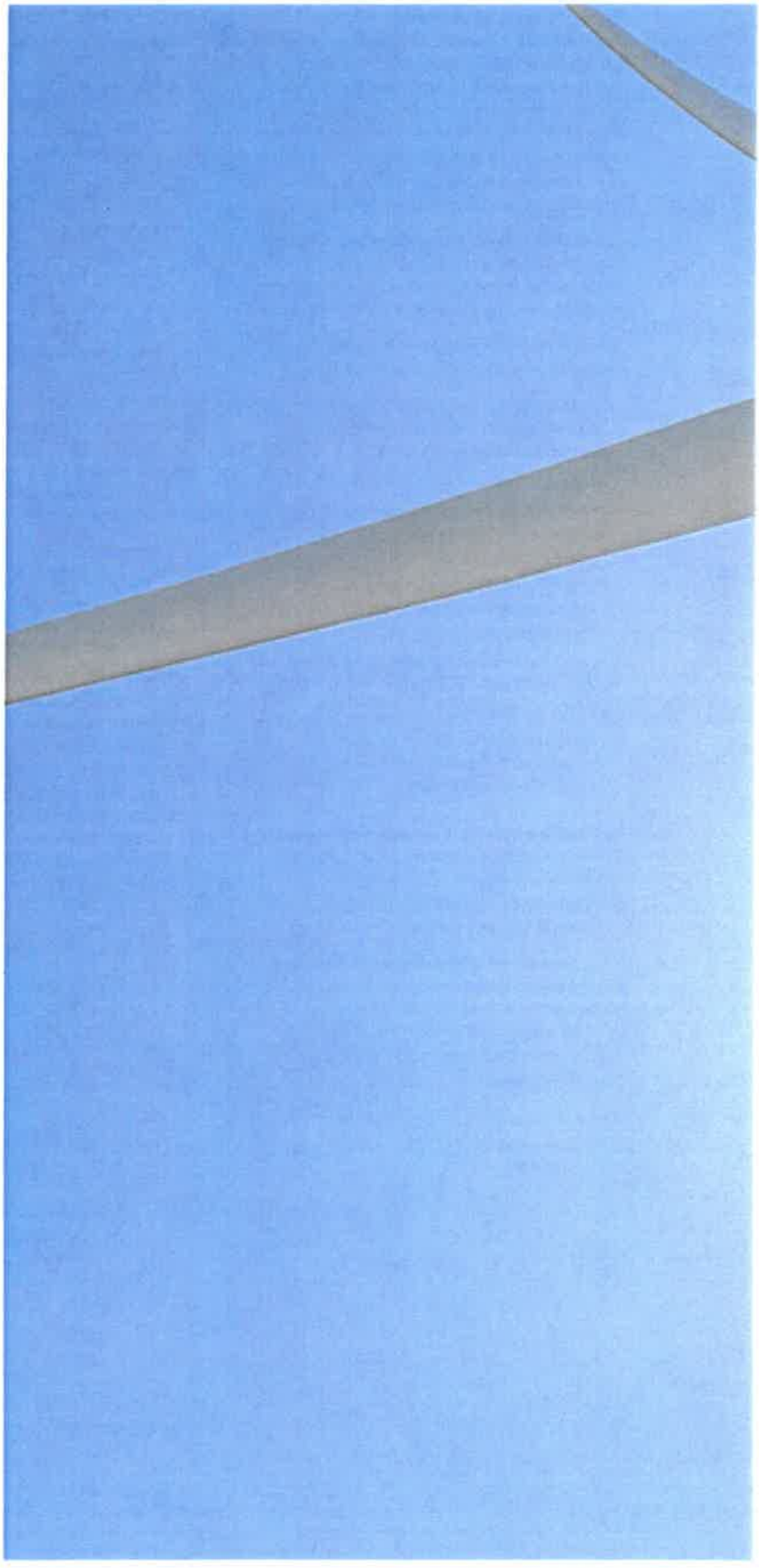
- Explicit carbon-pricing mechanisms (for example, carbon tax, emissions trading systems).
- Measures that put an implicit price on carbon (for example, energy taxes, industry-specific regulations).
- Targeted support for research and development (for example, subsidies relating to clean tech).
- Revisions to policies that run counter to emissions reductions goals (for example, fossil fuel subsidies).

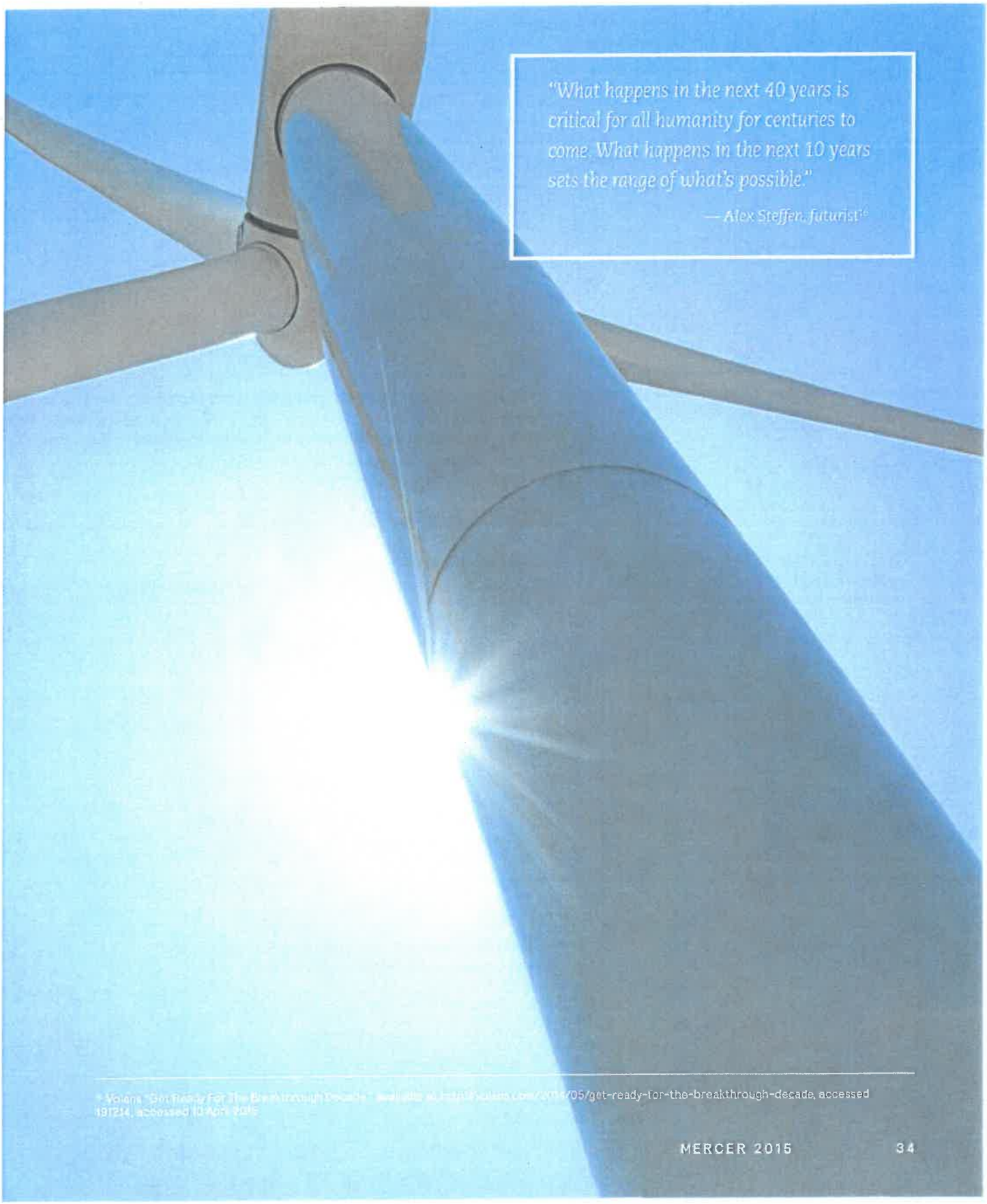
Such policies can be classified into two categories, whether they focus on the supply or demand side. That said, policies that focus on one side of the market will indirectly affect the other (for example, taxes on one commodity implicitly subsidise others[15]):

- Supply-side policies encouraging substitution of higher-emission technologies (for example, coal-generated electricity and fossil fuels) with low-emission technologies and products (for example, renewable energy and biofuels).
- Demand-side policies discouraging consumption of products that generate emissions, either through price increases of those products and/or non-price-induced decreases in demand for emissions-intensive products (for example, via labels showing embedded CO_2 emissions of various products).

[15] OECD. *Effective Carbon Prices*, 2013, available at http://www.oecd-ilibrary.org/environment/effective-carbon-prices_9789264196964-en, accessed 9 April 2015.

SCENARIOS





[6] Voiana, "Get Ready For The Breakthrough Decade," available at [illegible].com/2014/05/get-ready-for-the-breakthrough-decade, accessed 191214, accessed 10 April 2015

As noted by the Intergovernmental Panel on Climate Change (IPCC), the "warming of the climate system" is "unequivocal".[17] The extensive uncertainties that still exist include just how much our current practices will contribute to this unequivocal warming by way of emissions, what level of warming will be sustainable, and what damages investors need to prepare for, whatever the level of warming. What happens by the end of 2015 will have a significant influence on what happens over the coming decade and ultimately which scenario plays out in the longer term.[18]

Table 2 sets out four future scenarios relevant for investors. These scenarios were developed collaboratively by NERA and Mercer, with input from all 18 project partners and the project's advisory group, and are based on some of the most advanced climate modelling and scientific literature available. They offer investors "a range of what's possible", providing several viewpoints of the way the next 35 years might play out.

Table 2: Summary of the Scenarios

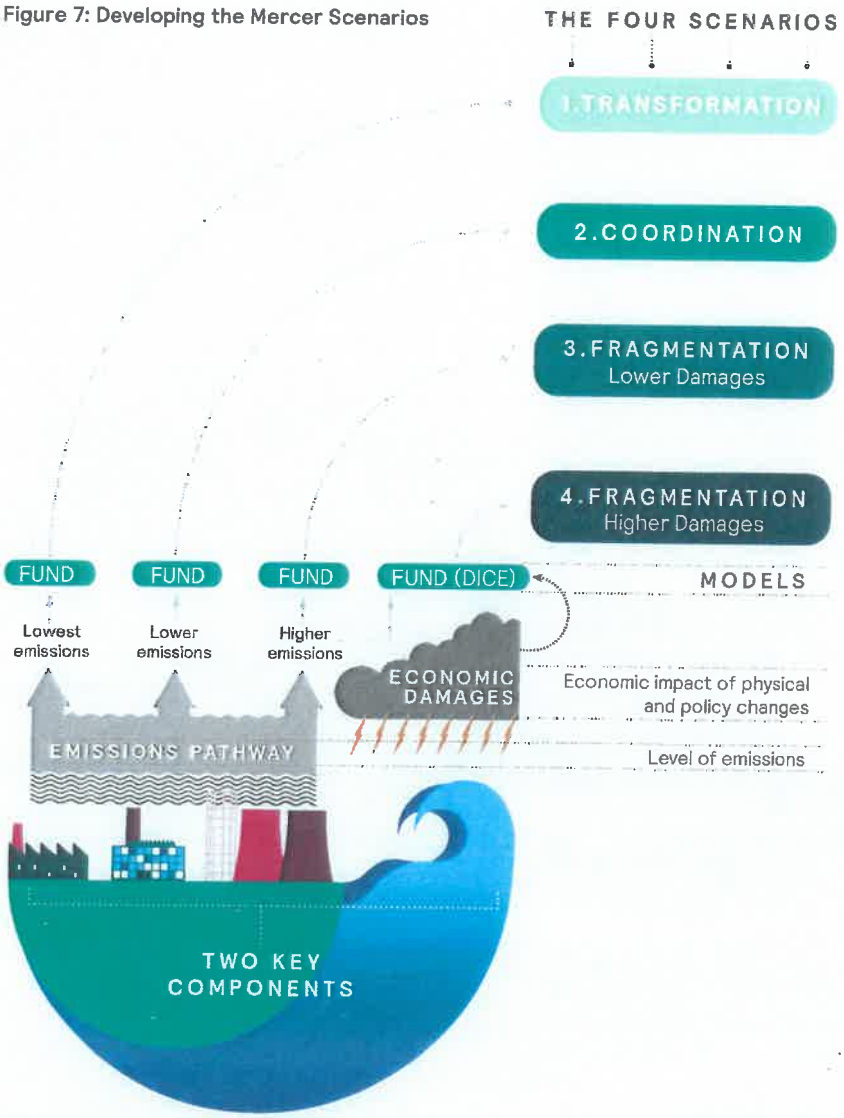
SCENARIO	DESCRIPTION
1. TRANSFORMATION	
More ambitious climate change mitigation action that puts us on a path to limiting global warming to 2°C above pre-industrial era temperatures this century.	Strong climate change mitigation action: • Emissions peak by 2020 then reduce by 56% relative to 2010 levels by 2050. • Fossil fuels represent less than half of the energy mix at 2050. • Estimated annual emissions at 2050 of 22 gigatons (Gt) of equivalent carbon dioxide (Gt CO_2e).
2. COORDINATION	
Policies and actions are aligned and cohesive, keeping warming to 3°C above pre-industrial era temperatures this century.	Substantial climate change mitigation action: • Emissions peak after 2030 then reduce by 27% relative to 2010 levels by 2050. • Fossil fuels represent around 75% of the energy mix at 2050. • Estimated annual emissions at 2050 of 37 Gt CO_2e.
3. FRAGMENTATION (LOWER DAMAGES)	
Limited climate action and lack of coordination result in warming rising to 4°C or above from pre-industrial era temperatures this century.	Limited climate action: • Emissions peak after 2040, increasing by 33% over 2010 levels by 2050. • Fossil fuels represent 85% of the energy mix at 2050. • Estimated annual emissions at 2050 of 67 Gt CO_2e.
3. FRAGMENTATION (HIGHER DAMAGES)	
As above, coupled with assumed higher damages.	• As per Fragmentation (Lower Damages), but assumes that relatively higher economic damages result.

[17] IPCC, Climate Change 2007: Synthesis Report. available at https://www.ipcc.ch/publications_and_data/ar4/syr/en/spms1.html, accessed 11 May 2015.
[18] Consensus of the study partner group.

Our scenarios are built on two key components:

1. The emissions pathway (which depends on the ambitions of climate action).
2. The economic damages based on how sensitive the climate and the economy are to future levels of CO_2 concentrations (modelled using IAMs — see "Executive Summary" — including WITCH, DICE, FUND, and other inputs).

Figure 7: Developing the Mercer Scenarios



Source: Mercer

But what do such scenarios mean for investors? Each scenario highlights the potential future effects of climate change mitigation and adaptation, as well as physical impacts across regions, countries, asset classes, and industry sectors. Applying climate-related scenarios within investment models is new to investors, thus providing additional insights in order to position portfolio-allocation decisions that respond to their informed expectations around climate change risk and opportunities.

The more likely scenario may become clearer by the end of the year, determined by the outcome of the December 2015 United Nations Climate Summit in Paris. This year is perhaps our last chance to align international policy objectives behind strong action. We hope the findings of this study will play an influential role in shaping the commitments, disclosure, and changes needed to support a transition to a resilient, low-carbon economy by limiting warming to within 2°C. The commitments required are significant, and views currently vary as to the likelihood of whether this can be achieved. However, negotiations and economic analysis continue to focus on the 2°C limit, so it makes sense for investors to try to understand the risks and opportunities under this type of scenario.

In an important recent development, the leaders of the US and China announced a "historic deal" that has set the two nations "on a path to achieving deep emissions reductions by advanced economies that the scientific community says is necessary to prevent the most catastrophic effects of climate change."[19]

The deal saw the US and China — two nations that together account for over one-third of global GHG emissions — agree to move peak GHG emissions targets earlier than currently expected and increase the use of non-fossil-fuelled energy by 2030.

The commitment by China's President Xi Jinping to peak his nation's CO_2 emissions by around 2030 while increasing non-fossil-fuelled energy to around 20% by that time is almost perfectly aligned with our study's Coordination scenario. The US goal to reduce net GHG emissions to 26% — 28% below their 2005 levels — by 2025 is actually more ambitious than our Coordination scenario.

The signposts on the following pages help to summarise the key indicators for investors in relation to each of the TRIP factors for each scenario.

[19] Biello D, "Everything You Need to Know about the U.S.-China Climate Change Agreement," *Scientific American*, 2014, available at http://www.scientificamerican.com/article/everything-you-need-to-know-about-the-u-s-china-climate-change-agreement/, accessed 2 April 2015.

SCENARIO SIGNPOSTS

TRANSFORMATION

Rate of investment in technologies supporting the low-carbon economy:

- Cumulative investment of US$65 trillion in energy supply and efficiency (ex-fossil fuels) is required over 2015–2050 (approximately 64% of total energy investments).**
- For the period 2015–2035, this is assumed to be split between energy efficiency (48%) and energy supply, such as nuclear, renewables, biofuels (40%), and other technologies (CCS).[20]

Potential changes to energy mix: [21]

- In 2050, fossil fuels represent approximately 43% of total energy.
- Energy efficiency, renewables, and CCS make the largest contributions to global emissions reductions in the Transformation scenario. Respectively, they account for shares of 38%, 30%, and 14% cumulative emissions reductions to 2050.

Potential shifts in long-term weather patterns and impact on resource availability:

- Limited impact by 2050.
- Economic damages expected to be minimised by gains in Agriculture, partially offset by losses related to Biodiversity and Water availability.

COORDINATION

Rate of investment in technologies into supporting the low-carbon economy:

- Total energy investments increase from US$1.41 trillion in 2020 to US$2.31 trillion in 2050.*
- Cumulative investment in energy supply and efficiency (ex-fossil fuels) required from 2015–2050 of US$47 trillion (approximately 46% of total energy investments).**

Potential changes to energy mix:

- Some (but limited) use of CCS by 2030.
- In 2050, fossil fuels represent:
  - 75% of primary energy.
  - 74% of secondary energy.
  - 44% of electricity.

FRAGMENTATION (lower/higher damages)

Rate of investment in technologies into supporting the low-carbon economy:

- Total energy investments increase from
- US$1.59 trillion in 2020 to US$3.13 trillion in 2050.*
- International Energy Agency (IEA) estimates not given.
- Investment requirement (ex-fossil fuels) presumed to be less than for Coordination.**
- Limited investment into low-carbon energy.

Potential changes to energy mix:

- In 2050, fossil fuels represent:
  - 86% of primary energy.
  - 85% of secondary energy.
  - 68% of electricity.

* In 2014 US$

** International Energy Agency, Mercer

FRAGMENTATION (LOWER DAMAGES)

- Estimated total net economic benefit [22] from resource availability as a percentage of global GDP of:
  - 0.63% at 2030.
  - 0.50% at 2050.
- Driven by gains in agriculture, partially offset by losses related to biodiversity and water.

FRAGMENTATION (HIGHER DAMAGES)

- Estimated total net economic loss from resource availability as a percentage of global GDP of:
  - 0.27% at 2030.
  - 0.80% at 2050.
- Driven by losses due to energy, water, and biodiversity.

[20] IEA. World Energy Investment Outlook, 2014, available at http://www.iea.org/publications/freepublications/publication/WEIO2014.pdf, accessed 11 May 2015.

[21] IEA. Energy Technology Perspectives, 2014, (2°C Scenario at 2050).

[22] Estimates of economic damage (gain) produced by the FUND model and as supplemented by Guy Carpenter do not necessarily translate directly to industry sector or asset class investment losses (gains). In certain instances – most notably related to Agricultural damages (gains) – we used supplemental research to inform our investment modeling assumptions.

The level of physical damages caused by catastrophic events, such as floods and hurricanes: • Limited impact by 2050. Driven by losses from (extra)Tropical Storms and Coastal Flood. • Estimated damages based on FUND model output, supplemented by Mercer with support from Guy Carpenter for Coastal Flood and Wildfire.	**Global policy response** • Most effective from a climate change mitigation perspective, but an unexpected carbon price introduction is likely to catch financial markets off guard. **Expected cost of carbon**[23] • Global carbon pricing introduced relatively swiftly, then flattening out to around $180 ($US2013/t CO_2) by 2050. **Global GHG emissions at 2050:**[24] • 22 Gt CO_2e/yr. • 56% decrease versus 2010 levels. (emissions peak by 2020).	TRANSFORMATION
	Global policy response • Existing policy pledges with respect to carbon emissions are implemented with mitigation efforts extended to 2030. **Expected cost of carbon** • Global carbon pricing introduced more slowly, picking up pace after 2030 and reaching $210 ($US2013/t CO_2) in 2050. **Global GHG emissions at 2050:** • 37 Gt CO_2e/yr. • 27% decrease vs 2010 levels (emissions peak bt 2030).	COORDINATION
FRAGMENTATION (LOWER DAMAGES) • Estimated total net loss from physical impacts as a percentage of global GDP of: – 0.25% at 2030. – 0.41% at 2050. • Driven by losses from (extra) Tropical Storms and Coastal Flood **FRAGMENTATION (HIGHER DAMAGES)** • Estimated total net loss from physical impacts as a percentage of global GDP of: – 0.40% at 2030. – 0.73% at 2050. • Primarily represents losses from Wildfire and Coastal Flood, and extreme temperatures.	**Global policy response** • Divergent with limited efforts beyond existing pledges. • Although a reduction in emissions of 10% (versus 2010 levels) is achieved by 2050 by developed markets, this is outweighed by increases in emissions in emerging markets with total emissions increasing by 33% increase from 2010 levels. **Expected cost of carbon** • Lack of global carbon price development recognised by the market. • Where pricing mechanisms exist, carbon pricing limited to around $40 by 2050.	FRAGMENTATION (lower/higher damages)

* In 2013 US$

** International Energy Agency, Mercer

[23] See Appendix 2 – Scenario detail for more detail on expected cost of carbon

[24] Total GHG emissions here refers to the sum of the CO_2 equivalent of the six GHGs covered by the Kyoto Protocol (carbon dioside, methane, nitrous oxide, hydrofluorocarbons, perfluorinated compounds, and sulphur hexaflouride). 2010 Levels were approximately 50 $GtCO_2$e/yr.

ASSET SENSITIVITY

HOW SENSITIVE ARE DIFFERENT ASSET CLASSES TO CLIMATE CHANGE?

Investment portfolios are typically well-diversified across a broad range of different asset classes and geographies, some of which will be more sensitive to climate change than others. Indeed, asset classes and regions will also differ in terms of whether we expect climate change impacts to be beneficial or detract from investment returns.

In order to help investors consider the potential portfolio impacts, this study has assessed the sensitivity of different asset classes and industry sectors to our four climate change risk factors: Technology, Resource Availability, Impact (of physical damages), and Policy. This assessment is captured within sensitivity heat maps.

The heat maps are constructed based on current-day evidence with some forward-looking qualitative judgement. Although the investment modelling undertaken assumes that the sensitivities will be static over the period modelled (to 2050), we know that in practice this will not be the case.

We will revisit and update the heat maps on a regular basis to ensure developments are captured as additional evidence becomes available. While asset owners do not typically consider industry-level detail when making strategic investment decisions, the sensitivity of different industries enables areas of focus to be identified from a climate change perspective. It is necessary to "drill-down" to the industry sector level due to the disparity of sensitivity across different industries. This will require understanding total portfolio industry exposures and then engaging with investment managers on the TRIP factor sensitivities, expecting managers to understand the potential implications for the industries and companies in which they invest.

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 (either positively or negatively) to climate change. 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.

Figure 8: Sensitivity to the Climate Change Risk Factors — Asset Class Level

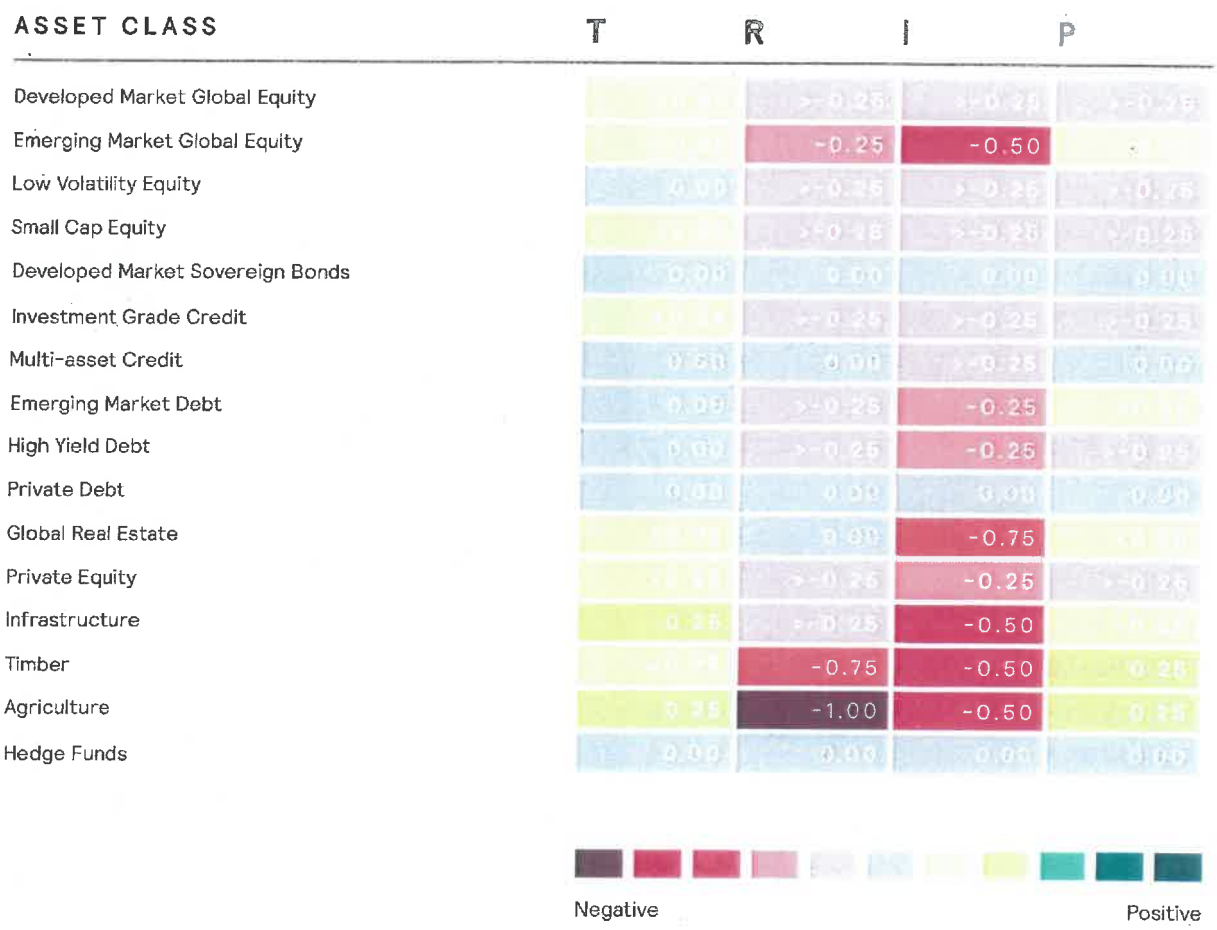


Figure 9: Sensitivity to the Climate Change Risk Factors – Industry and Sector Level[25]

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

Negative Positive

[25] Based on MSCI Global Industry Classification System.

WHY PAST PERFORMANCE IS NOT A GUIDE TO FUTURE PERFORMANCE

All investors will be familiar with the standard caveat around the performance of investments: past performance is no guide to future performance. However, investment modelling remains based on long-term historical returns data, albeit with informed oversight, and over the typical timeframe used for setting investment strategy (10 years).

Although investment modelling provides a useful guide, existing modelling is not able to capture very long-term structural changes — precisely the type of change we would expect as the world manages the risks posed by climate change.

We have adapted our investment model by adding the TRIP factors and our four defined climate change scenarios.

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. One relatively recent example is the shift to mobile-based technology. Emerging market consumers are bypassing the use of fixed-line technology and going straight to mobile-based technology.

It remains very difficult to capture long-term forward-looking changes within quantitative 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 an 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 pink 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 industry sectors (and sub-sectors) there will continue to be different supply and demand drivers. This also applies to industries where overall sensitivity may be neutral. However, we have not attempted to adjust our modelling to predict the specifics of these future developments.

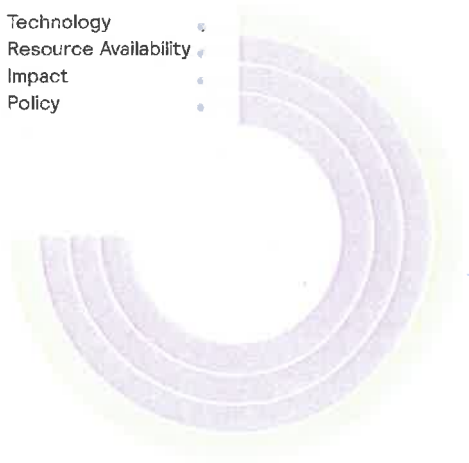
Although we have not looked at security-level analysis as part of this study, it is crucial that investors understand where risks and opportunities might lie and for asset owners to ensure that their investment managers are fully considering these risks when building portfolios. This is particularly relevant when considering investing in asset classes, industry sectors, and sub-sectors with the highest sensitivity to climate change.

EQUITIES

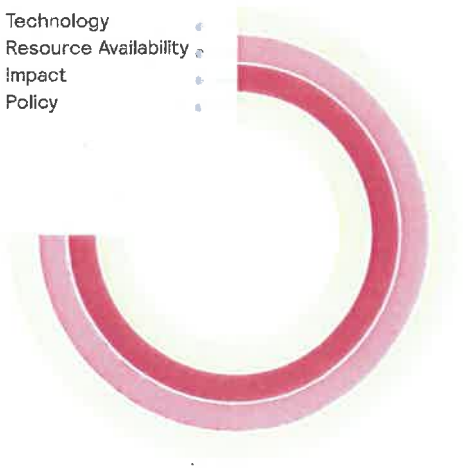
Equities typically comprise a significant proportion of most institutional investment portfolios. At an asset class level, climate change implications are better understood for equities given the relatively high level of integration of ESG issues relative to other asset classes. We also note that there are thematic sustainable investment strategies where exposure to a sector such as industrials may be high but climate change sensitivity is lower given the nature of the underlying companies.

We have used our global sector analysis as a starting point for considering regional and global equity portfolios by aggregating the sector exposure by region and have made some adjustments based on considerations at a country level. We recognise that differences in local climate change policy, as well as other local market drivers, will cause some regional divergence.

DEVELOPED MARKET GLOBAL EQUITY



GLOBAL EMERGING MARKET EQUITIES



In particular, we would expect:

- UK, Australian, and Canadian equities to be more sensitive given the higher exposure of these regional equity markets to carbon-intensive sectors.
- UK and European equities to be less vulnerable to climate change policy shocks given existing policy and commitments in place. We expect these markets to be better prepared for additional climate-related policy given the relative transparency regarding the direction of future policy.
- Australian equities to be more sensitive to a climate change policy shock given the greater level of policy uncertainty in this market.
- We expect the US to continue to drive global equity markets in the near term. Therefore, we would expect any significant policy developments in the US to impact global equities to a greater extent than developments in other regions.
- Although there will be country-level differences across emerging markets, overall we would expect emerging market equities to benefit from additional climate change mitigation policy and technology developments (subject to the support and other terms of an international climate agreement). Emerging market equities are more sensitive to the climate change risk factors associated with physical damages of climate change (physical impacts and resource scarcity) than developed markets, and also are more likely to face costs around adaptation to climate change. Thus, emerging markets are likely to receive greater relative gains from more ambitious mitigation policies than developed markets.

For small-cap equity and low-volatility equity, risk factor exposures are derived from the sector-level analysis. We would note that within the small-cap space, there is considerable opportunity to invest in companies directly related to the shift towards a low-carbon economy. Low-volatility equities have slightly lower negative sensitivity to the climate change risk factors than standard global equities.

The industry sector of most interest to investors is energy, in that it is expected to be most affected by a structural change to a low-carbon economy. Changes in the energy mix — from fossil fuels to low-carbon energy sources — are one of the key signposts to investors as highlighted in our discussion on the four climate change scenarios.

The energy industry is expected to be the most sensitive to climate change impacts and also the most differentiated, in that sensitivity to our climate change risk factors ranges from -1 for coal to +1 for renewable energy. The detailed heat map for the energy industry is shown below.

Although the world cannot change its reliance on fossil-fuel-based energy overnight, we have assigned the following sensitivities:

- The coal sector is very negatively sensitive to Policy due to the much higher level of associated CO_2 emissions from burning coal compared with gas, whereas renewable energy has high positive sensitivity. We note that within the coal sector, the market drivers for thermal coal (used to generate electricity) and metallurgical coal (used for steel production) are very different and thus we would expect differentiation in sensitivity between companies operating in these two areas.
- We have assigned a positive sensitivity to Policy and Technology for the gas sector as gas is expected to be the "transition fuel" in the shift to a low-carbon economy.

ENERGY SENSITIVITY TO CLIMATE RISK FACTORS

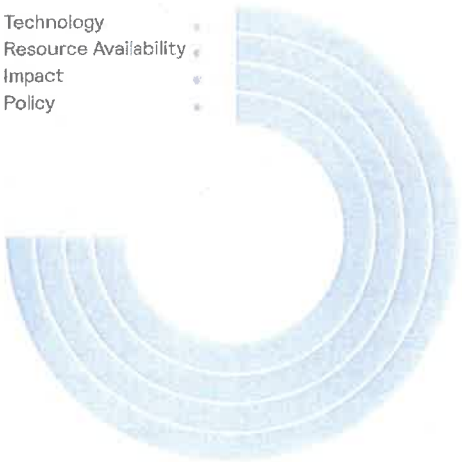
	T	R
ENERGY	• The greatest technological advances and subsequent efficiency gains are expected to occur in the renewable and nuclear industries, with fossil fuels becoming increasingly challenged by exploration limits. Although there are positive opportunities expected for investors, reflecting demand changes, the negative risk factor sensitivity reflects the current weightings within the energy sector.	• All energy production has exposure to resource shortages, especially water, which has a broad impact across fossil fuels, nuclear, and renewables (hydro).
Oil	• Oil accounts for 95% of transport energy use. • New technologies and fuels (e.g. natural-gas vehicles, hybrids, and electric vehicles) are expected to take market share, with technological advancements potentially advancing the switching pace. • Increasing technical and logistical complexity for new reservoir exploration and development will make this more costly – borne by the company and/or passed on to customers.	• Oil is the most water-intensive of the fossil fuels, and more so than nuclear.
Gas	• Shale gas has already changed the shape and level of the oil and gas cost curve, with some regional variation. • Although environmental concerns remain with the growth of fracking, gas is seen as a key "transition fuel" in a move to a low-carbon economy.	• Gas has exposure to water-scarcity risk, although is less water-intensive than oil and coal.
Coal	• Coal is often a dominate source for base power supply. • Without rapid and widespread adoption of high- efficiency coal-fired generation technologies and, in the longer term, of CCS, coal will be incompatible with climate goals.	• Coal has exposure to water scarcity risk, more so than gas, but less water-intensive than oil and nuclear.
Renewables	• Parity for renewables is already a reality in some markets and is expected to become more widespread in a short timeframe. • The rate that the price of solar panels has reduced has exceeded expectations. The predictability and low-risk nature of solar also make it well suited to debt financing. • Wind technology is evolving, but more slowly than solar. Wind has the advantage in that it is cheaper.	• Wind/solar have little exposure to resource availability risk. • Hydro (accounting for around 50% of overall renewable energy capacity globally) is very exposed to water risk, with regional variance. • Bioenergy has exposure to water-scarcity.
Nuclear	• Future reactor technologies and associated fuel cycles will seek continued improvements over the current generation in the areas of safety, economics, fuel use, waste production, and non-proliferation of weapons materials.	• Nuclear has exposure to water scarcity risk.

I	P	
• Physical damages will negatively affect all forms of energy. However, fossil fuels are at higher risk given that supply is often centralised and near coastal areas.	• Policies are expected to support low-carbon energy and pose a risk to fossil fuels.	ENERGY
• Oil infrastructure is often in coastal areas (as well as offshore) resulting in storm-surge and other extreme weather risks causing operational disruptions.	• Oil is affected by energy efficiency, carbon intensity, subsidies, and/or carbon-pricing policies. The policy impact is expected to be less severe for some time than for coal because: – Oil is less carbon intensive. – Alternate options for transport fuel are not yet available at scale. • Unconventional oil is also at risk of a diminished "social license to operate" due to social activism on climate concerns.	Oil
• Risk of operational disruptions due to extreme weather events.	• Gas is the least carbon-intensive of the fossil fuels, and thus affected the least by carbon-pricing policies. • Over the coming decades, gas is expected to benefit from tighter carbon-pricing policies, but ultimately will see reduced demand towards a low-carbon economy.	Gas
• Coal infrastructure is often in coastal areas (refineries and export terminals) resulting in storm surge and other extreme weather risks causing operational disruptions.	• Regulation of CO_2 emissions together with pollution from other toxic emissions from power plants leaves coal (particularly, thermal coal) very exposed to the impacts of climate policies. • Coal is also at risk of a diminished "social license to operate" due to social activism.	Coal
• Risk of operational disruptions due to extreme weather events.	• Renewable-energy-related policies (e.g. renewable targets, subsidies, etc.) have had a significant impact on growth of renewables to date, and are expected to continue in the future.	Renewables
• Risk of operational disruptions due to extreme weather events.	• Government policy underpins the outlook for nuclear power given large upfront investment costs, long construction times for new reactors, and intense public concern surrounding a wide range of issues (safety, managing waste, nuclear weapons, etc.). • Nuclear could continue to play an important role in energy systems where there is fast-growing electricity demand, goals to improve energy security, and an avoidance of GHG emissions and other air pollutants. • Existing nuclear is not expected to benefit from this positive sensitivity to Policy.	Nuclear

BONDS

Bonds are typically held within institutional investment portfolios for a number of reasons, including liability "matching" and growth seeking. Mercer typically categorises investment in bonds into three areas:

- Developed market sovereign bonds and equivalents (for example, municipal bonds, supranational bonds such as those issued by the World Bank, etc.).
- Investment-grade credit (corporate bonds).
- "Growth fixed income", which includes a number of different underlying opportunities, including high-yield debt, emerging market debt (sovereign and corporate), asset-backed securities, leveraged loans, convertibles, distressed debt, etc.



DEVELOPED MARKET SOVEREIGN BONDS — US, UK, AND EUROPE

Developed market sovereign bonds that have been classified as "least vulnerable" by Standard & Poor's[26] — one of the leading global rating agencies — include the US, the UK, Canada, and the majority of developed market European sovereign bonds, including Germany and France. In Mercer's view, there is not a case for assigning sensitivity to the climate change risk factors to the sovereign bonds of these developed markets, as the drivers of these will continue to be dominated by other macro-economic factors. In addition, the ability of these nations to adapt to potential adverse effects of climate change is high.

Within the US, we note that state and local municipal issuance is likely to be more sensitive; however, the consideration of this is beyond the scope of our analysis.

We note the following specific markets, which have some differences from the overall findings.

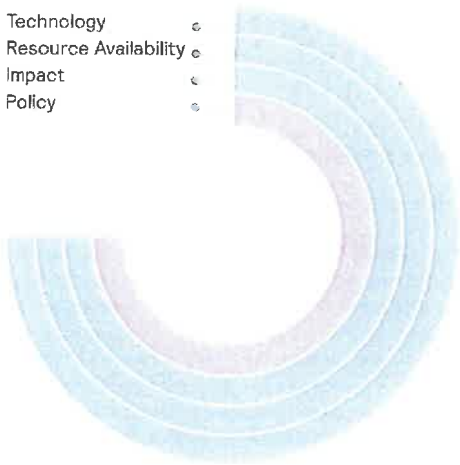
NEW ZEALAND

New Zealand is the most vulnerable of the developed market sovereign bonds, due to a higher proportion of the population living in low-lying areas, as well as the higher dependence of national GDP on the agriculture sector compared to other developed markets. New Zealand's expected ability to cope with the adverse effects of climate change helps to improve the overall ranking of New Zealand.

[26] Climate Change Is A Global Mega-Trend For Sovereign Risk, Standard & Poor's, May 2014

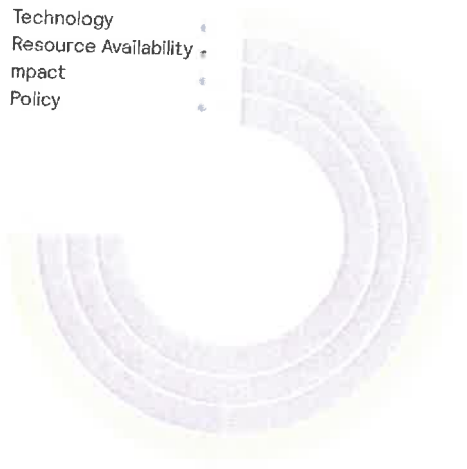
JAPAN

Japan is also susceptible to rising sea levels, with a relatively high proportion of its population living in low-lying areas.



AUSTRALIA

We have assigned a negative sensitivity to the Policy risk factor for Australian sovereign debt given the heavy reliance of Australian economic growth on resources (notably mining and agriculture). We believe that the Australian economy is more susceptible to a policy shock than other developed markets given the uncertainty surrounding its national climate change policy, which currently lags other developed markets, combined with the level of dependency of the Australian economy on carbon-intensive sectors.



INVESTMENT-GRADE CREDIT

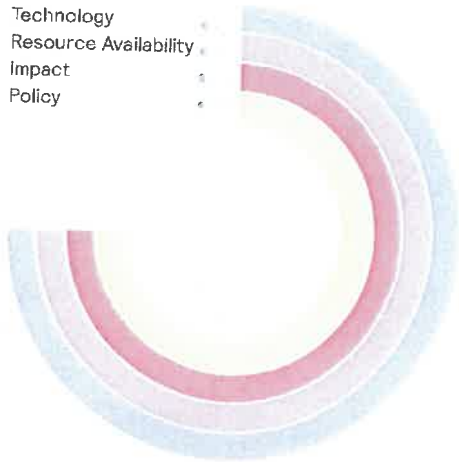
We anticipate global credit markets to have a similar, albeit less-sensitive profile to that of global equities, as we expect the same sector drivers that impact companies on the equity side will also impact the debt side. The sensitivities assigned in the heat map above are derived from the interaction of the credit model (which considers volatility of credit spreads) and the sensitivity we have assigned to the equity sectors.

Companies that issue debt in order to fund changes to become better prepared for the shift to a low-carbon economy may face cost pressures in the short term, but over the longer term we would expect the benefits of being prepared to outweigh the initial financing costs. As with equities, we would expect winners and losers to emerge, with those companies failing to adapt being more susceptible to potential downgrade or default.

We would expect the extent to which credit ratings integrate environmental risks to increase, particularly for those sectors that are more carbon-intensive.

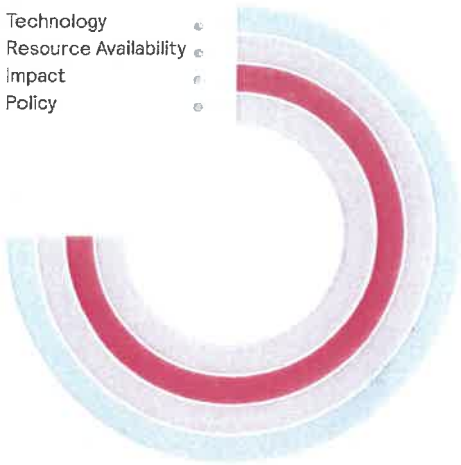
GROWTH FIXED INCOME

We believe the greatest sensitivity to climate change from an investment perspective is within growth fixed income, particularly emerging market debt and high-yield debt.



EMERGING MARKET DEBT

Emerging market sovereign bonds are more vulnerable to the potential impacts of climate change. This is a result of the lower ability of emerging market countries to accommodate the often higher costs of climate change adaptation. In addition, emerging market economies are typically more reliant on agriculture. As noted in the emerging market equity discussion, emerging market regions may benefit from government policies on climate change due to an increase in financial support from developed nations to climate-vulnerable regions. Institutional investors typically do not have exposure to those nations most at risk, and so the sensitivities assigned on our heat map remain modest.



HIGH YIELD DEBT

Similarly to investment grade credit, the sensitivity to the climate change risk factors is linked to the industry-sector analysis. We expect high yield debt to be more sensitive to the climate change risk factors, as we assume a higher correlation with the equity analysis than for investment grade credit. Within the high yield debt universe, the energy sector represents 15% of the index.

We expect multi-asset credit strategies to have limited sensitivity to the climate change risk factors through exposure to high yield debt. Although private debt has linkage to the exposure of the broader fixed income space to the climate change risk factors, we do not believe that there is a clear case to assign sensitivities to this asset class.

GREEN BONDS

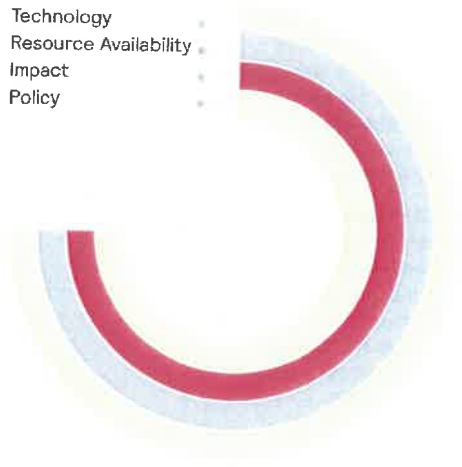
Fixed income generally remains a more difficult asset class for ESG considerations to be integrated relative to equities (both listed and private) and real assets, including real estate and infrastructure. However, one opportunity arising is the growth of the green bond market. The term "green bonds" is applied to bonds for which the proceeds raised are used to support projects or activities that have a positive environmental impact, such as those focused on energy efficiency or renewable energy.

Although still a nascent investment area, the green bond market is growing rapidly and, in time, could offer attractive opportunities to investors. Although the scale of issuance remains small in the context of global fixed income, in 2014, green bond issuance reached US$35 billion, growing from US$5 billion back in 2011 when Mercer undertook our first study on the impacts of climate change. Historically, the issuers of green bonds were typically supra-nationals such as the World Bank Group and regional development banks; however, the number of corporates issuing green bonds has increased.

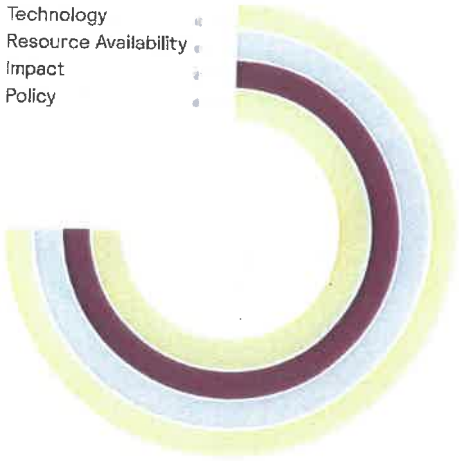
As the market grows, it is also overcoming some of the barriers that have historically made it difficult for institutional investors to allocate capital to this area. Several investable green bond indices have been launched over the last couple of years and the Green Bond Principles[27] were established. The Principles are voluntary process guidelines that recommend transparency and disclosure, and promote integrity in the development of the market. We have seen an increasing focus on this space and will continue to research this growing area of the fixed income market

[27] For more information, see http://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-bonds/, accessed 21 May 2015

GLOBAL REAL ESTATE



EMERGING MARKET REAL ESTATE



REAL ESTATE

Climate change has the potential to have an impact on real estate investment returns through changes in operating costs (for example, water and energy costs, tax, maintenance, depreciation, insurance) and occupancy rates (efficiency and location discounts/premiums). In addition, capital growth may be affected through changes in depreciation and expected rental growth (again, efficiency and location discounts/premiums). Technology is already well developed within the real estate sector, and many technologies that focus on energy have already been proven.

We have assigned positive sensitivity to Technology, as the sustainability of development and environmental ratings of buildings can impact potential tenant interest as well as reduce running costs. In addition, the potential impact on build costs is expected to be outweighed by longer-term benefits.

For emerging market property, we have assigned a more positive sensitivity, as we would expect a higher proportion of buildings to be built from scratch with latest technologies.

The following considerations led us to assign a negative sensitivity to Impact of physical damages:

- A disproportionately large segment of the commercial real estate sector by value is low-lying and in coastal population centres.
- Under-insurance against catastrophic events, which are increasing in frequency and severity.
- Risk of insurance-market disruption as a result of catastrophic perils (catastrophe [re]insurance prices are currently very low; increases in premiums or capacity shortages could result from climate catastrophes and insurance costs are a high portion of property operating costs).

PRIVATE EQUITY

At a high level, private equity consists of several groups (including venture capital, growth equity, mezzanine debt, buyouts), with each having specific characteristics and risk/return drivers. These strategies span the lifecycle of companies, ranging from venture capital or investments in early stage/start-up companies, through to development capital and expansion financing for growth companies, and to funding typically control-oriented buyouts in more stable, mature businesses and investments in financially, operationally troubled or distressed entities. Typically, these strategies encompass primarily equity-oriented investments, but can include debt investments as well (for example, distressed debt investing).

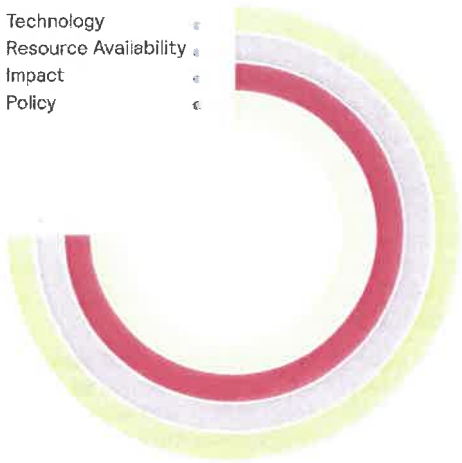
Given the diversity of private equity strategies, at an overall asset class level, we expect the sensitivity to the climate change risk factors to be relatively low, and this is linked to our equity-sector analysis. Similarly to equities, although there will be certain sectors, such as clean tech (including renewable and energy efficient technologies), that we would expect to be highly sensitive (positively) to Policy and Technology, this is offset by other sectors, where the sensitivity is negative.

Clean tech and other environmentally driven strategies are expected to have more positive sensitivity to the Technology and Policy factors.

EXISTING ASSETS VERSUS NEW ASSETS

We have sought to capture, at a high level, the sensitivity of different asset classes and industries to climate change. One important aspect for investors to consider, particularly for asset classes such as real estate and infrastructure, is the extent to which the implications of climate change will differ for existing assets and new assets. Such consideration is too granular to be captured by our modelling and is outside the scope of our analysis, but it is crucial that investors are cognisant of this issue.

Taking real estate as an example, in developed-market regions such as Europe, the focus is on retrofitting existing properties to comply with increasingly stringent regulation around the energy efficiency of buildings. Although such activity will incur short-term costs, in the longer term this should be offset by savings, as well as maintaining the attractiveness to tenants. Retrofitting can lead to significant savings in energy use, but the largest and most cost-effective savings occur when buildings are designed from scratch with energy efficiency in mind. Therefore, emerging-market regions, where there are high levels of construction in such new-build properties, are expected to offer the greatest potential for low-cost climate change mitigation.



INFRASTRUCTURE

Infrastructure is an attractive asset class for institutional investors given the potential for predictable earnings streams and cash flows, as well as a degree of inflation linkage in returns. The potential impact of climate change on infrastructure, at an asset class level, needs to be considered in the wider context of the drivers for additional investment in infrastructure globally, including:

- Replacement of ageing assets.
- Provision of additional capacity to reflect socio-economic growth (a growing global population and rising living standards in developing economies).
- Replacement of assets or construction of new assets as part of adapting to climate change.
- Increasing efficiencies to support economic growth.

The key drivers (from a climate change perspective) behind long-term infrastructure investment trends are the adaptation to climate change through the replacement of assets or the construction of new assets. In terms of how these will translate into risk/return characteristics, the most important factors will be changes at the global and regional level regarding climate policy and technology advancements. We note that although infrastructure would be sensitive to any impacts on inflation that may arise, such impacts are highly uncertain.

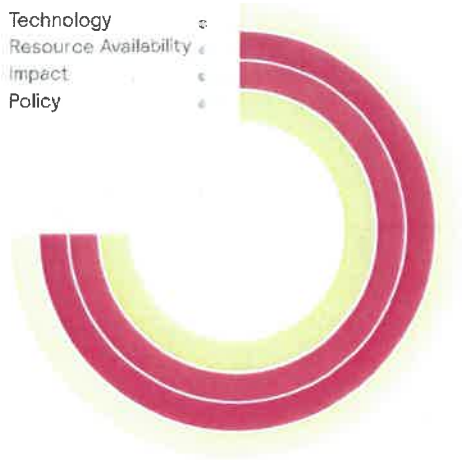
There is also a distinction between existing investments and new investments, where existing assets might be more vulnerable to the climate risk factors if they have not been adequately priced into the asset value. Future (new) investments face the challenge of putting a market value on these risks to ensure the investor is adequately compensated.

We note that sensitivity to the climate change risk factors will vary by underlying sector. More stringent climate policy (and investment in technology) is likely to reduce the value of some infrastructure assets that are less advanced or unable to adapt (and in the most extreme cases, some infrastructure assets, such as coal power stations, could be "stranded"), whereas others, particularly those in the pure-play clean energy space, will benefit strongly.

The New Climate Economy report suggested that "maintaining or strengthening economic growth to 2030 will require a significant increase in investment, including an estimated cumulative US$89 trillion of investment in infrastructure. A shift to low-carbon infrastructure will have an additional impact, changing both the timing and mix of infrastructure investment."[26]

Overall, we would expect more stringent climate policy to be a net (albeit slight) positive for infrastructure, as policy changes would drive an extended period of significant economic transformation and investment in infrastructure globally. We have therefore assigned positive sensitivity to the Policy and Technology risk factors.

[26] The New Climate Economy. *Better Growth, Better Climate*, available at http://newclimateeconomy.report/misc/downloads/, accessed 11 May 2015. NCE also concluded that a low-carbon transition across the entire economy could be achieved with only 5% more upfront investment from 2015-2030.



TIMBER

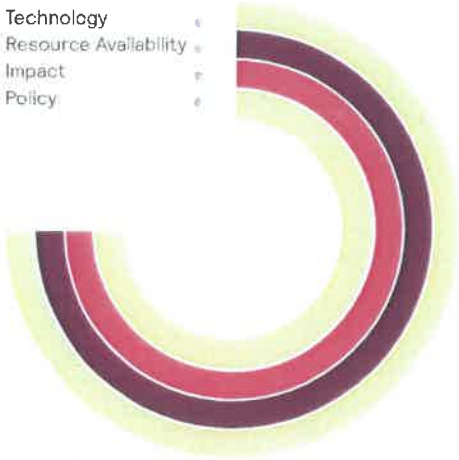
Relatively few institutional investors have exposure to timberland given the nuances of investing in this area. However, one of the distinguishing features of timberland (and its key source of return) is its biological growth, which underpins the rationale for timberland investment and drives many of the diversification benefits that can come from investing in timberland. The low-carbon credentials of this asset class can give it a clear role within portfolios for investors looking to hedge against the impact of climate change. Although biological growth drives the harvest value of an area of timberland, the ultimate return from a timberland investment is also heavily influenced by the purchase price. The expected return drivers typically comprise three main components: the strategic risk premium, changes in timber prices, and active management.

The US remains the largest and most developed market for institutional investment in timberland, although the opportunity set has expanded over the past few years to other global regions, including Latin America (Brazil, Uruguay, and Chile), Australia, New Zealand, and Europe.

We would expect timberland investments to benefit from favourable climate policy shifts, as we would expect this to increase the penalties for deforestation and increase 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

Relatively few institutional investors have exposure to agriculture given current challenges for investment managers in this area, which include the lack of established and proven track records, difficulties in sourcing specific agricultural experience, and a lack of institutional-quality operational structures. The current universe of agriculture funds is relatively small and disparate; however, we are seeing increasing interest from investors in this space.

Broadly speaking, agriculture is a collection of heterogeneous activities, as are the investment opportunities seeking exposure to it. The asset class of agriculture or farmland broadly covers investment in the following commodities:

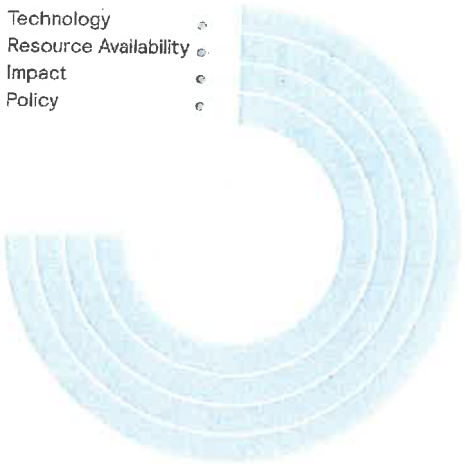
- Row crops — for example, wheat and other grains (typically rotated every year).
- Permanent crops — for example, fruits and nuts.
- Livestock — for example, cattle and sheep.

The long-term returns for agriculture investments are typically generated from the sale of agriculture-based commodities (crops and livestock) and appreciation of land and food prices. Investment exposure to these various end commodities can be achieved in a number of ways, with varying risk/return profiles, and the risks of investing in agriculture are, to a certain extent, regionally dependent.

Geographically, the US, Latin America (in particular Brazil), Australia, and New Zealand are the core areas of focus when considering agricultural investments. Prominent countries in the European Union (EU) are less attractive as investment opportunities because of their reliance on subsidies to determine pricing (and in parts of the UK, land prices more directly reflect potential development values rather than expected agricultural returns). The US also employs subsidies, but we believe there are opportunities to navigate these and, on the whole, managers will not look to incorporate subsidies into return estimates.

Opportunistically, areas such as Central and Eastern Europe may provide potential satellite exposure, capturing the opportunities for creating economies of scale in fragmented markets and the potential benefits of closer EU relationships.

The impacts of climate change on agriculture would be country specific, but at an overall asset class level, we would expect agriculture investments to benefit from more stringent climate policy, which we would expect to promote sustainable crop methods, reducing the risk of disrupted production. However, there is a risk that protectionist policies in response to food shortages could create unrest and additional geopolitical risk premium for agriculture investments. Overall, we have assigned positive sensitivity to the Policy risk factor. In the case that more stringent policy is implemented, we



would expect substantial capital would be made available to assist emerging market countries with respect to adaptation in farming methods.

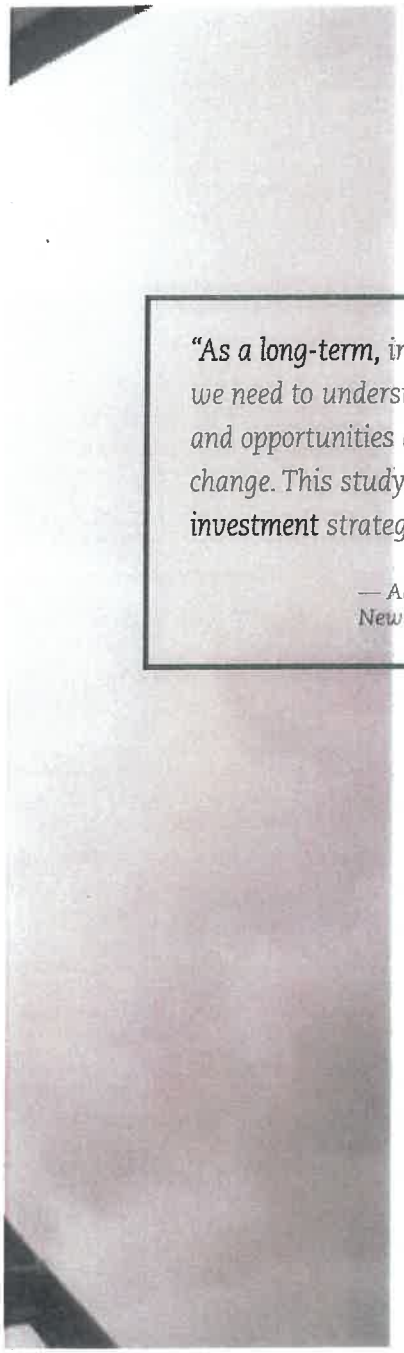
We would expect agriculture investments to benefit from technological development with respect to more productive and resilient crop varieties, and we would anticipate that more heat- and drought-tolerant crops would be introduced in order to improve the climate resilience and reliability of production. To reflect this, we have also assigned a positive sensitivity to the Technology risk factor.

Agriculture is the asset class that is most sensitive (negatively) to Resource Availability. 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.

HEDGE FUNDS

Although often categorised as such, hedge funds are not strictly an asset class. Rather, hedge funds are a collection of heterogeneous investment strategies. These strategies tend to have disparate risk/return profiles and individual hedge fund managers implementing the same investment strategy often target and generate contrasting risk profiles. Given the disparate nature of hedge funds, we have not assigned sensitivity to the climate change risk factors. We note that some strategies, such as insurance-linked strategies that seek to capture catastrophe risk premia, are likely to be sensitive; however this would require more detailed analysis at a strategy level, which is outside the scope of this report.

PORTFOLIO IMPLICATIONS AND INVESTOR ACTIONS



> *"As a long-term, intergenerational investor, we need to understand the investment risks and opportunities associated with climate change. This study will help us calibrate our investment strategies accordingly."*
>
> — *Adrian Orr, CEO, New Zealand Super Fund*

Our approach to investment modelling analyses changes in return expectations in the 35 years between 2015 and 2050, driven by the four climate change scenarios reviewed. The modelling results allow us to identify the potential climate impact on returns, including the minimum and maximum impact investors can expect when climate considerations areincluded (that is, the TRIP factors and four climate scenarios).

Our investment modelling has demonstrated the following:

1. Climate change, under the scenarios modelled, will inevitably have an impact on investment returns, so investors need to view it as a new return variable.
2. Industry sector impacts will be the most meaningful. For example, depending on the climate scenario which plays out, the average annual returns from the coal sub- sector could fall by anywhere between 18% and 74% over the next 35 years, with effects more pronounced over the coming decade (eroding between 26% and 138% of average annual returns). Conversely, the renewables sub-sector could see average annual returns increase by between 6% and 54% over a 35 year time horizon (or between 4% and 97% over a 10-year period).
3. Asset class return impacts could also be material – varying widely by climate change scenario. For example, a 2°C scenario could see return benefits for emerging market equities, infrastructure, real estate, timber and agriculture. A 4°C scenario could negatively impact emerging market equities, real estate, timber and agriculture. Growth assets are more sensitive to climate risks than defensive assets.4
4. A 2°C scenario does not have negative return implications for long-term diversified investors at a total portfolio level, over the period modelled (to 2050), and is expected to better protect long-term returns beyond this timeframe.

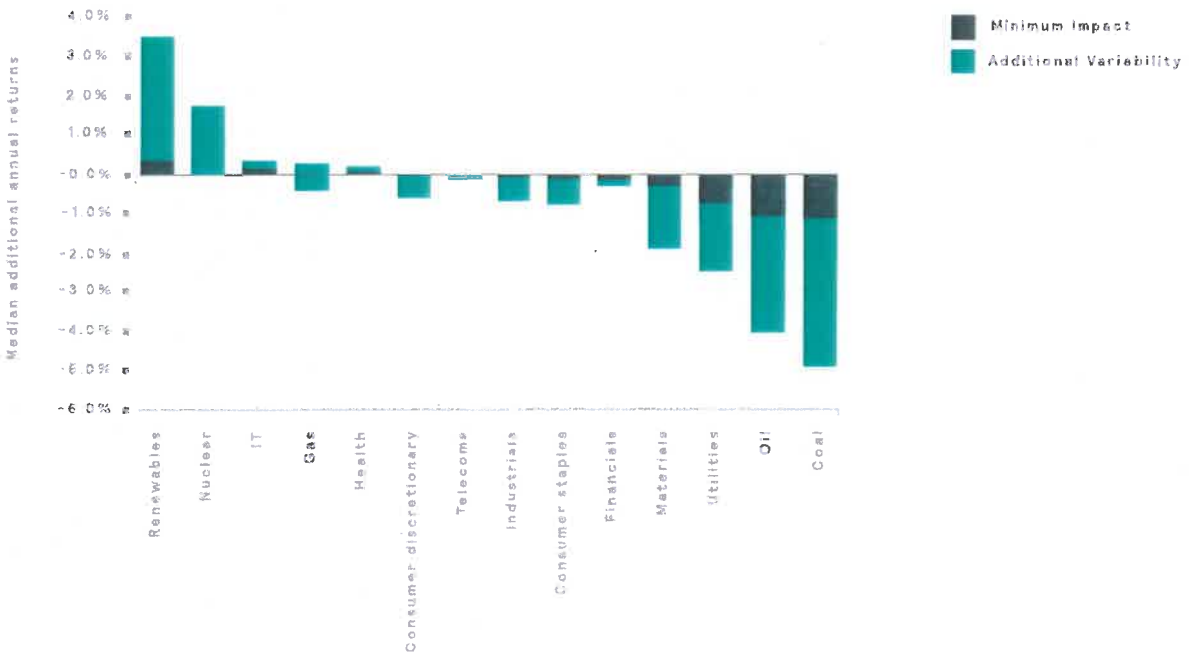
Where return impacts are positive, investors can position their portfolios to access those opportunities. Where return impacts are negative, investors can position their portfolios to minimise risk exposures.

In assessing the results, we begin with a consideration of industry sectors instead of asset classes, as this is where the climate risk impacts are most pronounced. This result is in itself an interesting take-away, given that the majority of investors build portfolios around asset classes (i.e. going forward, an increased focus on sector exposure seems warranted).

Figure 10 below shows the potential climate impact on median annual returns for industry sectors over the next 35 years. The range shows the minimum impact and the additional variability, to reach a maximum potential impact for each industry sector when climate considerations are included. These impacts should be considered in context as a percentage of underlying expected returns, which range from 6-7% per annum.

The energy sector is broken into its sub-sectors, as one of the most impacted industries. Coal's average expected annual returns could be reduced from 6.6% p.a. to between 1.7% p.a. and 5.4% p.a. over the next 35 years, depending on the scenario. Oil and utilities could also be significantly negatively impacted over the next 35 years, with expected average returns potentially falling from 6.6% p.a. to 2.5% p.a. and 6.2% p.a. to 3.7% p.a. respectively. This would negatively impact unprepared investors. Renewables have the greatest potential for additional returns: depending on the scenario, average expected returns may increase from 6.6% p.a. to as high as 10.1% p.a.

Figure 10: Climate Impact on Returns — by Industry Sector



Source: Mercer

10-YEAR IMPACTS – CONSIDERING 'STRANDED ASSETS'

The concept of stranded assets relates to investments that lose significant economic value well ahead of their anticipated useful life as a result of changes in legislation, regulation, market forces, disruptive innovation, societal norms, or environmental shocks.[29] In the context of this study, to understand the potential for stranded assets it is important for us to consider potential return impacts under a shorter timeframe – we therefore look at return impacts over the coming ten years (i.e. versus average impacts to 2050).

Our results largely support the recent discussions on stranded assets, which have focused on the constraints that would be placed on fossil fuel companies from climate action similar to that expected under our Transformation scenario. We expect that under the Transformation scenario, coal and oil sector returns could be eroded over the next 10 years (in fact, we expect potential average returns of -2.0% p.a. and -0.7% p.a. respectively).

Our analysis expands on the issue of fossil fuel stranding, by modelling how a range of possible climate change scenarios will impact investor returns across all sectors and asset classes.

- Under the Transformation scenario we also discover that utilities' returns could fall from 5.1% p.a. to 1.2% p.a. over the next 10 years. In contrast, the renewables sub-sector can be expected to see potential returns increase from 5.3% p.a. to 10.4% p.a. and the nuclear energy sub-sector from 5.3% p.a. to 7.7% p.a. over the same time period.
- Because our study accounts for four climate risk factors, we are also able to demonstrate the minimum impact that could occur regardless of the level of policy response we see in the coming decades. Over the next 10 years, the minimum impact for the coal sub-sector could result in expected annual returns falling from 5.2% p a. to 3.9% p.a., and for the oil sub-sector from 5.3% p.a. to 4.0% p.a.

Our results show that regardless of future policy action, climate change could significantly impact sector returns over the next 10 years. In addition, while the Transformation scenario may be viewed by most investors as more contentious, it presents a potential risk that is worthy of consideration. Those investors that remain unprepared and are exposed to these higher risk sectors (and companies) are most at risk of remaining invested in 'stranded assets'.

Related actions are discussed in the next section.

[29] The Generation Foundation. "Stranded Carbon Assets: Why and How Investors Should Incorporate Carbon Risks Into Investment Decisions." 2013. available at http://genfound.org/media/pdf-generation-foundation-stranded-carbon-assets-v1.pdf, accessed 11 May 2015.

CLIMATE IMPACT ON RETURNS — ASSET CLASS

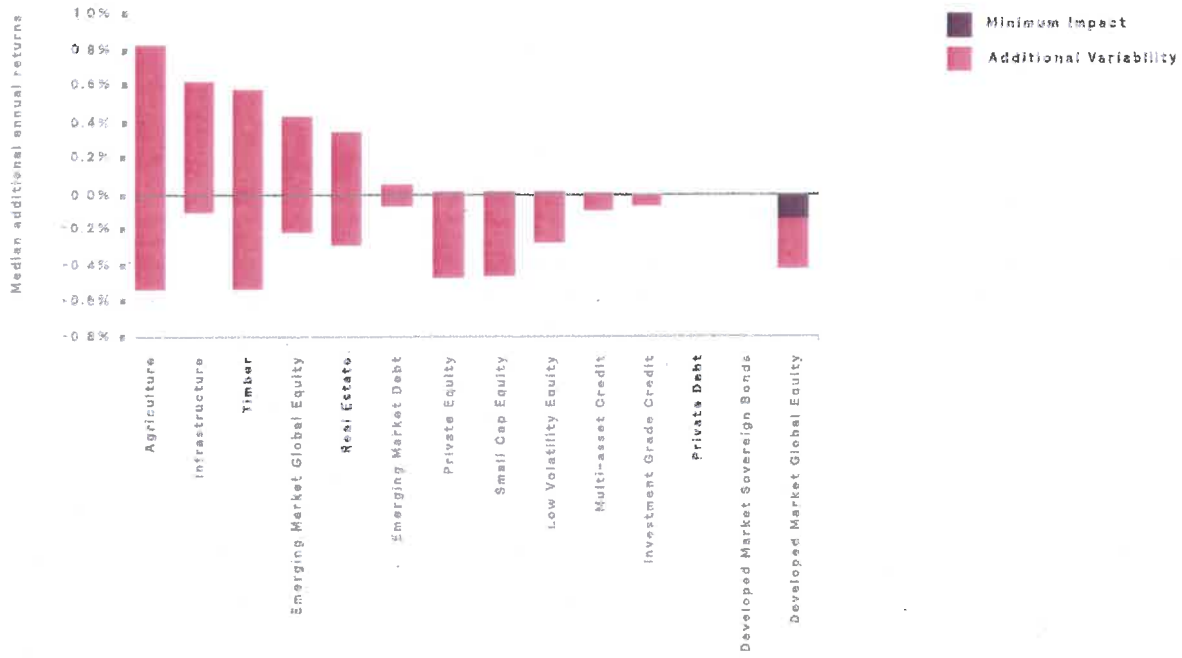
There are also material impacts to be considered at the asset class level, with the outcome dependent on the eventuating scenario in many cases.

As can be seen from Figure 11 below, only developed market global equity is expected to experience a reduction in returns across all scenarios. For the other asset classes, climate change is expected to either have a positive or negative effect on returns dependent on the future scenario.

Interestingly, over 35 years, timber and agriculture are among the asset classes that have the potential for the largest additional returns or reduction in returns. These results may underplay impacts within the asset classes.

Developed market sovereign bonds are not viewed as climate risk sensitive at an aggregate level (they remain dominated by other macro-economic factors), with some exceptions such as Japan, Australia, and New Zealand.

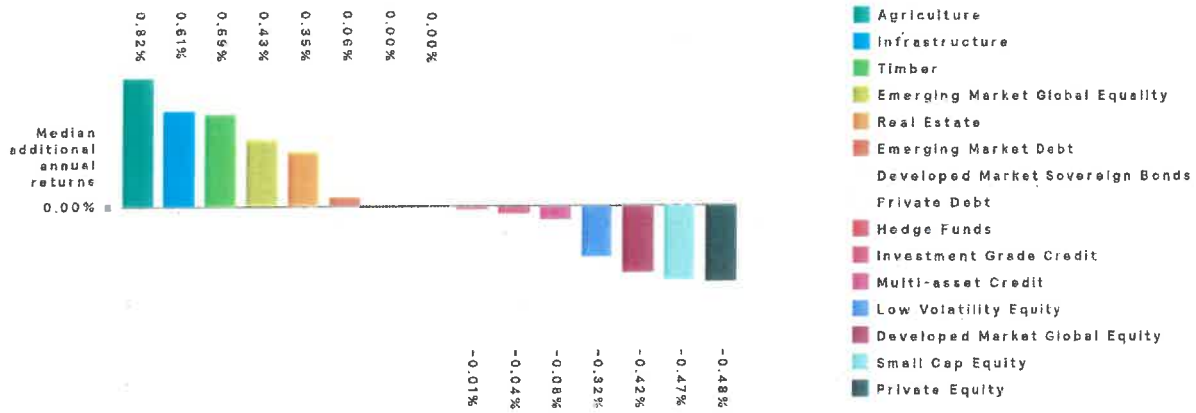
Figure 11: Climate Impact on Returns — by Asset Class (over 35 years)



Source: Mercer

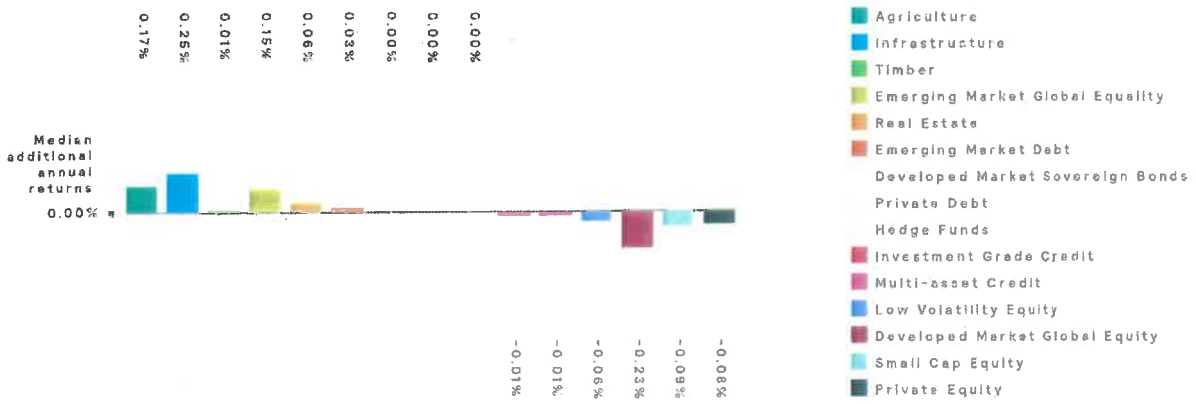
Figures 12 – 15 illustrate the potential climate impact on returns we see across the different asset classes for each scenario.

Figure 12: Asset Classes Under Transformation Scenario (Median Annual Return Impact Over 35 years)



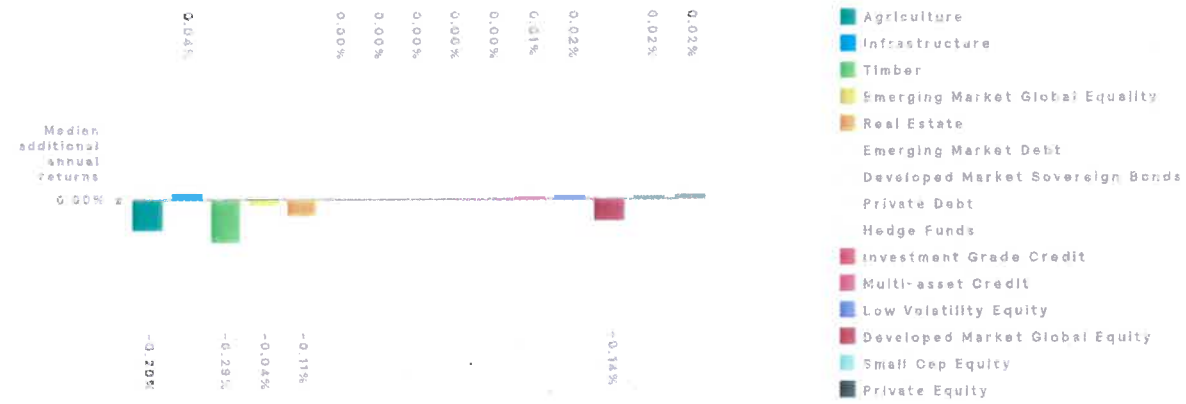
Source: Mercer

Figure 13: Asset Classes Under Coordination Scenario (Median Annual return Impact Over 35 years)



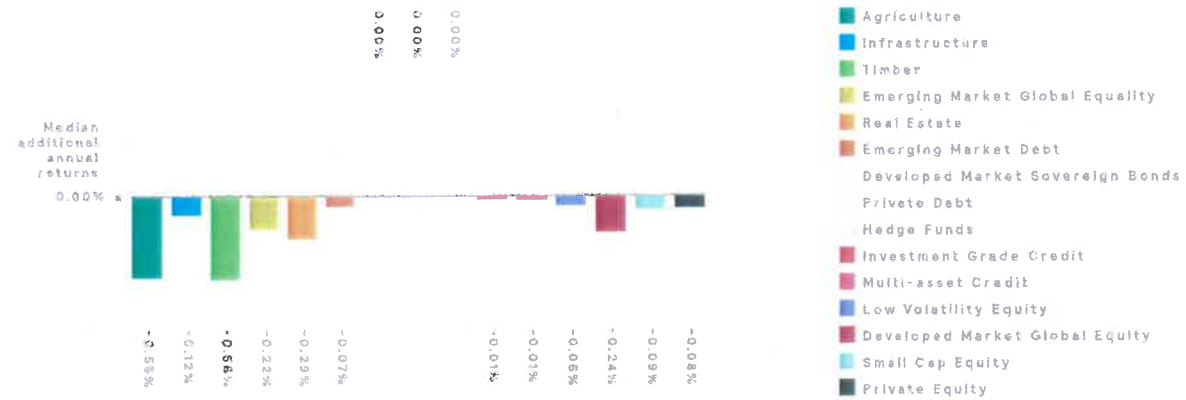
Source: Mercer

Figure 14: Asset Classes Under Fragementation (Lower Damages) Scenario (Median Annual return Impact Over 35 years)



Source: Mercer

Figure 15: Asset Classes Under Fragementation (Higher Damages) Scenario (Median Annual return Impact Over 35 years)



Source: Mercer

TOTAL PORTFOLIO IMPLICATIONS

As demonstrated above, we can expect different asset classes to have an increase or decrease in expected returns depending on the future scenario. The below diagrams depict an example investor's total portfolio exposure to climate change risks and opportunities under each scenario. The climate return portfolio impact estimates are based on 10-year figures, consistent with the typical strategy-setting timeframe for investors. Ten-year return impacts will differ from 35-year impacts shown on previous pages, driven by the pathway of the climate scenario (i.e. the relative impact of each TRIP factor at 2025 versus at 2050 in each scenario). See the Scenarios section and Appendix 2 for further detail.

The reference portfolio is diversified, as per the allocation in the table below, with an 85% exposure to growth assets.

Table 3: Sample Portfolio Asset Allocation

ASSET CLASS	PERCENTAGE PORTFOLIO
Developed-market Global Equity	17.50%
Emerging-market Global Equity	10.00%
Low-volatility Equity	7.50%
Small-cap Equity	2.50%
Private Equity	5.00%
Hedge Funds	5.00%
Real Estate	10.00%
Infrastructure	5.00%
Timber	2.50%
Agriculture	2.50%
Private Debt	5.00%
Emerging-market Debt	2.50%
Multi-asset Credit	10.00%
Developed Government Bonds	10.00%
Corporate Bonds	5.00%

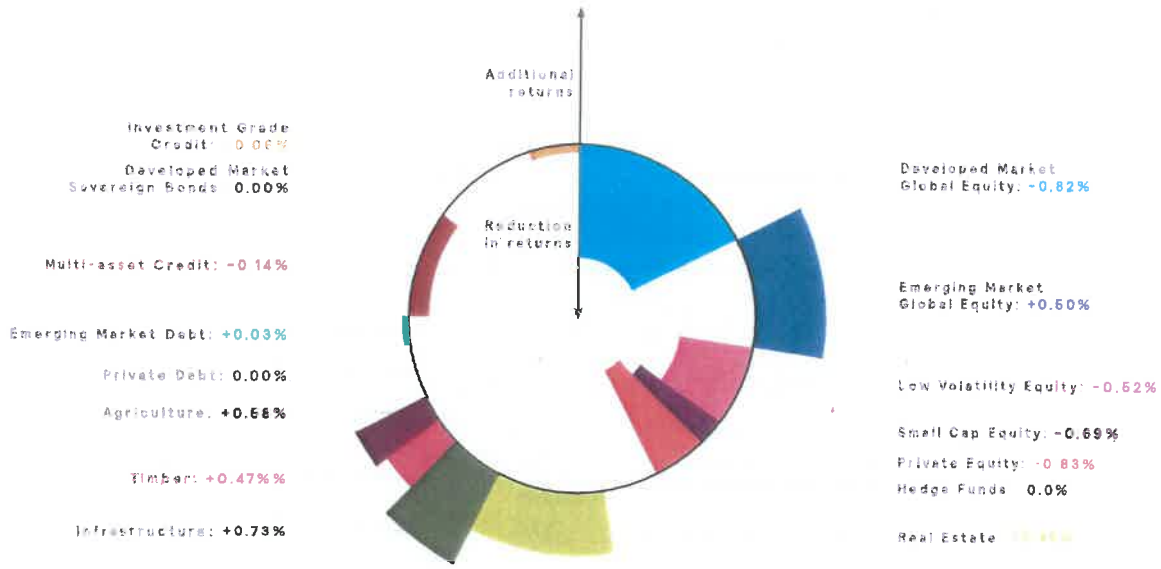
Source: Mercer

The black circle represents a 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.

Investors should prioritise their actions for asset classes by those with the largest weightings and largest movements inwards or outwards from the black circle.

For a typical investor, the greatest risk exposure is expected to come from developed market equities under all scenarios. This is reflected by the fact that, as demonstrated above, the only asset class with a minimum vulnerability is developed market equities. Although small tactical adjustments to this asset class weighting may be possible, the primary way investors will likely reduce this risk exposure is through considering the underlying sector-level exposures of the asset class.

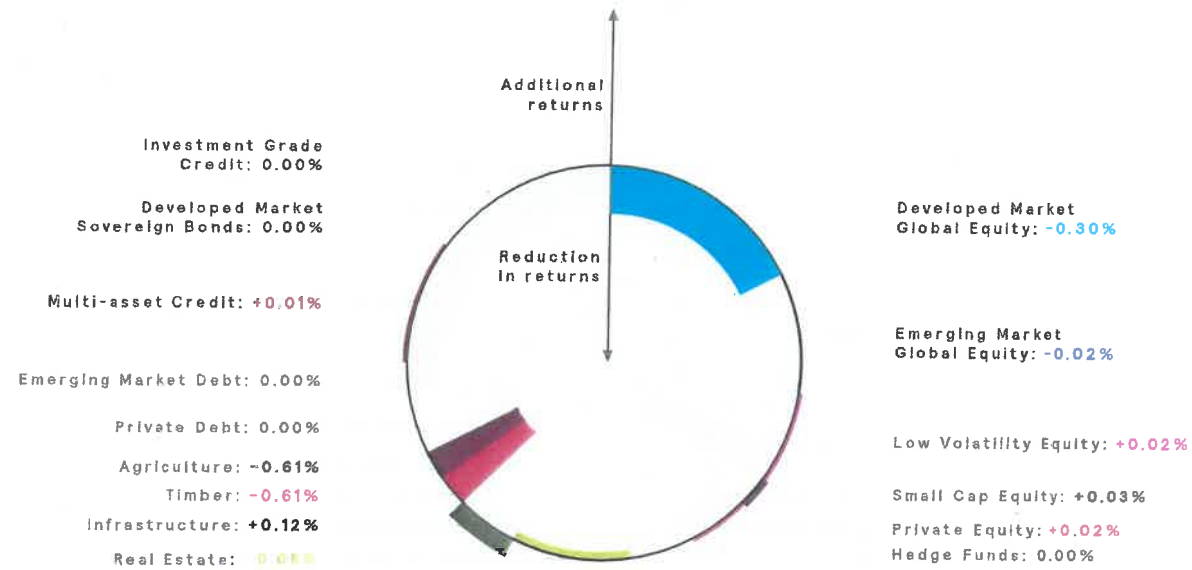
Figure 16: Portfolio Impacts — Transformation
(Median Annual Return Impact Over 10 years)



Source: Mercer

- Under this scenario, we expect generally larger impacts compared to other scenarios, although the net portfolio impact will be similar. This could mean that, if effectively anticipated, this scenario could lead to the biggest net positive returns for investors who can reduce their asset class risk exposures and pursue associated opportunities.
- Key risks relate to developed market equity, private equity, and low volatility equity exposures, with expected gains driven by emerging market equity, real estate, infrastructure, timber, and agriculture.
- Portfolio re-allocations could be considered, and additional risk management measures (such as industry-sector exposure analysis and company-level engagement) employed. These are explored further in the following section.

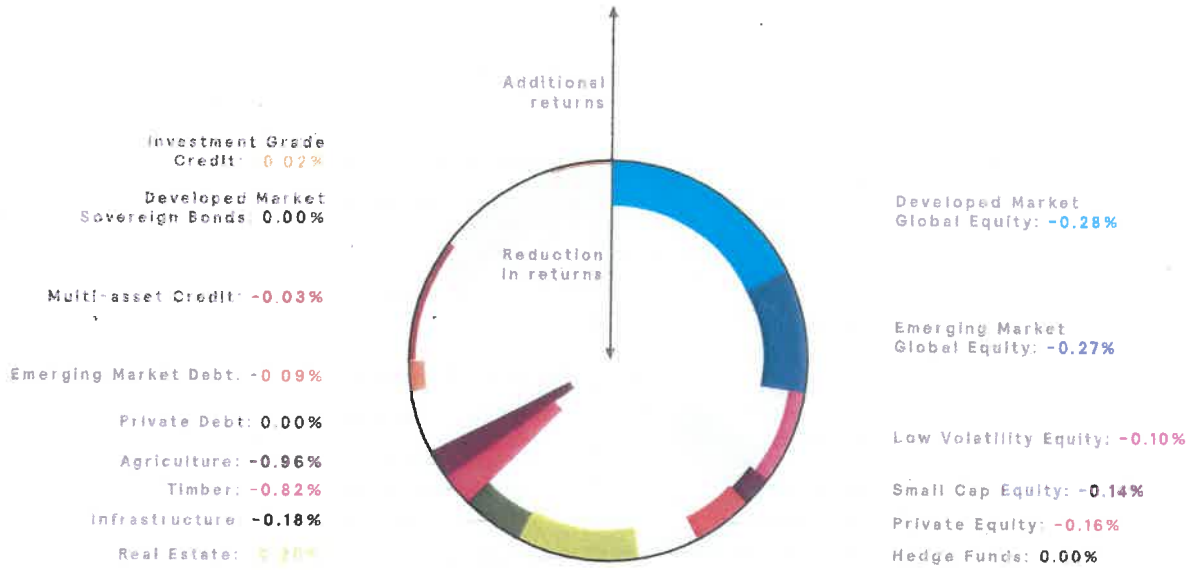
Figure 17: Portfolio Impacts — Coordination
(Median Annual Return Impact Over 10 years)



Source: Mercer

- Asset class impacts under the Coordination scenario are generally less significant, with the largest downside risk relating to agriculture and sector exposures underlying global developed market equity exposure.
- In this scenario, the key focus should be on risk exposures within asset classes — including listed and unlisted equities.

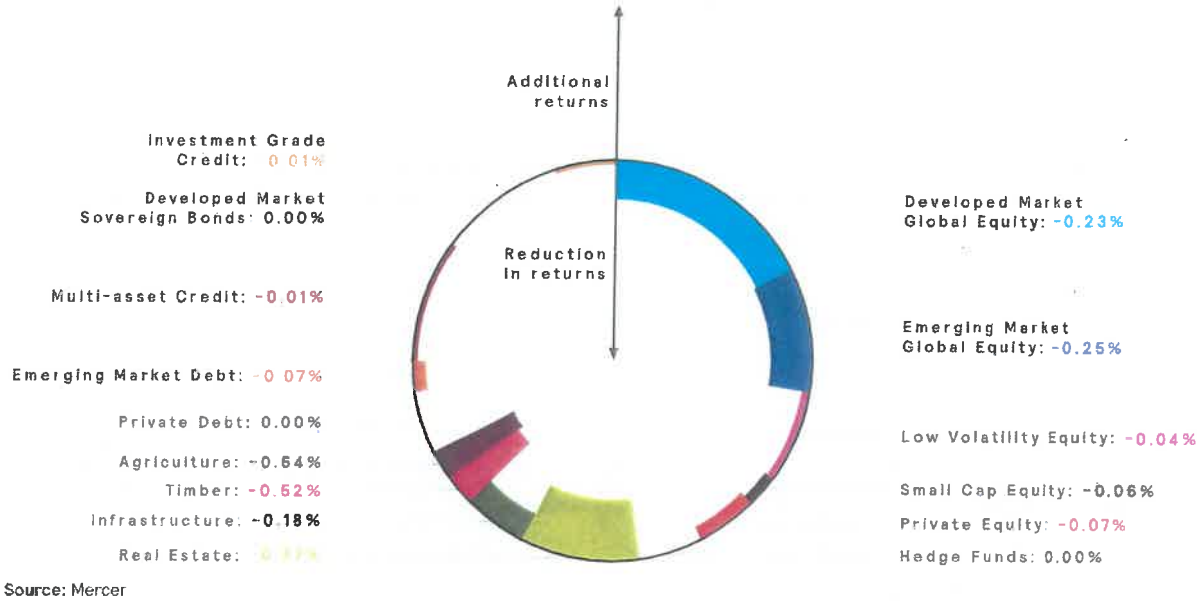
Figure 18: Portfolio Impacts — Fragmentation (Lower Damages)
(Median Annual Return Impact Over 10 years)



Source: Mercer

- Under both Fragmentation (Lower Damages) and Fragmentation (Higher Damages), there are no additional positive returns expected. This means that for a typical investor who does not consider sector-level exposures, these scenarios will likely only lead to reduced returns.
- The most significant negative return impacts are apparent in timber, agriculture, real estate, and equity allocations — both in emerging and developed markets.

Figure 19: Portfolio Impacts — Fragmentation (Higher Damages)
(Median Annual Return Impact Over 10 years)



Source: Mercer

- The most significant negative return impacts are apparent in timber, agriculture, real estate, and equity allocations — both in emerging and developed markets.
- Investors should consider undertaking geographic risk assessments at the portfolio level.

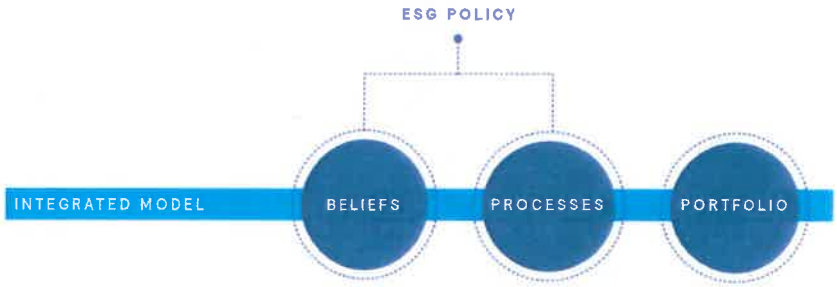
FROM THINKING TO DOING: NOW WHAT?

This section provides investors with further guidance on the "now what", in considering how to establish an appropriate governance and implementation framework for monitoring and managing climate risk.

The key objective for investors is to first understand their portfolio exposures to the asset classes and industry sectors most sensitive to the TRIP factors and those with the greatest potential climate impact on returns and, second, position their portfolios accordingly.

Consistent with our thinking on the best way to incorporate ESG considerations into the investment process, we recommend an integrated approach within setting beliefs, policy, process, and portfolios. As set out in Figure 20, this enables investors to integrate climate risk management within a broader risk management function during the investment process.

Figure 20: Integrated Model for Addressing ESG Considerations



Source: Mercer, *An Investment Framework for Sustainable Growth*[30]

PORTFOLIO DECARBONISATION

The concept of "portfolio decarbonisation"[31] has been developed, reflecting action taken by investors to reduce the carbon-intensity of their portfolios over time. This generally begins with equities and can advance to cover other asset classes. The advantages of this approach from the perspective of the TRIP risk factors are as follows:

- It reduces the Policy risk (P) of the portfolio, and, more broadly, helps to address market mispricing of carbon. The lower the carbon-intensity of the holdings, the less susceptible they should be to increasing carbon pricing and/or related regulation.
- This, in turn, supports the flow of capital to a resilient low-carbon economy, which should help to reduce the long-term physical Impact risks (R and I).
- It can also result in increased investment exposure to companies or assets benefiting from climate action strategies, which are more likely to be supported by new Technology solutions (T).

[30] 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

[31] See the Portfolio Decarbonisation Coalition (http://unepfi.org/pdc), which follows the September 2014 Montreal Pledge supporting portfolio decarbonisation at the PRI meeting at http://montrealpledge.org/

Embarking on this process will lead to an evolution of portfolios over time, from the total portfolio asset allocation, through to exposures within asset classes, and an enhanced focus on monitoring and engaging with managers on sector exposures and company positions. Climate risks may be addressed alongside and as a part of other ESG considerations.

Investors will require a governance approach that enables them to build capacity to monitor and act on shorter-term climate risk indicators (1–3 years), as well as longer-term (10-year plus) considerations. Initially, investors may take a safeguarding position. This may develop into a more proactive approach in time.

Safeguarding

Investors believe particular industry sectors or asset classes are likely to be "at risk". In equity portfolios, they can proactively seek to manage or change sector weights. At the company level, this may include tilting towards less carbon-intense companies within industry sectors.[32]

Proactive

Investors believe that low-carbon industry sector or assets are relatively more attractive over the long-term. They may choose to structure deliberate biases in portfolios over the coming decades. This could involve a change of outlook on appropriate sector classifications and market benchmarks.

ACTIONS FOR POLICY MAKERS

The key action for policy makers is to put policies in place that serve to reduce the scenario-uncertainty risk currently facing investors, which serves as a barrier to enacting the low-carbon transition that avoids the worst long-term impacts of climate risk. The Global Investor Coalition Statement on Climate Change (2014)[33] summarised this as follows, calling on governments to:

- Provide stable, reliable, and economically meaningful carbon pricing that helps redirect investment commensurate with the scale of the climate change challenge.
- Strengthen regulatory support for energy efficiency and renewable energy, where this is needed to facilitate deployment.
- Support innovation in and deployment of low-carbon technologies, including financing clean energy research and development.
- Develop plans to phase out subsidies for fossil fuels.
- Ensure that national adaptation strategies are structured to deliver investment.
- Consider the effect of unintended constraints from financial regulations on investments in low-carbon technologies and in climate resilience.

These policy changes will ultimately protect investors from the negative sensitivities their assets have to the Resource Availability and Impact (physical damages) risk factors (that is, those boxes shown as red on Figures 8 and 9).

[32] A number of low-carbon indices are now available which closely track the performance of key broad-based indices while significantly reducing the carbon footprint of the overall portfolio.

[33] *Investor Statement on Climate Change*, 2014, available at http://1gkvgy43ybi53fr04g4elpcdhfr.wpengine.netdna-cdn.com/wp-content/uploads/2014/09/GlobalInvestorStatement2014_Final.pdf, accessed 30 April 2015.

Table 4: Overview of Actions Within a Four-step Process

		ACTIVITY TYPE	TOTAL PORTFOLIO
1. BELIEFS		Investment Beliefs	Develop investment belief(s) at a Board/Trustee level to establish a shared understanding and formal strategic approach to oversight of climate risk across internally- and externally-managed investments. This could be a section within a broader ESG-beliefs document, or stand-alone. These investment beliefs articulate the outlook on climate risk and opportunity in the context of industry best practice, beneficiary timeframes and views, fiduciary duty, and stakeholder expectations – evolving already adopted beliefs (if any).
2. POLICIES		Investment Policies	Reflect your approach to climate risk and opportunity in formal policies including: references to risk management techniques; return targets, constraints and measures of compliance; engagement objectives and priorities; and related resources. Climate risks may be referenced alongside other ESG considerations.
3. PROCESSES		Portfolio Specific	Establish resourcing needs and incorporate climate risk within current investment procedures, in particular risk management procedures, but also in areas such as manager selection and monitoring, documenting this as any other risk. Incorporate climate risk in reporting and communication to stakeholders, to disclose annual climate metrics and actions.
		Systemic (Market-Wide)	Review and join relevant collaborative industry initiatives to engage with policymakers, access ongoing education and share best practices.
4. PORTFOLIO		Risk Assessment	Assess climate risks/exposures at the portfolio, asset and industry sector level, which, for investment managers, includes company-level detail.
		Risk Reduction, Transfer, Hedging	Rebalance/reallocate and adapt portfolios to reduce downside risk. Some investors have adopted hedging strategies.[34]
		Identify Opportunities	Invest an appropriate proportion of each asset class in low-carbon and sustainability themes, taking into account opportunities focused on mitigation and adaptation.
		Engage Investment Managers	Require investment managers to provide information on their investment analysis and voting/engagement approach to climate-specific risks and opportunities, as part of their ESG integration processes, as appropriate. Once the information is being reported and monitored, additional steps can be considered accordingly.
		Engage Companies	Consider TRIP factor exposure at company/individual asset level and encourage greater disclosure of related information by opaque companies. Once reporting is in place, additional steps can be considered accordingly.

[34] For a discussion of this approach, see: http://www.corporateknights.com/channels/responsible-investing/make-killing-shorting-coal-companies-14279976/

Table 5: Overview of Actions Within a Four-step Process: Descriptive Activities by Asset Class

	ACTIVITY TYPE	EQUITIES	FIXED INCOME	ALTERNATIVES*
1. BELIEFS	Investment Beliefs	Gather views from investment committees and staff on key beliefs and priorities that are specific to the relevant asset class. Develop knowledge through research to understand past experience in the relevant asset class, current stakeholder needs, and future expectations.		
2. POLICIES	Investment Policies	Establish asset class specific policies as appropriate, and apply across internally and externally managed investments.		
3. PROCESSES	Portfolio Specific	Enhance mandates of external service providers (such as asset consultants, legal, and investment managers), to explicitly include consideration of climate risk, where possible. Develop asset class-specific metrics for monitoring; for example, carbon footprinting, and reporting on potential energy efficiency gains across private markets holdings.		
	Systemic (Market-Wide)	Encourage mandatory company reporting on climate risk and related metrics.	Engage (supra)national bodies and encourage regulations that enable capital to flow easily into climate mitigation and adaptation; encourage natural capital valuation.	Promote funding for climate resilience projects.
4. PORTFOLIO	Risk Assessment	Assess holdings against TRIP industry-sensitivities. Carbon footprinting can isolate company-level sensitivity to climate policy changes. Review existing manager approaches to ensure climate risk analysis is integrated.	Review existing manager approaches to TRIP factor assessment, supplemented by possible holdings analysis.	Assess private market holdings against TRIP industry-sector sensitivities. Conduct geographic exposure assessment for real asset holdings.

*Alternatives are an aggregation of other asset classes, including real estate, private equity, infrastructure, timber, and agriculture

Table 5: Overview of Actions Within a Four-step Process: Descriptive Activities by Asset Class (Continued)

	ACTIVITY TYPE	EQUITIES	FIXED INCOME	ALTERNATIVES*
4. PORTFOLIO (CONTINUED)	Risk Reduction, Transfer, Hedging	Options depend on portfolio analysis, implementation considerations, and scenario signposts over time. May include exiting positions with highest climate risk exposure, creation/adoption of alternative indices that exhibit targeted climate-friendly sector biases, setting portfolio decarbonisation targets, and/or engagement actions. Show preference for managers that integrate climate analysis and active ownership in their investment process.	Portfolio decarbonisation — potentially through exiting positions (or sectors) with the highest climate risk. Show preference for managers that integrate climate risk in investment analysis and decision-making. Engage in credit default swaps to hedge credit risk of vulnerable issuers.	Employ same actions as for public equities, and drive responses specific to risk assessment findings, such as ensuring appropriate insurance cover across portfolios. Derivatives may also be an option to consider.
	Identify Opportunities	Opportunities cover both mitigation and adaptation themes, including low-carbon investments, clean energy, water, agriculture, and broad sustainability themes. Allocate to managers that invest in companies with expertise in resilient/sustainable infrastructure development/ management.	Potential growth opportunities in green bonds and social-impact bonds, which provide some focus on low-carbon investing.	Numerous examples, such as clean-energy infrastructure, low-carbon transport, dedicated timberland funds, clean tech private equity, resilient infrastructure projects (e.g. flood defences), insurance-linked securities (ILS), catastrophe bonds, and firms driving innovative solutions to climate-related risks (e.g. microinsurance).
	Engage Investment Managers	Develop strategy for voting and engagement with managers/ companies. Work with managers to develop/enhance their approach to climate risk management.	Develop strategy for engagement with managers/debt issuers at time of issue. Work with managers to develop/enhance their approach to climate risk management (strategic use of ESG ratings).	Work with managers to develop/enhance their approach to climate risk management (strategic use of ESG ratings).
	Engage Companies	Encourage disclosure of climate/carbon exposure, ask companies with large carbon footprints for GHG-reduction plans (mitigation); address corporate lobbying; ask companies with large exposure to weather or resource risks for climate risk management plans (adaptation).	Same as public equities, though most effective if conducted at time of debt issuance; encourage borrower disclosure of environmental risk information; engage with target companies or public issuers to encourage issuance of climate/green bonds.	Same as public equities, in many cases, with specific engagement topics for each asset class, for example, real estate and retrofitting properties.

8

CLOSING REFLECTIONS

> *"For investors, the key question is whether they will actively take a role in encouraging a 2°C outcome in line with our Transformation scenario"*

LONG-TERM INVESTORS AS CLIMATE STAKEHOLDERS

This study has provided Mercer and its study partners the opportunity to identify interesting implications of the climate scenarios and TRIP factors, and associated actions for investors to consider.

Our study considered the coming 35 years, stretching the practical perspective of the typical long-term investor. The challenges of short-termism are well documented in the industry, and the issue of climate change compounds this issue.

A study on the impact of climate change would be remiss without reference to longer-term implications and opportunities. Appendix 2 looks beyond the next 35 years to consider how our climate scenarios are likely to unfold to 2100. The physical implications are progressively worse as we consider a Coordination scenario or the Fragmentation scenarios. Investing to adapt now is widely argued to present a more attractive economic outcome than relying on the concept of greater wealth in the future to provide solutions. Although many of the worst projected climate impacts could still be avoided by holding warming below 2°C, this would require substantial policy, technology, economic, institutional, and behavioural change. For investors, the key question is whether they will actively take a role in encouraging a 2°C outcome in line with our Transformation scenario.

Investors have two key levers they can use to help steer in this direction: investment and engagement. It is interesting to consider "what's required" from the long-term investment community to meet this challenge. Numerous industry groups are working on different components, yet a more concrete mapping of "from here, to there" is required if these efforts are to be coordinated for maximum effort.

9

INVESTORS AS 'FUTURE TAKERS' OR 'FUTURE MAKERS'

All investors will be influenced by whichever global political and physical climate scenario emerges over the coming decades. In this sense, they are all "future takers" in the context of climate change, although investors will face this issue with different levels of resilience — with those investors unprepared for the minimum return impact expected to accompany any of the future scenarios effectively negating their best possible outcome.

On the other end of the spectrum is the emergence of a group of investors that we could term "future makers". These investors feel compelled by the magnitude of the longer-term risk of climate change to seek to influence which scenario comes to pass.

Collaboratively, these institutional investors are recognising that they have a potentially meaningful role to play in echoing the position that has been taken by most countries (including major powers like the US and China) in recognising the scientific evidence that limiting global warming to 2°C is required to avoid "dangerous" interference with the climate. Moreover, they are recognising the need to encourage policymakers and businesses to prepare accordingly. Some investors, for a number of reasons (including their size, resources, or governance constraints) are not likely to adopt an influencing role, yet we still expect to see an increase in the number of such investors over the coming years.

Three different investor perspectives can be summarised in Figure 21. We encourage investors to progress along these phases to the extent they can.

Figure 21: From Future Taker to Future Maker

CLIMATE-UNAWARE FUTURE TAKERS	CLIMATE-AWARE FUTURE TAKERS	CLIMATE-AWARE FUTURE MAKERS
1. Will ignore the risks and opportunities associated with different climate scenarios to the potential detriment of long-term returns within and across industry sectors and asset classes.	2. Will include consideration of climate risks across their portfolios, taking action across and within asset classes and industry sectors as appropriate to manage them.	3. Will build upon the climate-aware future-taker position and make a concerted effort to influence systemic, market-wide outcomes. This will involve explicitly engaging with policymakers and other key stakeholders (such as industry groups and high-profile companies) in order to seek to reduce additional uncertainty and achieve carbon mitigation in line with a 2°C world.

THE CRITICAL QUESTION FOR FIDUCIARIES IS: WHICH CATEGORY BEST DESCRIBES YOUR APPROACH?

ACKNOWLEDGEMENTS

Mercer would like to thank the following forward-thinking organisations for their support and contributions, without which this important climate change study would not have been possible. They are collectively responsible for more than US$1.5 trillion in assets from pension and sovereign wealth funds, endowments, insurers, private banks, and investment managers.

PUBLIC REPORT PARTNERS

IFC International Finance Corporation
WORLD BANK GROUP

In partnership with

Federal Ministry for Economic Cooperation and Development

IFC, a member of the World Bank Group, is the largest global development institution focused exclusively on the private sector. Working with private enterprises in about 100 countries, we use our capital, expertise, and influence to help eliminate extreme poverty and boost shared prosperity. In FY14, we provided more than $22 billion in financing to improve lives in developing countries and tackle the most urgent challenges of development. For more information, visit www.ifc.org.

UKaid
from the British people

Department of Energy & Climate Change

The Department for International Development (DFID) leads the UK government's work to end extreme poverty. A ministerial Department, its overall aim is to reduce poverty in poorer countries, in particular through achieving the Millennium Development Goals (MDGs). DFID works directly in 28 priority countries across Africa, Asia, and the Middle East, and has regional programmes in Africa, Asia, the Middle East and North Africa, and the Caribbean, as well as development relationships with three Overseas Territories – St Helena, the Pitcairn Islands, and Montserrat. www.dfid.gov.uk.

PARTNERS

Thank you to the many individuals who have represented these partner organisations and actively participated throughout each stage of the study, providing valuable insights and contributions.

- Allianz Climate Solutions GmbH — Germany*
- Baillie Gifford & Company — UK*
- BBC Pension Trust — UK
- British Telecom Pension Scheme (BTPS) UK*
- Church of England National Investing Bodies — UK
- The California State Teachers' Retirement System (CalSTRS) — US
- Construction and Building Industry Super (Cbus) — Australia
- Connecticut Pension Fund — US
- Credit Suisse — US*
- The Environment Agency Pension Fund (EAPF) — UK
- Första AP-fonden (AP1) — Sweden
- Guardians of New Zealand Superannuation Fund (NZ Super) — New Zealand
- The New York State Common Retirement Fund (CRF) — US
- Queensland Investment Corporation (QIC) Limited — Australia
- State Super Financial Services (SSFS) — Australia
- WWF-UK — UK

** Research partners*

MARSH & MCLENNAN COMPANIES

MERCER

NERA
Economic Consulting

The author of this report, Mercer, is a leading global investment consultant, and has been growing a specialist team in sustainable investing since 2004. This report builds on our examination of climate change and strategic asset allocation implications in our seminal 2011 study, and our expertise in strategy setting and long-term investing. Thanks to the numerous people across Mercer who were involved and contributed, particularly:

Core Team

Jane Ambachtsheer
Alex Bernhardt
Helga Birgden
Kate Brett
Vanessa Hodge
Aled Jones
Karen Lockridge
Rodney Marmilic
Jillian Reid
Tom Snape
Christina Teague

Additional Contributors

Brian Birnbaum
David Coleman
Michael Cross
Sarika Goel
Hendrie Koster
Harry Liem
Steven Sowden
Nick Sykes
Thien Tran
Lucy Tusa
Nick White

Leadership Sponsors

Deb Clarke
Global Head of Investment Research, Mercer

Simon O'Regan
President, EuroPac Region, Mercer

The NERA team has drawn on its world-recognised expertise on the economics of energy and environmental policies to develop some of the scenarios and conduct analysis, grounded in the climate change modelling literature, to assess the potential impacts of those scenarios on geographic regions and sectors. Thanks to:

Dr David Harrison Jr
Senior vice president and co-chair of NERA's Global Environment Practice

Dr Noah Kaufman[35]
Senior consultant in NERA's Environment Practice

Conor Coughlin
Research associate in NERA's Environment Practice

GUY CARPENTER

The Guy Carpenter team has applied its in-depth knowledge of a range of climate perils, such as flooding, hurricanes, and droughts to supplement NERA's research with analysis on the physical impacts resulting from climate change over the coming decades. Thanks to:

Alex Bernhardt[36] Lead on physical impact and resource availability risks

Desmond Carroll and Peter Wei
Impact research, modelling, and indexation

[35] Noah joined the Advisory Group for the study when he started a new role at the World Resources Institute in March 2015.
[36] Alex joined Mercer as the US Head of Responsible Investment in March 2015

ADVISORY GROUP

The Advisory Group has provided a sounding board and industry insights into different elements of the study. Advisers are drawn from academia, climate modelling, green finance, traditional finance, and risk. We thank our advisers for their contributions and for sharing their expertise.

Thanks to:

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

Sean Kidney
Climate Bonds Initiative, UK/Global

Bob Litterman
Asset Owners Disclosure Project, Financial Analysts Journal, US

Nick Robins
UN Environment Programme, UK

Mike Wilkins
Standard and Poor's Ratings Services, UK

Dr Paul Wilson
RMS, UK

Helene Winch
Low Carbon, UK

We also thank **Dr Myles Allen** from the University of Oxford for his input.

APPENDIX 1 — CLIMATE MODELS

The impacts of climate change on the global economy include the effects of mitigation activities on the one hand and physical damages on the other. Physical damages may also be partially or wholly averted through adaptation activities.

Quantitative projections of climate change impacts depend upon the use of highly aggregated, large-scale integrated assessment models (IAMs). IAMs are integrated in the sense that they use climate science and economic data together. IAMs are diverse in structure but can be described as stylised representations of the relevant interactions of natural and human systems. These models take a set of input assumptions (for example, population growth, baseline GDP growth, technological change) and produce long-term projections of various outputs (for example, mitigation costs, physical damages).

For the purpose of providing detailed quantitative impact estimates, IAMs are the best tool available. Their known limitations, and the way we have attempted to address some of those limitations, are outlined in this appendix to the report..

Current models, although "integrated", do not tend to consider the crucial linkages and feedbacks between the three impact categories of mitigation, physical damages, and adaptation. Notably, the roles of adaptation and damages in large-scale mitigation models are generally ignored.

The Intergovernmental Panel on Climate Change (IPCC) in its Fifth Assessment Report (AR5) cites this disconnect as a "major gap in the ... literature."[37] Thus, we provide separate estimates from the literature of mitigation costs and of adaptation and physical damages, using prominent IAMs that capture these impacts independently. However, experts may take different views on the necessary adjustments to these models and assumptions, so the outcome of the models — and the conclusions as a result of these adjustments — may be materially different.

Further, IAMs are, by their nature, highly simplified numerical representations of extraordinarily complex systems. As such, they must ignore drivers that are difficult or impossible to quantify (for example, political forces) and most often assume fully functioning markets and competitive behaviour to arrive at cost-minimising outcomes. Moreover, arriving at usable economic damage estimates for climate change requires interpretation between assumptions around potential future human actions and their potential impact on GDP with several layers of interpolation between. Accepting that all of this introduces uncertainty at many stages of the modelling process (see Figure 22), IAMs remain the most concrete foundation we have to provide detailed quantitative impact estimates.

[37] Intergovernmental Panel on Climate Change – Working group III. "Chapter 6" in *Fifth Assessment Report* (AR5).

Figure 22: Degrees of Uncertainty in Integrated Assessment Modelling
IAM Methodology for Calculating Economic Damages

Source: Mercer

MITIGATION COSTS

Models of mitigation costs are diverse but are most easily distinguished by level of detail (full-economy versus partial-economy). Partial-economy models describe one or more sectors of the economy with a "bottom up" level of detail and treat the rest of the economy exogenously. Partial-economy estimates of mitigation costs rely on models that represent the energy sector in detail and calculate within-sector abatement costs.

Full-economy models, on the other hand, represent the macroeconomic feedbacks across all economic sectors (described in significantly less detail) to arrive at an economy-wide, general equilibrium solution. Detailed energy-sector impacts are not provided in such "top down" models. In recent years, efforts have been made to develop "hybrid" models that pair a detailed, bottom-up approach to the energy sector with a general equilibrium representation of the economy. The WITCH model, developed by the climate change group at Fondazione Eni Enrico Mattei (FEEM), is one of the most well-regarded of these hybrid models and is the source of our mitigation cost estimates.

In the WITCH model, economic and environmental pathways are simultaneously selected by 12 regions to maximise each region's future consumption stream. Incentives to mitigate climate change are implemented in the model by a cap on emissions with allowances allocated to each region. These allowances are subsequently traded between regions based on the allowance price and the relative mitigation opportunities. The WITCH model includes technological advancement in the energy sector that is driven by regional investments in research and development.

The WITCH model is as well respected as any of its kind. It has been used extensively in academic publications and "model inter-comparison studies" such as the Stanford Energy Modelling Forum. The mitigation cost estimates cited in IPCC AR5 are based on results from WITCH and similar models.

Of course, as a dynamic model of the global economy and energy system, WITCH also makes numerous simplifying assumptions. Regions have "perfect foresight", meaning that nothing in the model occurs unexpectedly. It is not possible to model less efficient (but more politically feasible) public policies or private-sector-driven mitigation in WITCH.

PHYSICAL DAMAGES AND ADAPTATION COSTS

The three most prominent models used to estimate the physical damages associated with climate change are the FUND, DICE and PAGE models.[38] These models include (relatively simple) climate modules that translate forecast greenhouse gas emissions into temperature changes and other physical effects. The models then rely on highly aggregated "damage functions" to translate projected climate outcomes into monetised physical damage estimates (generally stated as a percentage of GDP). The form of these damage functions varies across models, as does the level of regional and sectorial detail.

FUND and DICE are widely used by economists and policymakers. Along with the PAGE model, they are the focus of IPCC AR5's discussion of "aggregate climate damages."[39] All three models were also used by the United States Government to estimate a "social cost of carbon" for regulatory impact analyses.

There is much literature on the limitations of models that estimate the economic effects of the physical damages from climate change. The uncertainties associated with projections of the global economy and energy system, projections of changes in the climate associated with changes in the economy, and projections of monetary damages due to changes in the climate are all immense. According to IPCC AR5, "the reliability of damage functions in current IAMs is low."[40]

Based upon this consensus of uncertainty around IAM outputs, we have endeavoured to undertake a qualitative analysis of all major FUND results to determine their accuracy and degree of relevance to the sectors, regions, and asset classes considered in this study. We have also endeavoured to supplement FUND results where gaps have been identified and could be readily filled using current research and available data. More on our methodology for grounding and supplementing FUND is included in the following sections.

FUND

FUND was developed by the economists David Anthoff and Richard Tol, who helped to write the chapter on economics for IPCC AR5.[41] FUND is comprised of bottom-up damage functions for 16 regions and 15 impact categories – a major advantage over the DICE and PAGE models, which include top-down global damage functions with almost no sectorial detail. Additionally, damages in FUND depend on both the level and rate of climate change, and the damage functions explicitly consider adaptation in various sectors. The DICE model, developed by William Nordhaus, includes adaptation only implicitly via the underlying climate change studies to which its damage function is calibrated. The major advantage of DICE is that damages from climate change reduce investment, leading to worse economic outcomes in the future. Economic growth in the FUND and PAGE models is exogenous.

[38] The Climate Framework for Uncertainty, Negotiation and Distribution (FUND); Dynamic Integrated Climate-Economy (DICE); Policy Analysis of the GReenhouse Effect (PAGE)

[39] IPCC – Working Group III, "Chapter 3"

[40] Ibid.

[41] IPCC – Working Group III, "Chapter 10".

Figure 23: FUND Model Regions and Damage Estimates

FUND regions

- USA United States of America
- CAN Canada
- WEU Western Europe
- JPK Japan and South Korea
- ANZ Australia and New Zealand
- CEE Central and Eastern Europe
- FSU Former Soviet Union
- MDE Middle East
- CAM Central America
- SAM South America
- SAS South Asia
- SEA South East Asia
- CHI China
- NAF North Africa
- SSA Sub Saharan Africa
- SIS Small Island States

FUND damage estimates

Agriculture	
Forestry	
Water resources	
Energy (heating/cooling)	Heating expenditures Cooling expenditures
Sea level rise (SLR)	Dryland loss Wetland loss Coastal protection Immigration cost
Biodiversity	
Extreme weather	Tropical storms Extratropical storms
Human health	Vector-borne diseases Cardiovascular and respiratory mortality Diarrhoea

FUND RESULTS

The Fragmentation–Higher Damages Scenario shows results scaled up to align with the damage function in DICE (for more on this fourth scenario, see "Validating and Supplementing"). The overall net damage estimate coming out of FUND before any Mercer supplementation for the three unmodified scenarios ranges from -0.45% (Fragmentation/Transformation) to -0.42% (Coordination) of global GDP, meaning the net impact of climate change over this time horizon is shown as economically positive. This result is overwhelmingly driven by the Agriculture damage function. The net result for the fourth scenario with scaled-up damages is 0.89% of global GDP.

Separately, we have attempted to fill gaps in the FUND damage estimates by developing new functions that address damage and peril types otherwise neglected by the model. Where warranted, we have also reviewed key FUND damage functions that contribute significantly to overall damage estimates during the study period for reasonability and directional accuracy based upon current research and expert judgment. In some cases, this review has resulted in judgmental adjustments to FUND model outputs, which serve as an input into the final investment modelling.

VALIDATING AND SUPPLEMENTING THE MODELS

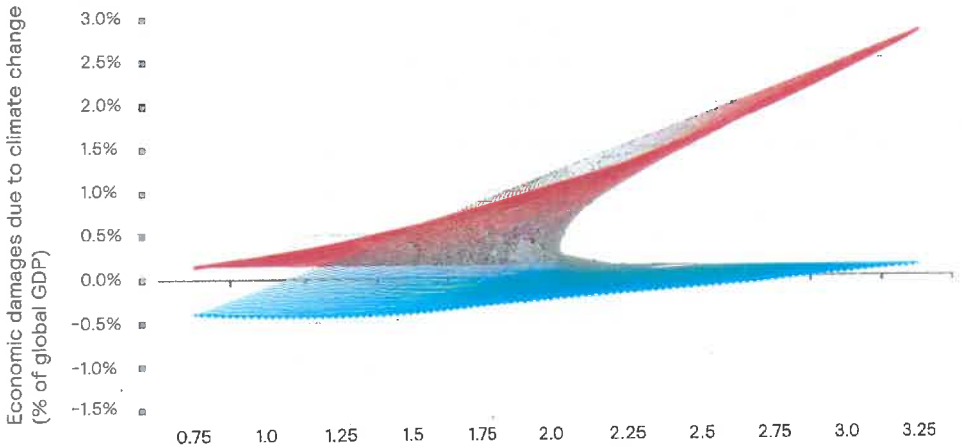
IAMs are often used by policymakers to assess the "social cost of carbon" (SCC). Paraphrasing the United States Environmental Protection Agency,[42] the SCC is meant to be a comprehensive estimate of climate change damages and includes, but is not limited to, changes in net agricultural productivity, human health, and property damages from changes to weather risk. However, given current modelling and data limitations, none of the IAMs include an assessment of all important damages or perils.

FUND is unique among IAMs in the sectorial and regional detail it provides, making it uniquely suitable for this study for which such detail is important to determining the differing effects of climate change on diverse investment asset classes. However, as is the inevitable consequence of developing a bottom-up model, various impact categories remain unquantified or underrepresented in FUND. Moreover, some of the research underlying FUND impact estimates naturally lags behind current research.

These issues are not excessively problematic for the purposes of this study so long as the results of FUND's macroeconomic damage estimates are at least directionally in line (or at least not markedly out of line) with most current thinking with respect to likely damages from climate change. However, overall FUND damage estimates are notably lower than damage estimates produced by other similar models (that is, PAGE and DICE) over the time horizon considered in this report. Possible causes of the relatively low damage estimates include "missing" damage categories due to bottom-up damage functions and optimistic assumptions with respect to agricultural adaptation and production. Although neither of the IAMs is "right", this discordance calls into question the directional validity of FUND results, necessitating some supplementation and authentication.

To adjust for these relatively low damage estimates (and the uncertainty surrounding the output of damage functions), we have taken a two-pronged approach to supplementation.

Figure 24: FUND vs DICE Damage Function Comparison



DICE model:

- Global damage functions for a single economic sector.
- Total damages are calibrated to IPCC global damage estimates at 3-4 degrees warming.

FUND model:

- Only damage function with sufficient sectoral/ regional detail.
- Total damages low due to agricultural gains and reduced heating costs.

[42] United State Environmental Protection Agency. "The Social Cost of Carbon," available at http://www.epa.gov/climatechange/EPAactivites/economics/scc.html, accessed 26 March 2015.

"We developed an objective indexation methodology that allowed us to assign country-level damage values to areas outside of the US using GDP and various relative measures of exposure."

First, we have included one scenario in which FUND damages are "scaled up" to match the estimates from the DICE global damage function. Although this on-levelling was conducted linearly with no differentiation between damage estimates, it nonetheless allows us to maintain the benefit of FUND's granularity while observing what damages might otherwise look like in a more pessimistic scenario.[43]

Second, to assure a reasonably complete assessment of the estimates supplied or neglected by FUND, we created a two-tiered taxonomy in which the potential physical impacts of climate change are categorised both by damage type and climate peril/ resource category. Using this taxonomy, we were able to determine which damage types and climate perils/resources are underrepresented by FUND and fill gaps where possible.

In short, FUND's treatment of damages from the physical impacts of climate change resulting from extreme weather is very light and the only physical impact estimate in FUND that accounts explicitly for property damage is Extratropical Storms (loss of life is also considered). This does not paint a full picture of catastrophic climate

[43] We acknowledge recent critiques of the relatively low severity of the DICE damage function in extremis and the alternatives espoused by Diets and Stern (2014) and Weitzman (2012), and as comparatively analyzed by Covington and Thamotheram (2015). However, for the purposes of this study, the differences between the DICE damage function and the more recent alternatives out to 2050 were not significant enough to warrant a switch away from the more established DICE curve.

perils[44] or their potential influence on the built environment. Flood (both inland and coastal) and Wildfire in particular would also need to be considered to allow for a more comprehensive treatment. Additionally, although both Extratropical Storms and SLR are considered, the consequences of their interaction are not. Finally, the impacts of potentially more frequent and severe Drought is not considered in the Agriculture estimate and several other, albeit auxiliary climate perils in terms of aggregate economic impact (for example, Tornado/Hail) are ignored altogether.

Judging from our direct experience with catastrophe risk modelling, knowledge of current climate change research, and our own analysis of climate change[45] to address the above mentioned gaps in physical impact estimates, we identified out of those perils not otherwise quantified by FUND the two acute climate-driven risks that we believed would have the largest potential impact on the economy over the term of interest for this study (the next 35 years) — namely Coastal Flood and Wildfire. We then identified two leading recent pieces of research estimating the influence of climate change on these two perils in the US and producing economic estimates of damage. For Coastal Flood, we used the detailed technical results developed by RMS for the Risky Business Project US national economic climate change risk assessment,[46] and for Wildfire we used the research summary and analysis produced by the Cost of Carbon Project in its report, *Flammable Planet*.[47]

Using these best-in-class resources and their robust economic loss estimates for the US, we then developed an objective indexation methodology that allowed us to assign country-level damage values to areas outside of the US using GDP and various relative measures of exposure.[48] This resulted in global economic damage estimates at 2030 and 2050 for the two perils otherwise unquantified by FUND. Appendix 2 includes an overall summary of damage estimates at 2050, including the supplemental damage estimates produced exclusively for this report. Charts are provided showing detail by peril and the aggregate influence of Resource Availability versus Physical Impact damages (gains) for each scenario. In sum, the range of total net damage estimates at 2050 for the three main scenarios is -0.09% (Fragmentation) to -0.20% (Transformation) of global GDP. The equivalent number for the scaled-up Fragmentation scenario is 1.53% of global GDP or US$2.6 trillion.

On the side of FUND validation, we conducted a thorough review of the FUND technical documentation[49] to assess the appropriateness of each FUND damage estimate in the context of this report. Given that Agricultural damages (gains) represent ~70% of the absolute value of total damage estimates produced by FUND at 2050, most of our focus for the three main climate scenarios, in terms of validation, has been on this particular estimate. The result of our validation process was to modify the agricultural impacts in our investment model so that the effects of greater warming on agriculture reflect economic damages rather than gains.

[44] The term "climate perils" is used herein to refer to any hazard that is influenced by climate conditions and could potentially cause economic damage. This term is differentiable from the term "climatological perils" used later on to categorise those physical impacts that are influenced predominantly by temperature or precipitation shortfalls or excesses. See table in Appendix 2 section for detail.

[45] Guy Carpenter. "Global Warming: The Evolving Risk Landscape," 2013, available at http://gcportal.guycarp.com/portal/extranet/popup/insights/reportsPDF/2013/2013%20September%20Climate%20Change%20Report?vid=1, accessed 26 March 2015.

[46] Rhodium Group. "American Climate Prospectus: Economic Risks in the United States," 2014, available at www.climateprospectus.org, accessed 26 March 2015.

Rhodium Group. "Technical appendix: Detailed Sectoral Models," 2014, available at http://rhg.com/wp-content/uploads/2014/10/Appendix-III-Sectoral-models.pdf, accessed 26 March 2015 (additional detail provided by RMS direct to Guy Carpenter for the purposes of this report).

[47] Cost of Carbon Project. "Flammable Planet: Wildfires and the Social Cost of Carbon," available at http://costofcarbon.org/files/Flammable_Planet__Wildfires_and_Social_Cost_of_Carbon.pdf, accessed 26 March 2015.

[48] Country-level indicators sampled from the ND-GAIN Index (http://index gain.org/), including 1) projected change of sea level rise impact; 2) coastal vulnerable population; and 3) projected change of heatwave hazard.

[49] Anthoff D, Tol RSJ. "FUND – Climate Framework for Uncertainty, Negotiation and Distribution: Technical Description (Version 3.9)," 2014, available at www.fund-model.org/versions, accessed 26 March 2015.

APPENDIX 2 — SCENARIO DETAIL

SCENARIO 1 — TRANSFORMATION

A TRANSFORMED WORLD

The year is 2050. Investors and governments have worked collaboratively and with success to mitigate the long-term effects of climate change. Action has been decisive, with strong private-sector demand for clean energy, backed by public and private investment in supply. Emissions peaked at 2020, reducing to two-thirds of 2012 levels. Energy generation via fossil fuels in 2050 has reduced 40% from 2012 levels. There has been a 90% decrease in the emissions intensity of electricity, transforming energy supply and usage.

However, such transformation has not come about without a high degree of disruption and significant financial cost associated with mitigation activities, brought on by earlier and higher carbon pricing. Many investors who assumed the future would mirror the past have missed out on key opportunities and some have been left holding on to devalued or even valueless "stranded" assets. Annual incremental energy efficiency investments in transport, industry, and buildings rose by approximately US$336 billion.

Yet appreciation of the so-called "social cost of carbon" trumped concerns about the financial cost of mitigation, in part due to engagement by investors with regulators. Climate policy and related government support provided the critical impetus to advance investment in low-carbon power sources. Had there been no long-term clean energy policy goals and policies kept changing, clean energy investment would have been hindered.

This transformed world has come at a lower financial cost than expected by investors, who were able to benefit from investment opportunities in growing sectors, emerging markets, and infrastructure to offset losses in declining sectors.

TRANSFORMATION DESCRIPTION	MODELS/REFERENCES
• Strong climate action. • Emissions peaked by 2020 then reduced by 56% by 2050 versus 2010 levels. • Fossil fuels represent less than half of the energy mix at 2050. • Estimated annual emissions of 22 Gt CO_2e at 2050	• IEA 2°C Scenario.[50] • IEA World Energy Outlook[51] and World Energy Investment Outlook[52] 2014 projections extended from 2040 and 2035, respectively. • FUND damages. • Guy Carpenter physical damage supplements.

[50] International Energy Agency. "Scenarios and Projections," 2014, available at http://www.iea.org/publications/scenariosandprojections/, accessed 2 April 2015.

[51] International Energy Agency. "World Energy Outlook," 2014, available at http://www.worldenergyoutlook.org/publications/weo-2014/, accessed 2 April 2015.

[52] International Energy Agency. "World Energy Investment Outlook," 2014, available at http://www.iea.org/publications/freepublications/publication/WEIO2014.pdf, accessed 2 April 2015.

SCENARIO 2 — COORDINATION

A WORLD OF ACTION

It's 2050, but we've fallen short of the Transformation scenario. Still, the world is less volatile than it might otherwise have been (see next two Fragmentation scenarios).

There has been some climate action, with investors and governments working collaboratively rather than going their own way. A range of positive and successful climate policy actions have been introduced. This has included pricing carbon to reflect its ultimate cost — though considerably less than for Transformation. Copenhagen and subsequent policy pledges were all fulfilled by 2030. This provided a strong financial imperative, motivating industry research and development of alternatives. Private-sector demand for clean energy is strong in 2050, backed by public and private investment in supply. Energy generation via fossil fuels has been reduced 25% on 2010 levels. There has been a 30% reduction in greenhouse gases since 2030.

As predicted in the World Economic Forum Global Risks Report 2015, water availability has become a major risk for societies and investors in 2050. In the worst affected regions — the Former Soviet Union (FSU), Middle East (ME), and Central Eastern Europe (CEE) — water availability is creating geopolitical tensions on the back of related food security and agriculture issues, further compounding the global risks. There is a net benefit for forestry in most regions, except for Australia, New Zealand and the FSU.

COORDINATION DESCRIPTION	MODELS/REFERENCES
• Some climate action. • Emissions peak after 2030 then reduces by 27% versus 2010 levels. • Estimated annual emissions of 37 Gt CO_2e at 2050.	• NERA Coordination pathway. • FUND damages. • Guy Carpenter physical damage supplements.

SCENARIOS 3 AND 4 – FRAGMENTATION (LOWER AND HIGHER DAMAGES)

The year is 2050 and the ability of companies to do business is significantly disrupted in a challenging physical environment due to limited climate action. With hindsight, it is clear to see the fault lies in the inability of major economies to coordinate and work together, and the unwillingness of fossil-fuel-rich countries to join in mitigation efforts.

Carbon remained cheap for far too long. High reliance on fossil fuels as a primary energy source persists, with energy generation via fossil fuels in 2050 just 14% lower than 2010 levels. There has been a 33% increase in greenhouse gases versus 2010 levels. Though Copenhagen and subsequent policy pledges were all fulfilled by 2030, limited action took place thereafter. Each major economy implemented policy in different timeframes, and on an ad-hoc basis.

The old turn-of-the-century target of limiting global warmth to just 2°C by 2100[53] is a long-lost hope. The world is almost 2°C warmer than in 2010 already. Businesses make efforts to realign, but at significant cost, much to the consternation of shareholders and pension/super-fund members, whose dreams of a comfortable retirement are challenged by a less-hospitable environment.

A FRAGMENTED WORLD LOWER DAMAGES

There is more frequent and intense flooding, coastal storm surges, and wildfires, not to mention the increasing severity of cyclones/hurricanes and tsunamis. A higher sea level, "the single greatest threat posed by global warming," as noted in a 2013 Guy Carpenter report[54] on global risk, has become a real challenge to overcome, not just another potential risk to mitigate.

A HOT, HOT WORLD HIGHER DAMAGES

Emissions peaked after 2040 and any emission reduction in developed markets has been offset at a global level by the increase of emissions in emerging markets. Estimated damages as a percentage of GDP are the highest of any of the scenarios (0.80% economic loss at 2050 from resources such as water) and physical damages from wildfire, coastal flooding and extreme temperatures as a result of changes in long-term weather patterns and flooding due to sea level rise.

FRAGMENTATION DESCRIPTION

- Limited climate action.
- Emissions grew by 33% at 2050 versus 2010 levels.
- Fossil fuels represent 85% of the energy mix at 2050.
- Estimated annual emissions of 67 Gt CO_2e at 2050.

MODELS/REFERENCES

Lower Damages:

- NERA Coordination pathway.
- Lower damages (FUND).
- Guy Carpenter physical damage supplements.

Higher Damages:

- NERA Fragmentation pathway.
- Higher damages (FUND with DICE damage level).
- Guy Carpenter physical damage supplements.

[53] Victor DG, Kennel, CF. "Climate policy: Ditch the 2°C warming goal," *Nature: International Weekly Journal of Science*, 1 October 2014, available at http://www.nature.com/news/climate-policy-ditch-the-2-c-warming-goal-1.16018, accessed 2 April 2015.

[54] Global Warming: The Evolving Risk Landscape. Guy Carpenter Climate Change Report. September 2013. p.5 and associated press release.

FUTURE PATHWAYS OF THE CLIMATE RISK FACTORS

What are the future pathways for the climate change risk factors: Technology (T), Resource Availability (R), Impact of physical damages (I) and Policy (P) under each of the four climate change scenarios? This question is at the heart of what we call "scripting", which is a process to quantify the pathways in the investment model to isolate how the TRIP factors should generate their relative impact through time.

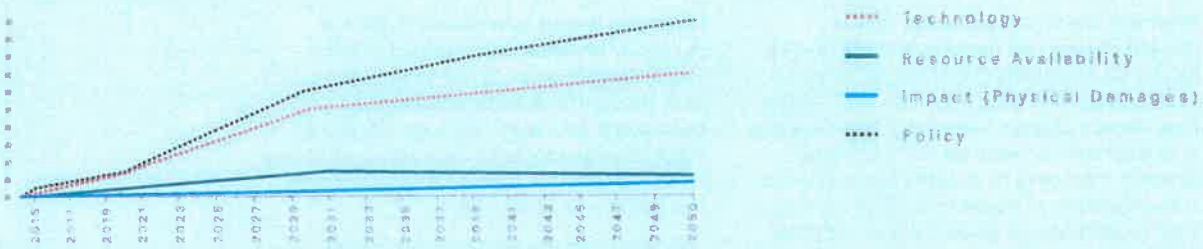
The pathways are based on the following elements:

- 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 consequence 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 timeframe of CO_2 emissions peaking, potential changes to the energy mix out to 2050, and modelled mitigation cost estimates.

Given the limited quantitative evidence currently available, information from the most relevant sources has been aggregated, with thoughtful adjustments where necessary. Educated, although ultimately subjective assumptions have also been made to fill holes in the available data or climate modelling when required.

The charts on the following two pages indicate the pathways for the climate change risk factors under each of the climate change scenarios. The pathways are a translation of the scenarios developed (using the climate change Integrated Assessment Models (IAMs) and literature review) into Mercer's investment modelling process. They show the relative magnitude of the climate change risk factors to each other under the four different scenarios over time. For example, if Policy is expected to cause economic cost of US$5 at year-35 of the model, and Resource Availability is expected to cause economic damage of US$1 at year-35 of the model, the ratio of their respective application in that year should be 5:1.

Figure 25: Transformation Scenario — Pathways of the Climate Change Risk Factors to 2050

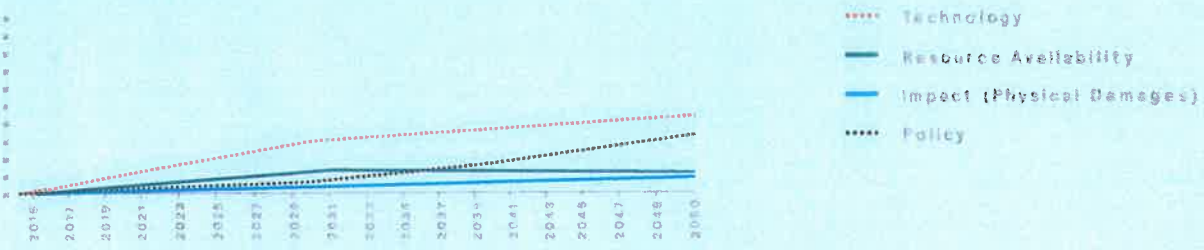


Source: Mercer

We can see that the dominant climate change risk factor impact is Policy under the Transformation scenario. Investment flows into the low-carbon economy — as indicated through the Technology risk factor -- are also sizable. Policy is clearly connected to the role of Technology The two factors are fairly well linked with technology investment flows and are expected to correlate to a large degree with the extent of policy interventions, but there may be a decoupling in the future where successful new technology is less reliant on policy settings.

Resource Availability and Impact (physical damages) have some influence, but the impact is limited for the timeframe of the study. Physical damages are expected to be greater beyond 2050.

Figure 26: Coordination Scenario — Pathways of the Climate Change Risk Factors to 2050

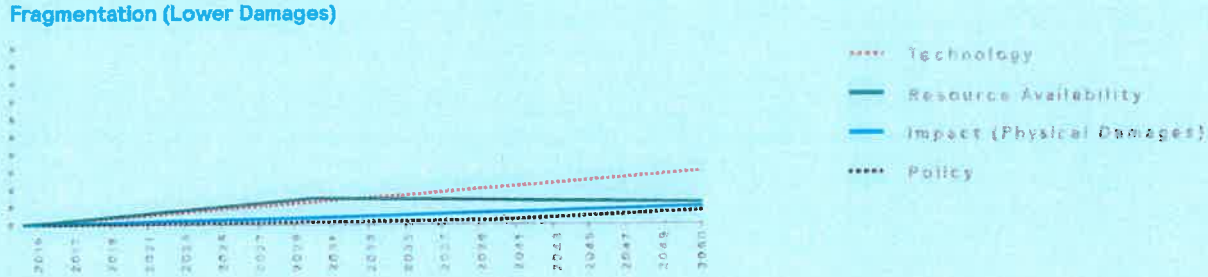


Source: Mercer

Policy action is limited under the Coordination scenario. Despite the lack of policy intervention, technology innovation attracts investment flows. As such, the Technology risk factor is the most significant climate risk factor under the Coordination scenario. Policy interventions begin to increase towards the end of the projection period.

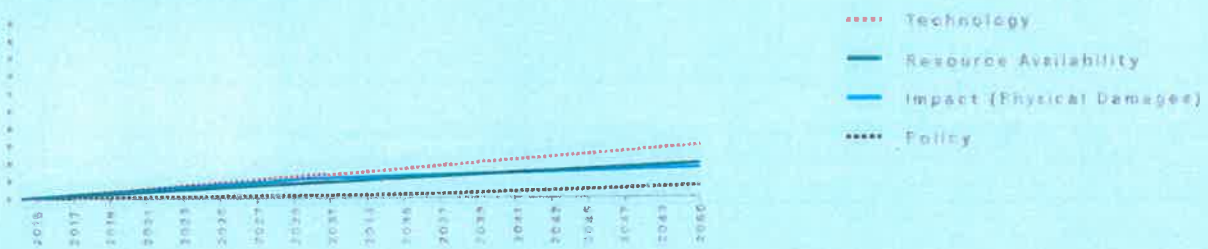
Similar to Transformation, Policy and Technology are dominant relative to Resource Availability and Impact (physical damages).

Figure 27: Fragmentation (Lower Damages)— Pathways of the Climate Change Risk Factors to 2050



Source: Mercer

Figure 28: Fragmentation (Higher Damages)— Pathways of the Climate Change Risk Factors to 2050



Source: Mercer

Note that the Technology and Policy pathways are the same for the Fragmentation (Lower Damages) and Fragmentation (Higher Damages) scenarios as both of these scenarios follow the same GHG emissions pathways. The difference between these two scenarios relates to the scaled-up level of damages under Fragmentation (Higher Damages), which is represented by changes in the two climate change risk factors associated with the physical impacts of climate change:

- Resource Availability (the impact on resources, such as water, as a result of changes in long-term weather patterns), and
- Impact of physical damages (the impact of catastrophes such as flooding caused by sea level rises).

The Resource Availability pathway rises more slowly for Fragmentation (Higher Damages) than the other three scenarios between 2015 and 2030 (recognising that agricultural gains in some regions will offset losses during this period), but then rises steeply after 2030 in recognition of growing resource challenges under this emissions trajectory and using a more severe damage function (DICE). In the Transformation, Coordination and Fragmentation (Lower Damages) scenarios the Resource Availability pathway rises to 2030, but then plateaus and declines as potential economic resource gains from climate change begin to fall. It would be expected to rise again over time as expected economic gains switch to losses.

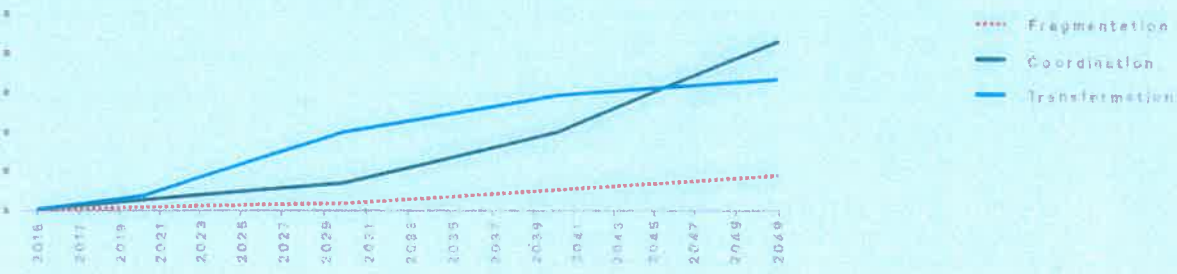
DETERMINING THE 'P' AND 'T' FACTORS

Policy (P) is clearly connected to the role of Technology (T). The two factors are fairly well linked with technology investment flows expected to correlate to a large degree with the extent of policy interventions, but there may be a decoupling in future when successful new technology is less reliant on policy settings. The Technology factor is material under all four climate change scenarios. However, the development pathway for Technology remains highly uncertain and this factor remains one of the most difficult to quantify given its complex interaction with mitigation and adaptation activities, and uncertainty surrounding research and development successes or failures.[6]

Estimates of the "least cost of carbon" offer a relative indicator of the strength of the climate polices aimed at reducing GHG emissions. In practice, a comprehensive climate policy strategy may include many targets, mandates, regulations, measures, and so on. The specific measures may also vary by region, depending on their ambition, carbon intensity, and local circumstances. Thus, actual policies and measures used may not represent the least costly approach, as assumed with a carbon price. In this study, we have not assessed, nor assumed, the cost-effectiveness of measures employed. We have only sought to reflect the strength of the market drivers mobilising economic shifts within each scenario.

PRICE OF CARBON ($US2013/T CO_2)	2020	2030	2040	2050
Transformation	40	90	130	155
Coordination	15	36	105	210
Fragmentation	4	10	21	41

Figure 29: Carbon Pricing Pathways by Scenario



Source: Witch Model Output (Coordination, Fragmentation), IEA 450ppm Scenario (Transformation), Mercer Adjustments/Analysis

FUTURE PATHWAYS AT 2100

The following pages outline the global and regional changes that could be expected in 2100 with the different temperature changes in the climate scenarios we explored.

Table 6: Key Physical Impacts of Different Climate Pathways at 2100[55]

	Impacts by 2100	Physical systems	Human systems	Biological systems
TRANSFORMATION	**2°C** global mean surface temperature change (relative to 1850–1900).	• Sea levels rise by around 40 cm. • 20% less water availability. • 40% increase in the strongest North Atlantic cyclones	• Heat waves similar to recent years, causing heat-related deaths, forest fires, and harvest loss. • Aggregate negative impacts on food production and price stability. Individual locations will benefit from increased yields at this temperature.	• Low to medium risk of decline in fish stocks.
COORDINATION	**3°C** global mean surface temperature change (relative to 1850–1900).	• Sea levels rise by around 50 cm. • 30% less water availability.	• Increased chance of famine. • Potential for increased agriculture yields eroded.	• Permanent loss of arctic sea ice.
FRAGMENTATION (LOWER/HIGHER DAMAGES)	**4°C** global mean surface temperature change (relative to 1850–1900).	• Sea levels rise by around 70 cm. • Coastal inundation. • 50% less water availability. • 80% increase in the strongest North Atlantic cyclones.	• High temperatures and humidity compromise normal human activities (e.g. growing food or working outdoors). • Risk to marine fisheries poses risk of reduced food supply and employment.	• Very high risk of damage from wildfires. • Medium to high risk of a decline in fish stocks. • Ocean acidification risk to marine ecosystems.

[55] Victor DG, Kennel, CF. "Climate policy: Ditch the 2°C warming goal," *Nature: International Weekly Journal of Science*, 1 October 2014, available at http://www.nature.com/news/climate-policy-ditch-the-2-c-warming-goal-1.16018 accessed 2 April 2015.

TRANSFORMATION: WHAT DOES A 2°C WORLD LOOK LIKE?

Europe faces increased economic losses by flooding in river basins and coasts, driven by growing urbanisation and coastal erosion. Adding to the strain is the potential for more water restrictions, significant reduction in water from groundwater sources and increased water demand. Rising temperatures, particularly in Southern Europe, have a negative impact on economies and people are affected by extreme-heat events, impacting health and labour productivity, crop production, and air quality. However, high adaptation can prevent most of the predicted damages in this scenario, particularly by introducing flood protection and water- efficiency technologies. Some impacts may be positive, such as reduced cold-wave risk in winter.

Over the long-term, North America faces high risk at 2°C of wildfire-induced loss of ecosystem integrity, property loss, and human morbidity and mortality as a result of increased evaporation and temperature trends. This is even with high-adaptation policies in place. This adaptation is to some extent constrained by rapid private property development in high-risk areas. The general population may experience an impact on public health and water quality due to sea-level rises, extreme precipitation, and cyclones.

South America faces issues with water availability in regions dependent on glacier melt. In Central America, there are concerns of flooding and landslides due to extreme rainfall. Without high levels of adaptation, the broader region will suffer from decreased food production and quality.

Asia's long-term risks include increased river, coastal, and urban flooding, leading to widespread damage to infrastructure, livelihoods, and settlement. Large-scale adaptation of vulnerable infrastructures — for example, water, energy, and waste management — would be required, and would drastically reduce the risks posed. The human impact of extreme heat events stands to be high even with concerted adaptation with increased heat-related mortality and drought-related water and food shortages causing malnutrition.

COORDINATION: WHAT DOES A 3°C WORLD LOOK LIKE?

Many impacts may be irreversible by 3°C. The impacts described above in Europe, the Americas, and Asia stand to be more pronounced than with 2°C warming. Some high-risk impacts, for example, increase the risk of drought and higher temperatures in North America bringing even greater harm, and significant adaptation efforts would have little effect. South America's food production faces huge risks with current levels of adaptation, although following a path of high adaptation could bring these risks down significantly. Asia's mortality risk from rising temperatures is predicted to remain very high even with significant levels of adaptation.

FRAGMENTATION: WHAT DOES A 4°C WORLD LOOK LIKE?

Extreme heat waves, that without global warming would be expected to occur once in every several hundred years, will be experienced much more frequently. The effects would not be evenly distributed. The largest warming would be expected to occur over land, and range from 4°C to 10°C. Increases of 6°C or more in average monthly summer temperatures would be expected in the Mediterranean, North Africa, the Middle East, and parts of the US.

Sea-level rise of 0.5–1 metre by 2100 is likely, with higher levels also possible. Some of the most highly vulnerable cities are located in Mexico, Venezuela, India, Bangladesh, Indonesia, the Philippines, Vietnam, and Mozambique.

The most vulnerable regions are in the tropics, sub-tropics, and towards the poles, where multiple impacts are likely to come together. Agriculture, water resources, human health, biodiversity, and ecosystem services are likely to be severely impacted. This could lead to large-scale displacement of populations and consequences for human security and economic and trade systems.

SELECT BIBLIOGRAPHY

MODELS

Ackerman F, Munitz C. "Climate damages in the FUND model: a disaggregated analysis," *Ecological Economics*, volume 77 (2012), pp. 219–224.

Anthoff D, Tol RSJ. "FUND – Climate Framework for Uncertainty, Negotiation and Distribution (Technical Description and Scientific Tables)," Version 3.9, 2014, available at http://www.fund-model.org/versions, accessed 20 March 2015.

Bosetti V, Massetti E, Tavoni M. "The WITCH Model. Structure, Baseline, Solutions," FEEM Working Paper 10, 2007, available at http://www.feem.it/userfiles/attach/Publication/ NDL2007/NDL2007-010.pdf, accessed 20 March 2015.

Bosetti V, Tavoni M, De Cian E, Sgobbi A. "The 2008 WITCH Model: New Model Features and Baseline," FEEM Working Paper 85, 2009, available at http://www.feem.it/userfiles/attach/200911191058448 5-09.pdf, accessed 20 March 2015.

Covington H, Thamotheram R. *The Case for Forceful Stewardship Part 1: The Financial Risk from Global Warming*, Working Paper 19, 2015.

De Cian E, Ferranna L. "Including adaptive capacity in the WITCH model," CMCC Research Paper RP0162, 2012, available at http://www.cmcc.it/wp-content/uploads/2013/05/rp0162- cip-11-2012.pdf, accessed 20 March 2015.

Dietz S, Stern N. *Endogenous growth, convexity of damages and climate risk: how Nordhaus' framework supports deep cuts in carbon emissions*, Centre for Climate Change Economics and Policy, Working Paper No. 180, 2014.

Nordhaus W, Sztorc P. "DICE 2013R: Introduction and User's Manual," 2013, available at http://www. econ.yale.edu/~nordhaus/homepage/documents/DICE_Manual_100413r1.pdf, accessed 20 March 2015.

Weitzman M. "GHG Targets as Insurance against Catastrophic Climate Damages." *Journal of Public Economic Theory*, 14:2 (2012), pp. 221– 244.

MIE STUDIES

"AMPERE Work Package 2 (WP2) model comparison study protocol," available at https://secure.iiasa.ac.at/web-apps/ene/AMPEREDB/static/download/WP2_study_protocol.pdf, accessed 20 March 2015.

Blanford G, Merrick J, Richels R, Rose S. "Trade-offs between mitigation costs and temperature change," *Climatic Change*, Volume 123 Issue 3– 4 (2014), pp 527– 541.

Eom J. et al. "The impact of near-term climate policy choices on technology and emission transition pathways," *Technological Forecasting and Social Change*, Volume 90 Part A (2013), pp. 73– 88.

Kriegler E, Tavoni M. "Harmonization vs. fragmentation: overview of climate policy scenarios in EMF27," *Climatic Change*, Volume 123 Issue 3– 4 (2014), pp. 383– 396.

Kriegler E, Tavoni M. "Harmonization vs. fragmentation: overview of climate policy scenarios in EMF27 (Supplementary material)," *Climatic Change*, Volume 123 Issue 3– 4 (2014), pp. 383– 396.

Kriegler E. et al. "The role of technology for achieving climate policy objectives: overview of the EMF27 study on global technology and climate policy strategies," *Climatic Change*, Volume 123 Issue 3– 4 (2014), pp. 353– 367.

Kriegler E. et al. "The role of technology for achieving climate policy objectives: overview of the EMF27 study on global technology and climate policy strategies (Supplementary material)," *Climatic Change*, Volume 123 Issue 3– 4 (2014), pp. 353– 367.

Kriegler E. et al. "Introduction to the AMPERE model intercomparison studies on the economics of climate stabilization," Technological Forecasting and Social Change, Volume 90 Part A (2015), pp. 1– 7.

Riahi K. et al. "Locked into Copenhagen pledges – Implications of short-term emissions targets for the cost and feasibility of long-term climate goals," *Technological Forecasting and Social Change*, Volume 90 Part A (2013), pp. 8– 23.

Riahi K. et al. "Locked into Copenhagen pledges – Implications of short-term emissions targets for the cost and feasibility of long-term climate goals (Appendix A: Supplementary data)," *Technological Forecasting and Social Change,* Volume 90 Part A (2013), pp. 8– 23.

Weyant J, Kriegler E. "Preface and introduction to EMF27," *Climatic Change*, Volume 123 Issue 3– 4 (2014), pp. 345– 352.

AGRICULTURAL DAMAGES

Ciscar JC. et al. "Climate Impacts in Europe: The JRC PESETA II Project," European Commission, 2014, available at http://ftp.jrc.es/EURdoc/JRC87011.pdf, accessed 20 March 2015.

Nelson GC. et al. "Climate change effects on agriculture: Economic responses to biophysical shocks," Proceedings of the National Academy of Sciences of the United States of America (PNAS), available at http://www.pnas.org/content/111/9/3274.full, accessed 18 May 2015.

Trevor H. et al. "American Climate Prospectus: Economic Risks in the United States," Rhodium Group, 2014, available at http://rhg.com/wp-content/uploads/2014/10/AmericanClimateProspectus_v1.2.pdf, accessed 20 March 2015.

ADAPTATION

The World Bank. "Economics of Adaptation to Climate Change: Synthesis Report," 2010, available at https://openknowledge.worldbank.org/bitstream/handle/10986/12750/702670ESW0P10800EACCSynthesisReport.pdf?sequence=1, accessed 20 March 2015.

GENERAL

Intergovernmental Panel on Climate Change (IPCC). "Fifth Assessment Report (AR5)," Cambridge University Press, 2014, available at http://www.ipcc.ch/report/ar5/, accessed 20 March 2

IMPORTANT NOTICES

This report, **Investing in a Time of Climate Change**, would not have been possible without the support of the Partners (listed in the Acknowledgements), International Finance Corporation, the World Bank Group, in partnership with Federal Ministry for Economic Cooperation and Development, Germany, and the UK Department for International Development and the UK Department of Energy and Climate Change.

The findings, interpretations, views, and conclusions expressed herein are those of the authors and do not necessarily reflect the views of the Executive Directors of the International Finance Corporation or of the International Bank for Reconstruction and Development (the World Bank) or the governments they represent, the UK Department for International Development, or the UK Government's official policies, or those of the Partners and other stakeholders.

The copyright in this report is owned jointly by Mercer, International Finance Corporation and the UK Department for International Development. Copyright in some content used in this report, including products, materials, and methodologies, may be owned by the Partners. Mercer, International Finance Corporation and the UK Department of International Development, each agree that they shall and hereby do irrevocably waive any right of accounting or similar right. Any pre-existing Mercer products, materials, and methodologies included in this report shall remain the sole property of Mercer. Any pre-existing products, materials, and methodologies of any of the Partners included in this report shall remain the sole property of the Partners.

Mercer owns the copyright in all original research and representations of data that it creates in connection with the report that is not required to produce the report.

This report is not for sale. This report may not be modified or otherwise provided, in whole or in part, to any other person or entity, without Mercer's written permission. This report may be shared without prior permission provided that it is shared in whole and without amendments and clear attribution is given to the copyright holders.

Information contained in this report has been obtained from a range of third-party sources. While the information is believed to be reliable, no representations or warranties are given as to the accuracy of the information presented and no responsibility or liability (including for indirect, consequential, or incidental damages) is accepted for any error, omission, or inaccuracy contained within this report.

The findings and opinions are not intended to convey any guarantees as to the future performance of any investment products, asset classes, or capital markets covered by this report. Past performance does not guarantee future results.

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

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

MERCER

For more information about this report and related content, please visit: www.mercer.com/ri/climate-change-study

Alternatively, you can connect directly with your region's Mercer RI expert:

GLOBAL

Jane Ambachtsheer
Paris
Jane.Ambachtsheer@mercer.com
+33 603 10 21 62

ASIA PACIFIC

Helga Birgden
Melbourne
Helga.Birgden@mercer.com
+61 3 9623 5524

CANADA

Ryan Pollice
Toronto
Ryan.Pollice@mercer.com
+1 416 868 8857

EUROPE

Aled Jones
London
Aled.Jones@mercer.com
+44 20 7178 3594

USA

Alex Bernhardt
Seattle
Alex.Bernhardt@mercer.com
+1 416 868 8857

14088-IC

MARSH & McLENNAN COMPANIES

ATTACHMENT 2

Monaco (2017, July 13)
"Legal Permissibility of Environmental, Social and Governance Investment Proposals"
Mondress Monaco Parr Lockwood PLLC

M|M|P|L
EMPLOYEE BENEFITS LAW

PRIVILEGED & CONFIDENTIAL

THIS DOCUMENT IS SUBJECT TO THE ATTORNEY-CLIENT PRIVILEGE.

MEMORANDUM

To: Board of Administration
Seattle City Employees' Retirement System

From: Michael Monaco

Date: July 13, 2017

Re: Legal Permissibility of Environmental, Social and Governance ("ESG") Investment Proposals

---

INTRODUCTION

In accordance with the directions of the Board at its meeting on April 13, 2017, we have conducted a comprehensive reexamination of whether there has been any expansion or change in the legal rules determining the legality of ESG investment proposals. Following a review of relevant legal authorities in Washington State, throughout the United States, and internationally, we conclude that there has been no change in the legal standards that SCERS must follow in considering ESG proposals. Indeed, the ESG legal standards relevant to SCERS have only been reaffirmed by relevant court decisions, legal articles and treaties, model laws, and opinions by other law firms regarding the fiduciary responsibility standards governing retirement plans.

Thus, proposals to SCERS for ESG investments remain subject to the legal standards outlined in the Board's Policy and Procedure for Consideration of Environmental, Social and Governance Investment Proposals, and there is no reasonable prospect of a change in those standards in the foreseeable future.

DETAILED LEGAL ANALYSIS

A. Long-Standing Elements of Fiduciary Responsibility and Legally-Required Analysis of ESG Investment Proposals

The ESG policy that SCERS adopted in 2013 and updated in 2016 follows the well-established legal approach to consideration of ESG investments. That policy states:

> The Board's fiduciary obligations to the members of SCERS are paramount. Investment actions that promote an ESG goal such as rewarding workplace

> diversity, promoting local industry, or protecting the environment may be considered if the proposed action does not adversely affect investment risk and/or return for SCERS and if the resulting expected return on investment and related risk for the proposed action are economically equivalent to other available investments in the same category. While the Board may give serious consideration to environmental, social and governance issues, the Board must follow its fiduciary obligations and Investment Policy and an investment cannot be selected, rejected, or divested from based solely on those considerations. In addition, where an ESG consideration has a direct relationship to the economic value of an investment, that factor is a proper component of the Board's fiduciary analysis of the economic merit of the investment decision.
>
> . . . .
>
> The Board will give preference to an Investment Manager that advances its ESG goals if the selection results in an expected return on investment and related risk that it is at least economically equivalent to other available Investment Managers in the same category.

These ESG policies have been developed and applied to SCERS because the retirement system's assets are held in trust solely for the benefit of members and their beneficiaries, and because SCERS is subject to strict requirements of fiduciary responsibility under Washington state law.

Seattle Municipal Code (SMC) 4.36.605A states:

> The retirement fund shall be a trust fund for the exclusive benefit of the members of the City Employees' Retirement System and their beneficiaries. No part of the corpus or income of the retirement fund shall be used for or diverted to, purposes other than for the exclusive benefit of the members of the system or their beneficiaries and the payment of fees and expenses of maintaining and administering the system.

This structure makes the Board of Administration members function as trustees over SCERS' assets – subject to the duty of loyalty as well as the duty of prudence in SCERS investments. As summarized by the Washington Supreme Court, the duty of loyalty means that the Board "must act with undivided loyalty to the trust beneficiaries, *to the exclusion of all other interests*. . . . It may not sacrifice this goal to pursue other objectives, no matter how laudable those objectives may be." *Skamania v. State*,102 Wn.2d 127, 134 (1984) (emphasis added).

Investment and management of SCERS assets is also a matter of fiduciary responsibility under state law. Under state law the Board of Administration must:

> act with the care, skill, prudence, and diligence under the circumstances then prevailing that a prudent man or woman acting in a like capacity and familiar with such matters would use in the conduct of an enterprise of a like character and with like aims; shall diversify the investments of the employees' pension system so as

> to minimize the risk of large losses; and shall act in accordance with the documents and instruments governing the employees' pension system, insofar as such documents and instruments are consistent with the provisions of this title.

RCW 35.39.060. This is very similar to the fiduciary responsibility of the Washington State Investment Board in investing the state retirement systems' holdings. RCW 43.33A.140.

Because of these directives, it has long been understood by the state, the City of Seattle and SCERS that investment proposals targeted to address environmental, social, and governance issues have to meet the same fiduciary standards of prudent investment as any other investments. For example, addressing proposed divestment from companies doing business in South Africa, in 1985 the Seattle City Attorney's office opined that "[w]hen the return to and the safety of principal from investments are equivalent, trustees may take into account in making trust investments . . . moral, ethical, and social considerations." Opinion 7695 (March 26, 1985). That opinion concluded that the Board of Administration "may not pursue a policy or practice, which reduces the financial return to the pension fund or significantly increases the risk to fund capital in order to further ethical or social considerations." This is consistent with legal opinions throughout the nation regarding public and private retirement fund investments. Exercising its authority to oversee fiduciary responsibility in private pension plans, the U.S. Department of Labor has likewise stated that "in the course of discharging their duties, fiduciaries may never subordinate the economic interests of the plan to unrelated objectives, and may not select investments on the basis of any factor outside the economic interest of the plan," except in the limited circumstance where two or more "investment alternatives . . . are otherwise equal with respect to return and risk over the appropriate time horizon." *See* U.S. Dept. of Labor Interpretive Bulletins 2008-1 & 2015-1. SCERS's policy for consideration of ESG investment proposals follows these requirements. Of course, where an ESG consideration has a direct relationship to the economic value of an investment, that factor has always been and remains a proper component of fiduciary analysis of the economic merit of the decision.

The Washington State Investment Board's policy regarding Economically Targeted Investments (ETIs) takes the same approach, stating that the WSIB "will consider for investment only those ETIs that are commensurate on a risk-adjusted financial basis to alternatively available investments" and that a "decision to invest in an ETI in consideration of its collateral benefits shall be made only after the opportunity is deemed acceptable exclusively on its economic investment merits."

Fiduciary duty has also long been understood to require that appropriate experts be employed to provide the Board members with the information that they need in order to meet their fiduciary responsibilities. Board members must either become knowledgeable themselves on sophisticated investment issues, or use experts to augment their own expertise in order to make investments consistent with the work of a sophisticated, professional investment team. As one federal appeals court put it: "A pure heart and an empty head are not enough." *Donovan v. Cunningham*, 716 F.2d 1455, 1467 (5th Cir. 1983).

B. Consideration of Changes to the Legal Standards for Permissible ESG Investments

Over the years, the accepted legal standards for consideration of ESG investments have sometimes been questioned or challenged, particularly by proponents of broader acceptability of ESG proposals. These efforts have not produced any changes in Washington law or in the law nationally, and instead the only substantial developments have been to reaffirm the legal principles described above.

1. Continuation of "Tie-Breaker" Legal Standard for ESG Actions

The Washington State Supreme Court's *Skamania v. State* decision remains in full effect in all state courts and continues to require that the Board of Administration "*act with undivided loyalty to the trust beneficiaries, to the exclusion of all other interests*" and "*may not sacrifice this goal to pursue other objectives, no matter how laudable those objectives may be.*" The court decisions from around the nation analyzing fiduciary responsibility have uniformly required that an ESG action be taken only where it is equivalent to other available investment options. *Associated Students of the University of Oregon v. Oregon Investment Council*, No. 78-7502 (Cir. Ct. Lane Co. Or. Jan. 21, 1985), *rev'd* 728 P.2d 30 (Or. App. 1986), *pet. den.* 734 P.2d 354 (Or. 1987); *Sgaglione v. Levitt*, 337 N.E.2d 592 (N.Y. 1975); *Board of Trustees of Employees' Retirement System of City of Baltimore v. Mayor & City Council of Baltimore,* 562 A.2d 720 (Md. App. 1989). To our knowledge after exhaustive research, no contrary court decisions have been issued in the 33 years since *Skamania* was decided, or in the wake of any of the other ESG decisions.

Meanwhile the U.S. Department of Labor has repeatedly reaffirmed the ESG "tie-breaker" framework, in which collateral benefits of an ESG proposal may only be considered if the ESG and non-ESG investment options are economically equivalent. The most recent of these reaffirmations came in 2015, in U.S. Dept. of Labor Interpretive Bulletin 2015-1.

In addition, as noted above, law firms other than MMPL have conducted independent analyses of the fiduciary responsibilities applicable to ESG proposals to plans like SCERS, and concluded that the ESG standard is consistent with SCERS's existing policy.

There are thus no court decisions or other authorities to suggest any likelihood of changes to the law of ESG investment consideration.

2. Continuing Need to Rely on Experts and Well-Accepted Economic Principles

Particularly in the wake of financial services scandals and the economic crisis of 2008-2009, some advocates of broader ESG investment have argued that ordinary methods of valuation of stocks and other securities are missing the mark and should be supplemented – simply for the benefit of the retirement fund and the beneficiaries, to protect them from overvaluations. In particular, advocates of divestment from fossil-fuel companies have suggested that the financial markets are overvaluing them, and that alternative analyses of the alleged weaknesses of these companies require consideration of fossil fuel divestment.

However, in the last few years the U.S. Supreme Court has reaffirmed that it is generally "implausible" for a fiduciary to believe that a retirement plan committee can predict the value of a publicly-traded company better than the financial markets have. *Fifth Third Bancorp v. Dudenhoeffer*, 134 S. Ct. 2459, 2471 (2014). The Supreme Court has endorsed rulings in other court cases that: "[a] trustee is not imprudent to assume that a major stock market . . . provides the best estimate of the value of the stocks traded on it" and "[f]iduciaries are not expected to predict the future of the company stock's performance." *Id.* (internal quotation marks and citations omitted).

Thus, we continue to believe that the legal hazards would be great if a fiduciary were to consider taking an ESG action based (in whole or in part) on a rejection of ordinary economic principles as explained by investment professionals. As stated above, U.S. Supreme Court expressly considers a fiduciary's acceptance well-established economic principles like the "efficient markets" view of publicly-traded companies to be prudent. More generally, the decisions by the U.S. Supreme Court (and other federal courts throughout the country) on these issues demonstrate the legal safety of basing investment decisions on analysis by established professionals with unquestionable expertise, and following established and accepted modes of analysis as well as the great hazard of failing to do so.

3. Rejection of General-Community-Benefit ESG Standard

It has sometimes been suggested that an ESG investment decision may be justified by not merely considering the economic value of the investment, but also considering the overall benefit to the community (particularly including non-economic advantages provided to beneficiaries of the plan). This reasoning has not been accepted by any courts or decision makers in the U.S., nor to our knowledge in any other countries. It also appears to be inconsistent with *Skamania* and the court decisions and agency rules discussed above.

While it might appear that some reputable treatises and reports have endorsed this type of expansive approach to ESG investments, no significant authorities have actually done so. For example, the 1988 edition of the legal treatise *Scott on Trusts* indicated that it might be permissible to consider the general benefit to the community as an element of fiduciary review of a corporate investment (even where that benefit does not translate into economic value of the company), stating that "the investor, through a trustee of funds for others, is entitled to consider the welfare of the community, and refrain from allowing the use of funds in a manner detrimental to society." Austin W. Scott, *The Law of Trusts ("Scott on Trusts")*, § 227.14 (4th ed. 1988). But the subsequent edition of that treatise clarified that in accordance with the Uniform Prudent Investor Act and the *Third Restatement of Trusts*:

> [T]he trustee should seek to secure for the beneficiaries the maximum overall return that is consistent with the level of risk that is appropriate under the circumstances. . . . No form of so-called "social investing" is consistent with the duty of loyalty if the investment activity entails sacrificing the interests of trust beneficiaries – for example, by accepting below-market returns – in favor of the

> interests of the persons supposedly benefitted by pursuing the particular social cause.

Scott on Trusts, § 19.1.13 (5th ed. 2007) (quoting Uniform Prudent Investor Act; internal quotation marks omitted).

Likewise, reports by influential international bodies are sometimes characterized as promoting a more permissive view of ESG investments, when they actually have not done so. For example, the 2005 legal analysis by the Freshfields Bruckhaus Deringer law firm for the United Nations Environmental Programmes' Finance Initiative (commonly known as the "Freshfields Report") broadly states that "a decision-maker may integrate ESG considerations into an investment decision to give effect to the views of the beneficiaries in relation to matters beyond financial return," but in the same section that Report ultimately states as follows:

> *[In] cases where a decision-maker* has exhausted the analysis of financial criteria, including value-related ESG considerations [i.e. those related to the economic value of the investment] . . . and *is still left with a number of alternatives, of equal attractiveness* from the point of view of the overall investment strategy . . . . the decision-maker would be entitled to select on alternative on the basis of its non-value-related ESG characteristics, without thereby being in breach of his or her fiduciary duties or civil law obligations.

UNEP Finance Initiative, *A Legal Framework for the Integration of Environmental, Social and Governance Issues Into Institutional Investment*, p. 12 (October 2005) (emphasis added) (emphasis added).

Thus the "Freshfields Report," like many other reports promoting ESG investment, may be referenced in ways that suggest that the field of legally-permissible ESG investments should be (or even has already been) expanded, when in fact the legal analysis in that report is in line with the ordinary rule that only where there are a "number of alternatives, of equal attractiveness" from an economic perspective can a fiduciary choose an ESG option on the basis of non-economic factors.

4. Impossibility of Obtaining Universal Beneficiary Consent to ESG Investments

Under Washington law and a wide variety of national legal authorities, including the *Restatement of Trusts*, it is widely accepted that there is no breach of fiduciary duty if a well-informed beneficiary consents to an investment – even if that investment underperforms economically.

On the basis of this, some have suggested that it may be permissible to make an ESG investment decision on the basis of a broad but not universal "consensus" of the beneficiaries of the trust – particularly in light of language of the Freshfields Report that fiduciary can make an investment decision by "point[ing] to a consensus amongst the beneficiaries in support of" the decision. *See Freshfields Report*, p. 12. But that types of statement in the Freshfields Report (and elsewhere) cannot be read to provide a legal basis for an ESG decision based on the consent of only *some* of

the beneficiaries affected by it. Under the well-established law, "the power of one beneficiary to ratify [an investment decision] cannot be used to impair the rights of the other beneficiaries." *See, e.g.,* John H. Langbein and Richard A. Posner, *Social Investing and the Law of Trusts*, 79 Mich. L. Rev. 72, 105 (1980).

In a pension plan with thousands of active members and retirees, it would be impossible to obtain universal consent to any proposed ESG decision, and the notion of a general "consensus" to a proposed ESG action would be of essentially no use in preventing claims of fiduciary breach. This would be true even if a mechanism could somehow be developed and implemented to "poll" members of SCERS and obtain express statements of support for an ESG action from a wide group (or even a large majority) of members of the system. In the end, even having done such laborious work to demonstrate "support" for an ESG action, there would still be a great risk that claims of fiduciary breach could be brought (at a minimum) by each and every person who had not given such "consent" or otherwise expressed support.

NEPC Fossil Fuel Divestment Commentary
January 24, 2018

ATTACHMENT 3

Bernstein (2017)
"Climate Risk Divestment Discussion"
Pension Consulting Alliance

Vermont Pension Investment Committee

CLIMATE RISK DIVESTMENT DISCUSSION

February 8, 2017

PCA PENSION CONSULTING ALLIANCE

Sarah Bernstein, Ph.D., FSA

Table of Contents

Acknowledgements

In PCA's opinion, VPIC stands among the leaders of U.S. public pension funds in its efforts to consider and to address potential climate change risks and their potential impacts on the VPIC portfolio. PCA is honored that VPIC retained our firm to examine the potential impact on the VPIC portfolio of divestment from one or more of the following: a) coal, b) ExxonMobil, and c) fossil-fuel investments, and to work with the Treasurer, VPIC staff and NEPC LLC to try to seek consensus recommendations for consideration by VPIC.

We thank the VPIC, the Vermont Treasurer, and VPIC staff for their inputs throughout this process; the 26 U.S. public pension funds that responded to PCA's survey of VPIC peers on climate change related investing strategies (Appendix 1); MSCI for providing lists of fossil fuel and thermal coal securities derived from the MSCI ACWI IMI universe, which PCA distributed to all VPIC managers for the sole purpose of preparing information for this report; every VPIC investment manager for their time and effort in contributing information for this report; FTSE/Russell, MSCI, SPDJI for providing information on new ESG indexes; MSCI, Northern Trust, Rhumbline, and SSGA for providing information on potential new passive ESG investment vehicles; CERES/INCR and the Sustainable Accounting Standards Board ("SASB") for their input; and Allan Emkin, PCA founder and Managing Director, for his insights and support.

VPIC's process for this report included outside review of PCA's report by a group designated by VPIC. We thank these individuals, each representing their respective organizations, for their thoughtful involvement: Margaret Belmondo and Chris Levell, Vermont's Investment Consultants, NEPC, LLC.; Andrew MacLean, ExxonMobil ("Exxon" or "XOM"); Austin Davis, 350.0rg Vermont; Eric Becker, Clean Yield; Guy Page, Divestment Facts; Joe Choquette, Independent Petroleum Institute in Vermont; Robb Kidd, Sierra Club, Vermont Chapter; and Sarah Wolfe, VPIRG.

Forward

Eighteen of the past 19 years have been the hottest on record. In our opinion, whether or not you are convinced of humanity's role in climate change, there is a preponderance of evidence for climate change and its potential risks. We believe climate risks to investments, including potentially stranded assets, have become a potentially material investment issue to the degree that the question has become: why would you not seek to understand and manage these risks? We believe VPIC should continue its effort to address and manage climate and other ESG risks and opportunities, and stay abreast of ever-changing assessments of risks and approaches to managing them. In our opinion, divestment of fossil fuels for VPIC is one possible strategy to mitigate one, potentially significant, climate risk – possible stranded assets of fossil fuel suppliers.

This report addresses the impact on the VPIC investment portfolio of divestment from fossil fuels, thermal coal, and ExxonMobil. We analyze these divestment strategies' potential impact on the expected returns, risks and costs to the VPIC investment portfolio, and the potential impacts of divestment phased in over time; consider divestment within the context of the VPIC's governance structure, including its asset allocation, investment strategy within public equities, proxy voting and engagement policy, and in the context of other investment management tools available to VPIC.

By the numbers, the larger the scope of any divestment, the larger the expected potential impact on returns and risk to the portfolio. For this report we employed a narrower definition of fossil fuels and of coal than was analyzed by VPIC staff in its 2015 study of divestment. We include only companies that own fossil fuel reserves rather than the full GICS energy sector; thermal coal rather than all coal; and we exclude utilities. VPIC invests in commodities via futures. Thus commodities are not relevant to this definition of fossil fuels. As a consequence of these differences in definition, this report finds a smaller fossil fuel and coal exposure and a smaller potential risk-return impact on the VPIC portfolio than the results reported by staff. A second consequence is that our report is less consistent than the VPIC staff report with the underlying general themes – divest from all fossil fuels and divest from all coal. In our opinion, our results and conclusions are consistent with those found by VPIC staff.

Second, VPIC's overall investment strategy is designed to diversify among asset classes to balance overall market risks. In our opinion, fossil fuel supplier divestment can be a tool primarily in public equities to remove exposure to potentially stranded fossil fuel owner assets. In our opinion, other portfolio-wide potentially material financial risks and opportunities posed by climate change are not addressed by fossil fuel divestment. Divestment does not: address climate change material risks (including technological, policy, and physical) evident in other industries from agriculture and forestry to infrastructure, buildings and insurance. Divestment does not provide enhanced exposure to companies involved in energy efficiency and renewable energy. Publicly held equity divestment only transfers ownership of fossil fuel securities; it cannot provide fossil fuel alternatives with any new financial resources. In our opinion, addressing potential climate change risks and opportunities in the VPIC portfolio is best accomplished through a bottom up analysis within each asset class.

Third, within VPIC's equity asset class, we find that divestment adds ongoing costs to portfolio management that are proportionally greater the smaller the fossil fuel divestment strategy (i.e., it is most expensive relative to the market value of the assets divested, to divest from ExxonMobil). We find that investment conflicts with VPIC's equity asset class governance structure, including its investment strategy, and proxy voting and engagement approach. VPIC allocates its publicly held equity assets primarily towards passively managed funds to gain inexpensive overall market exposure. VPIC complements these investments with actively managed investments in discrete market segments where VPIC believes active management can increase its risk-adjusted returns, net of fees. Divestment constrains active managers in their mandate to: find the best investment opportunities; distinguish

among differing magnitudes of risk by type of fossil fuel; weigh stranded asset risks at each company with other risks in security selection; and time buy/sell decisions.

For passively managed, market-wide equity investments, the risk of stranded assets is one of many potential long-term risks that VPIC must consider, including other climate risks. VPIC's passive equities are managed against market-cap weighted indexes. These indexes do not separately account for potentially stranded asset risks, over and above any stranded asset risk embedded in a company's market cap. These indexes include other biases. There exists a multitude of market-wide benchmarks that seek to offer investors better overall risk-adjusted returns than market-cap weighted indexes. These include fundamental, equal-weighted, smart-beta, and a burgeoning plethora of Environmental, Social and Governance ("ESG") indexes. We believe benchmarks other than ex-fossil fuel, or ex-coal can better balance potential stranded asset risk with the multitude of climate, ESG and macro risks (an ex-Exxon benchmark must be custom developed). Divestment of fossil fuels, thermal coal, or ExxonMobil, even within the equity asset class, requires costly restructuring of investments from inexpensive comingled funds, to higher cost separately managed accounts ("SMA"). In our opinion, divestment from fossil fuels or ExxonMobil would negate a critical element of VPIC's proxy voting efforts on these matters - VPIC's voting and co-sponsoring of shareholder proxies at fossil fuel companies (Appendix 2).

We believe that VPIC's significant proxy voting and engagement efforts on climate risk issues at fossil fuel companies, including ExxonMobil, and investment strategies other than divestment, are better suited than divestment for VPIC to manage risks and opportunities posed by climate change within its role as fiduciary of a U.S. public pension fund.

Executive Summary

Conclusions

- **We find that divestment from fossil fuels, thermal coal, or ExxonMobil could:**

  - increase costs
  - add diversification and technological change risks to VPIC's portfolio,
  - only effect potential stranded assets risk, not other material climate change risks and opportunities,
  - leave unaffected the financial situation of companies offering alternatives to fossil fuels,
  - conflict with VPICs governance in its asset allocation, equity investment strategy, and proxy voting and direct corporate engagement, and
  - introduce a slippery slope of potential for other restrictions on VPIC's investment universe whose potential benefits have not been shown to outweigh the potential harm to the VPIC portfolio.

  Each of the three divestment tracks carry different degrees of these central concerns.

  - Fossil fuel divestment may introduce meaningful diversification risk, increase costs - including cost to restructure the VPIC portfolio from commingled funds into to SMAs, higher management fees, and operational costs, reduce VPIC's proxy voting and engagement opportunities across an entire sector of the economy, introduce a slippery slope potential for other restrictions, particularly for other aspects of today's carbon economy. Fossil fuel divestment does not reduce the global economic dependence on, or demand for, fossil fuels, or impact the financing of the targeted companies.
  - Thermal coal divestment would entail higher proportional costs to VPIC than fossil fuel divestment, because the full costs of transitioning out of inexpensive commingled funds and paying the ongoing management fees of more expensive SMA's would be incurred for a much smaller divestment.
  - ExxonMobil divestment would entail the highest costs proportional to the size of the assets divested and reinvested, and would introduce a single company precedent for exclusion that would dramatically widen the opportunities for demands for exclusion from VPIC's investment universe despite increased costs to the plan. Exxon divestment would negate the proxy voting and engagement efforts at Exxon that VPIC and the Vermont Treasurer undertake (Appendix 2), and thereby potentially work against the broader institutional investor climate change related efforts that have gained traction among Exxon shareholders.

- **Markets now offer meaningful tools to address climate risk other than divestment**, from coordinated proxy voting and corporate and public policy engagement, to passive and active low carbon alternatives that avoid the broad market exit risk inherent in near-term divestment approaches.

- **Divestment conflicts with VPIC governing policies:** Given the financial and governance costs that come with fossil fuel divestment, in PCA's opinion, divestment of fossil fuels, thermal coal, or Exxon has not been shown to be in the best interests of VPIC pension beneficiaries, and conflicts with VPIC governance structure.

Recommendations

- **Be an active shareowner of fossil fuels in the VPIC portfolio.**

- **Continue VPIC's active shareowner proxy voting, and engagement** with both companies and public policy regulators regarding climate risk matters; maintain ongoing manager monitoring of climate change risk and opportunity management. Consider integrating distinctions between material and immaterial ESG risks, such as those defined by the Sustainable Accounting Standards Board ("SASB"), into VPIC's manager monitoring, and decisions over which shareholder proposals to invest VPIC's corporate engagement time and resources.

- **Continue VPIC's active engagement in institutional investor organizations** such as Ceres, INCR and SASB to further leverage VPIC's efforts.

- **Conduct a thorough review of VPIC's passive equity manager's proxy voting.** In the event that VPIC conducts a search for a passive equity manager, include consideration of managers' proxy voting policies and actual votes on climate change and other ESG issues to potentially further broaden VPIC's alignment of interests with the proxy voting done on VPIC's behalf by passively managed equity managers.

- **Reach out to other state public pension funds to explore possibility of creating a new passive equity investment vehicle that VPIC could potentially seed, designed to more closely align with VPIC's proxy voting** and engagement. The investment vehicle could be designed for VPIC and other U.S. public pension funds that do not have the resources to bring their passive equity investing in-house. Such a vehicle would offer long-term ongoing opportunity, regardless of market change, including long-term transformations in global energy. There appear to be options that could keep costs in line with VPIC's current passive equity comingled fund cost structure. Depending on how a fund was implemented, a new investment vehicle may involve higher management fees or costs than VPIC's current passive equity commingled funds.

  As of June 30, 2016, 53% of VPIC equities were passively managed ($806.5 million). PCA requested information from VPIC's current passive equity manager – SSGA, and from Northern Trust ("NT") on a potential new comingled vehicle. SSGA responded that it is not an option at this time for SSGA to launch a fund that implemented either custom public fund proxy voting guidelines, or guidelines of a third party proxy voting entity, as SSGA believes that their corporate policy is strong on ESG/climate issues (Appendix 3).

  Northern Trust offered a few options: VPIC could invest in NT's existing R3000 Labor Select Index Fund, which votes proxies according to ISS's Taft Hartley proxy voting guidelines and outsources the proxy voting to ISS; NT could open a new commingled passive equity fund for public fund investors to either invest according to a specialized proxy voting guideline from a proxy service provider, (such as the ISS' or Glass Lewis' public fund or ESG guidelines), or to invest in a new vehicle that votes proxies according to a new public fund custom proxy voting guideline developed by VPIC (or developed jointly with other public funds). The preliminary fee schedules for these options are set forth in Appendix 4. They assume a minimum of $250 million in assets to launch a new fund. The fee schedule is 3 basis points per annum for an S&P 500 (with securities lending) index fund, dropping to 2 basis points per annum for any investment $500 million or more. Implementation of a non-U.S. fund is more expensive. A final alternative might be for VPIC and other funds to set up their own investment management entity, such as a limited partnership, then retain the appropriate resources for legal, custody to operate the fund, conduct an RFP for a manager to passively invest in a comingled fund the new entity's assets, and conduct a search to retain a proxy service provider to implement the custom proxy voting guidelines.

For the custom public proxy voting guideline option, that utilizes NT, rather than going through a new entity, the participating funds would not need to establish a more expensive independent investment partnership. In PCA's opinion, a challenge may be reaching agreement among a sufficient number of public funds on a new custom public fund proxy voting policy to seed a new passive commingled equity fund. The participating pension plans could consider establishing an entity to manage their collective process and collaborations.

- **Work with VPIC custodian to explore custodial reporting on ESG factors in VPIC portfolio compared to market,** possibly including ESG corporate ratings, and carbon footprint analysis to further support VPIC manager monitoring efforts.

- **Consider shifting a portion of VPIC assets to strategies that are expected to stimulate and benefit from long-term shifts to a low-carbon economy.**

  - Public equities - consider shifting a portion of VPIC's passively managed assets to a fund benchmarked to an index such as MSCI's Low Carbon Index, or FTSE's Green Revenue Index. Neither index divests from fossil fuels. Instead, they reweight securities in the underlying benchmark to either reduce the economy-wide carbon footprint, or increase the green exposure, while optimizing to maintain a close tracking to their core underlying benchmarks. Today, low carbon indexes provide meaningful reduction in exposure to carbon emissions. Over time, we expect low carbon indexes to more closely resemble the carbon exposure of the underlying market cap weighted benchmark as the world moves towards a low carbon economy. At this point in time, a VPIC investment in such a passive equity fund would increase VPIC's management fees. There are not yet commingled passive equity funds in which VPIC could invest based on either benchmark. An ETF does exist based on MSCI's Low Carbon Index.

    PCA requested information from SSGA, Rhumbline (specializes in passive index funds) and MSCI on potential management fees to establish a new comingled low carbon fund. We used MSCI's Low Carbon Target Index as an example. Potential fee schedules are listed in Appendix 3 (SSGA), and Appendix 4 (Rhumbline). Any fund of this sort would include additional fees compared to VPIC's current passive equity, including index fees wrapped in due to the additional three to four basis points that MSCI currently charges for their custom ESG indexes.

Private equities - consider shifting a portion of VPIC's allocation to a strategy that includes a higher portion of clean technology investments. The costs involved in this strategy include the staff and Board time to determine a strategy, the costs and time of issuing an RFP, and may involve ongoing higher private equity management fees because VPIC's current sole private equity manager does not have an offering of this type.

Findings

As of June 30, 2016, VPIC held 3.6% of its $3.74 billion total portfolio in fossil fuels. This percentage is based on the MSCI ACWI IMI universe (broader than the VPIC MSCI ACWI reference benchmark because it includes securities for small cap companies, while the MSCI ACWI focuses on the large/mid cap universe), and defines fossil fuel companies as any company with proven fossil fuel reserves. Coal companies are defined using the California list of thermal coal companies, as provided by MSCI.

Fossil fuels:	3.6% ($134 million)
Thermal coal:	0.6% ($22 million)
ExxonMobil ("XOM"):	0.3% ($10 million)

At 3.6%, VPIC's actual exposure to fossil fuels was significantly lower than the benchmark. VPIC fossil fuel exposure was approximately half (54%) the 6.6% exposure of the MSCI ACWI exposure. Similarly, VPIC's Exxon exposure was 0.3% of its total portfolio, compared to 1.1% of the MSCI ACWI. VPIC's 0.6% exposure to thermal coal companies was below the 0.8% of the MSCI ACWI 0.8%.

Equities represented the largest VPIC asset class:

Equities:	40%
Fixed Income:	32%
Absolute Return:	17%
Alternatives:	11%

The VPIC equity asset class held the vast majority VPIC's fossil fuel exposure:

VPIC share of fossil fuels in VPIC Equity Asset Class:	79%
VPIC share of thermal coal in VPIC Equity Asset Class:	92%
VPIC share of ExxonMobil in VPIC Equity Asset Class:	92%

VPIC commingled funds (which includes all passively managed and many actively managed funds) held the largest share of VPIC's exposure to fossil fuels:

VPIC commingled funds share of VPIC fossil fuels:	58%
VPIC commingled funds share of VPIC thermal coal:	78%
VPIC commingled funds share of VPIC ExxonMobil:	97%

Active managers held modest to zero fossil fuel and thermal coal positions, and zero Exxon.

VPIC's total percentage exposure to fossil fuels, thermal coal and Exxon were each less than that of an equity reference benchmark presented in VPIC performance reports – the MSCI ACWI.

Risk and Return: By definition, divestment reduces diversification and thus increases risk. Going forward rates of return differences between VPIC's actual portfolio and its hypothetical portfolios under divestment cannot be estimated. Future returns cannot be forecast by historic returns. Macro and industry experts have failed to predict dramatic shifts, such as shale production. In our opinion, the potential to accurately predict the timing, industry and company return impacts for VPIC is low, given the high uncertainty in policy, winning technologies, and which companies may successfully adapt. PCA analyzed VPIC managers' hypothetical historic rates of returns for trailing one-year and five-year periods under the three divestment scenarios. The VPIC manager's estimates were self-reported. All managers were asked to use the fossil fuel and thermal coal lists of companies provided by MSCI for all data responses. The results show that under divestment, VPIC managers would have had mixed results compared to their actual performance for VPIC – some marginally better and some marginally worse rates of return than their actual returns.

Costs: The largest measurable explicit costs of divestment to VPIC would be ongoing increased management fees. **Management fees would increase under each of these three divestment scenarios** because VPIC commingled funds, where the bulk of VPIC's fossil fuel were held, would have to be restructured into materially higher-cost SMA funds. The ongoing higher fees are proportionally higher for the divestment scenario with the lowest amount of assets to be divested - Exxon - because the fee changes would be the same, whether VPIC restructured and set up an SMA to divest just from ExxonMobil, or to divest from all fossil fuels. For two of VPIC's four commingled equity funds, the commingled fund manager, SSGA, responded that VPIC cannot be moved to an SMA for those funds because the current level of AUM in those two accounts is too small, and such a transition would be cost prohibitive. VPIC's current SMA managers that held any fossil fuels reported that management fees would remain largely unchanged. **Transaction costs:** VPIC's commingled fund managers, which held the vast majority of VPIC's fossil fuel positions, cannot divest VPIC from individual securities, because VPIC does not hold direct ownership of individual securities in a commingled fund. Thus these funds

would have to be closed and restructured as SMAs. In addition to the ongoing higher management fees of a new SMA, the costs to close down these funds and reopen SMAs, where possible, would include the administrative costs of opening an SMA, new custodial costs to allow VPIC to hold the individual securities, and transaction costs to buy in VPIC's name the full set of ex-fossil fuel, ex-thermal coal, or ex-Exxon securities. The fossil fuel companies in the MSCI ACWI IMI trade in highly liquid markets. Consistent these market dynamics, and reflecting the small exposure to fossil fuels and thermal coal in VPIC SMAs, the combined transaction costs to divest (sell) were estimated by VPIC SMA managers: VPIC SMA fossil fuels, $185,422, and VPIC SMA thermal coal, $35,914.

VPIC private equity fossil fuel divestment would require selling all holdings on the secondary market, likely at a significant discount to Net Asset Value (NAV). **Monitoring costs** would increase to insure compliance throughout the portfolio of VPIC manager's compliance with VPIC-specific divestment lists. **Opportunity costs** are expected to vary depending on the manager's target market, and timing.

Phase-in: A short-term divestment phase-in would incur essentially the same magnitude of costs, including transaction costs and management fees, as immediate divestment, and may be at a poor time in the energy market. **A long-term divestment period,** could be designed to divest more in line with a long-term technological shift to a lower carbon economy. For example, Vermont's energy policy sets forth a 30-year period for the state to transition to 90% reliance on renewable energy. A 30-year divestment period might harmonize better with a shift from global dependence on fossil fuels to a degree that renewables become a larger share of global energy consumption. Such a long-term divestment period, if implemented in incremental steps throughout the portfolio, with regular review and reassessment, could smooth out divestment impacts and reduce the impact of near-term market timing. The increases in management fees required to dismantle VPIC's inexpensive commingled funds, and restructure those assets into more expensive SMA's would still be borne by VPIC, but would be spread out over time, if VPIC did not dismantle and restructure all commingled funds at one time. In our opinion, extending divestment over five-to-seven-year business cycle would do little to address the key underlying global dependence on fossil fuels, although, depending on timing, it could potentially contribute to smoothing out return impacts somewhat.

Additional divestment from VPIC's commodity asset class would allow VPIC to completely exit all fossil fuel related exposure. We agree with VPIC's staff analysis that such divestment would undermine the strategic benefits including inflation protection and diversification that the asset allocation to commodities brings VPIC and require a reassessment of VPIC's asset allocation strategy.

Divestment would negate VPIC's and the Vermont Treasurer's considerable efforts in proxy voting at fossil fuel companies, even as climate change related shareholder proxies are expanding in voting share. VPIC's efforts went beyond voting their proxies and included in 2016 co-filing six proxy proposals at major oil companies, including Exxon. Engagement at the regulatory level, and through general letters with broad institutional investor organizations of which VPIC is a member could still be undertaken.

Climate change risk is ubiquitous. Divesting from fossil fuels can reduce stranded asset risk, but does not address other climate change risks. Divesting from fossil fuel suppliers:

- Has little proven impact on fossil fuel corporate policies, or on government policies.
- Increases investments in: sectors whose products and services generate demand for fossil fuel energy including utilities and transportation, sectors that generate significant CO2 emissions, such as construction, sectors that finance fossil fuel development, and sectors facing material physical risks of climate change including real estate and consumer goods.
- Retains investments in oilfield services and equipment, necessary to fossil fuel production.
- Does not overweight VPIC's exposure to companies potentially stimulating and benefitting from low-carbon and renewable energy solutions.

Divestment from fossil fuels sets a 'slippery slope' precedent for VPIC to restrict its manager's stock selection based on criteria that are not proven to benefit VPIC. Divesting Exxon, as a single company, and then excluding it going forward from VPIC's securities universe, would open VPIC to an entirely new degree of precedent setting for demands for individual companies to be excluded for many varieties of reasons.

Introduction

VPIC's mandate to PCA for this project was to review potential divestment and its potential impacts on the VPIC portfolio, and to work with Treasurer staff and NEPC LLC to seek to come to consensus recommendations, for consideration by the VPIC subcommittee that was formed to examine the potential impact of divestment from one or more of the following: a) coal, b) ExxonMobil, and c) fossil-fuel investments from equities, fixed income, commodities, and other investment classes. For this report, VPIC requested that: "Specifically, this study would look at all three tracks (coal, ExxonMobil, and fossil fuels) and would consider a) the impacts, if any, on the return and risk characteristics of the VPIC portfolio, b) impact on costs, if any, including transaction costs, c) impacts on the governance structure of VPIC, including construction, management and oversight, and d) impacts that phase-in of various divestment strategies could have on the previously identified considerations."

In our review of the considerable prior work and discussion by VPIC on potential divestment of fossil fuels, we found the reports by VPIC Staff to provide thorough and thoughtful analysis of the potential impacts of fossil fuel divestment. We find the related memorandums and comments by NEPC well-reasoned. PCA's findings are consistent with the findings and recommendation of VPIC staff. As summarized in the July 28, 2015 staff report to VPIC: *"Staff recommends that proposals for fossil-fuel/energy divestment be rejected. Staff believes that analysis demonstrates that such divestment fails to satisfy the criteria set forth in the VPIC ESG Policy, presents significant governance challenges, and is not in the best interest of the pension beneficiaries."*

For this report, we seek to expand on the existing VPIC body of research by analyzing additional input from VPIC's managers on their estimates of return, risk, transaction costs, opportunity costs and management fees under three different scenarios: divestment from fossil fuels, thermal coal, and ExxonMobil. Managers were asked to estimate what hypothetical changes in their historic returns to VPIC under divestment, using their June 30, 2016 assets, and using June 30, 2016 as the endpoint for historic analysis. Similarly, managers were asked to estimate potential costs of potential divestment.

We further analyze divestment within the context of comparison to VPIC peer public pension funds actions regarding climate change issues. This report also assesses divestment strategies compared to other market alternatives available to institutional investors to address climate change issues, highlighting key parameters for institutional investors.

The VPIC Regulatory Framework

The framework for PCA's review is the legal and regulatory framework that guides VPIC. VPIC and its investment managers are required to make VPIC's investments in accordance with the standards of care established by the prudent investor rule under 14A V.S.A. 902. As noted in staff reports, the VPIC is "required to consider general economic conditions, the possible effect of inflation or deflation, the total role that each investment or course of actions plays within the overall trust portfolio, the expected total return from income and the appreciation of capital, and an asset's special relationship or special value, if any, to the purposes of the trust or to one or more of the beneficiaries.

The State retirement plans are subject to Section 401(a) of the Internal Revenue Code which provides that the plans must be maintained and the trustees must act for the exclusive benefit of the plan's beneficiaries. The exclusive benefit rule is codified in Vermont state law as follows:

> Under any trust or custodial account, it shall be impossible at any time prior to the satisfaction of all liabilities with respect to members and their beneficiaries for any part of the corpus or income to be used for, or diverted to, purposes other than the exclusive benefit of members and their beneficiaries (3 V.S.A. 472a(b)).

VPIC's ESG policy, adopted November 2013, further states that: the Committee may choose to consider ESG Initiatives, provided they are consistent with the Committee's obligations to the members and beneficiaries of the participating retirement systems and with the standard of care established by the prudent investor rule. In cases where investment characteristics, including return, risk, liquidity, and compliance with the allocation policy are appropriate for the Portfolio, the Committee may consider ESG Initiatives that have a substantial, direct and measurable benefit to the interests of the Portfolio.

The VPIC ESG Policy states that ESG Initiatives will be evaluated according to five specific factors:

1) Any ESG Initiative must add to or complement and not dilute or compromise the overall Portfolio strategy. ESG Initiatives will be evaluated within the context of the Portfolio as a whole and not in isolation. The Committee is a long-term investor that strives to maximize investment returns without undue risk of loss.
2) The ESG Initiative must target risk-adjusted, market-rate returns and provide net returns equivalent to or higher than other available investments at commensurate levels of risk. Social benefits of the ESG Initiative will not justify lower risk adjusted returns or higher investment risk for the Portfolio or any asset class within the Portfolio.
3) ESG Initiatives must not exceed a reasonable weighting in the Portfolio, or skew a reasonable weighting in the Portfolio as a result of investment in or divestment from any one investment strategy, sector or geographic locations. ESG Initiatives should maintain the overall Portfolio's compliance with its asset allocation strategy. Social benefits of an ESG Initiative will not justify deviation from the Asset Allocation Plan adopted by the Committee.
4) ESG Initiatives requiring an investment should be managed by qualified discretionary investment managers. The Committee will not make any direct investments. Similarly, any divestment of Portfolio assets should be accomplished by a qualified discretionary investment manager in a manner designed to minimize transactional costs and minimize losses to the Portfolio.
5) Any benefits of ESG Initiatives should be able to be quantified, reviewed and monitored by the Committee, State Treasurer's staff and third-party consultants without inappropriate expenditure of time and resources. A review of both the investment performance and the collateral benefits will be undertaken for the purpose of determining whether the Committee will maintain and ESG Initiative. The collateral benefits of an ESG Initiative shall be measured, in terms of foregone return, transaction costs and monitoring costs, alongside the estimated return of the ESG Initiative.

Reductions in expected returns to VPIC, whether from investment return downturns or increased costs, could increase the unfunded liability of the pension plans managed by VPIC, and potentially negatively affect the plans' funded status. As of June 30, 2016, the funded status of the State Employees', State Teachers' and Municipal Employees' plans were 75%, 58%, and 86% respectively. Vermont State Employees' and Teachers' plans are considered mature pension plans. For example, the ratio of retirees and beneficiaries to active employees was reported at 78% for the Vermont State Employees, and 88% for the Teacher's as of June 30, 2016. The Vermont Municipal Employees Retirement plan ratio of retirees and beneficiaries to active employees was 39% as of June 30, 2016. The more mature a plan, the less flexibility it typically has to recover from any market downturn.

The Numbers: Defining Fossil Fuels, Coal and ExxonMobil

VPIC allocates the largest share of its assets to the Equities asset class (40%), followed by Fixed Income, Absolute Return, Real Estate, Commodities, and Private Equity, as indicated below.

VPIC Asset Allocation (June 30, 2016)

Asset Class	Assets Under Management	
	(%)	($Millions)
Total Plan	100.0%	$3,743.2
Equities	40.0%	$1,507.7
Fixed Income	32.0%	$1,194.4
Absolute Return	17.0%	$647.8
Alternatives	11.0%	$393.2
Real Estate	6.4%	$239.9
Commodities	2.8%	$104.4
Private Equity	1.3%	$48.9

A reference portfolio for VPIC's Composite portfolio, as presented in NEPC's 2Q2016 Performance Report for VPIC, is 60% MSCI All Country World Index ("MSCI ACWI"), and 40% Barclay's Global Aggregate. To analyze manager estimates of divestment impacts based on consistent definitions of the set of securities to be divested, this analysis relies on an MSCI ACWI IMI ex-fossil fuel list of fossil fuel companies, and the MSCI ACWI IMI ex-thermal coal list of thermal coal companies.

The data analyzed in this report differs from that employed by staff in its 2015 analysis of the impact of divestment from fossil fuels and from coal. Staff's report identifies VPIC holdings by the Global Industrial Classification Standard ("GICS") codes. The GICS codes included in the VPIC study were energy (ex-Coal), Coal, and Utilities. Today's report concentrates on a narrower set of holdings, as outlined above. In particular, this study identifies fossil fuel holdings as only those companies that hold fossil fuel reserves, rather than the full GICS energy sector; we focus on thermal coal holdings, rather than the full GICS coal sector. Thermal coal is the coal used to produce energy, and generates high CO2 emission, as compared to metallurgical coal, which is used primarily in the production of steel, and generates relatively little carbon emissions. The thermal coal list from MSCI is the list adopted by California pension fund CalSTRS in its restriction on domestic U.S. thermal coal companies from the CalSTRS portfolio. Third, we identify utilities as users of fossil fuels, rather than suppliers, and include utilities as major contributors to carbon emissions, but exclude them from this analysis of divestment, focusing on suppliers of fossil fuels. The narrower definitions in this report result in smaller estimates of VPIC total exposure to fossil fuels and coal than staff reports. In our opinion, these studies are consistent with each other.

We note a few particulars that result in differences in the number of fossil fuel companies excluded from the MSCI ACWI compared to the MSCI ACWI IMI related list that was shared with VPIC managers. First, the MSCI ACWI index is composed of large/mid cap stocks and had 2,468 constituents. The ACWI IMI list includes large/mid/small cap and had 8,616 constituents (as of Nov. 30). With the more comprehensive list, we were able to query VPIC managers that may have held small cap names in their portfolios.

Second, the list of fossil fuel companies sent to VPIC managers, and those that are excluded from the MSCI ACWI IMI in the MSCI ACWI ex-Fossil Fuels Index can differ due to the type of fossil fuel reserves. The MSCI ACWI IMI ex-Fossil Fuels Index removes companies that have *proven fossil fuel reserves used*

for energy purposes. There are companies that have reserves but don't use them for energy. This broader list, based on all proven fossil fuel reserves, was sent to VPIC managers.

Both MSCI ACWI IMI fossil fuel and thermal coal divestment lists relate to investable equity benchmarks. MSCI does not publish an index that just excludes ExxonMobil. No comparable fossil fuel divestment lists of securities exist for the Barclay's Global Aggregate. MSCI provided PCA with the relevant equity and bond security identifiers for all of the companies included in its fossil fuel lists, so that we could request comparable information from VPIC's equity and fixed income managers, and from any absolute return managers that invest in company-level securities. The lists were distributed to all VPIC managers, for the sole purpose of preparing materials for this report.

The divestment analysis in this report is constrained to company-level securities of publicly traded securities. Thus, MSCI fossil fuel lists were not applicable to VPIC's Commodities asset class, which is invested through commodities futures. VPIC's Real Estate asset class holds no fossil fuel securities. VPIC's private equity asset class holds none of the publicly traded companies on the fossil fuel divestment lists used here. However, VPIC's private equity manager, Harbourvest, reviewed all eight of its funds in which VPIC is invested, and provided information on the market value of any private equity securities that might be deemed fossil fuels. We incorporate Harbourvest's estimates into our overall analysis of VPIC's exposure to fossil fuels.

VPIC Exposure to Fossil Fuels

To measure the VPIC exposure to ExxonMobil ("XOM", or "Exxon"), Thermal Coal ("ThC") and Fossil Fuel ("FF") holdings, we used the securities in the MSCI ACWI IMI Index of companies that held proven reserves of fossil fuels. All information is as of June 30, 2016 and provided by each VPIC manager. In total, VPIC held 3.6% ($134 million) of its $3.74 billion in assets under management ("AUM") in fossil fuel securities, 0.6% ($24 million) in thermal coal securities, and 0.3% ($11 million) in Exxon securities.

VPIC Total Plan Exposure to XOM, Thermal Coal and Fossil Fuel Holdings
(June 30, 2016)

	VPIC Assets Under Management							
	Total Plan		XOM		ThC		FF	
	$Millions	% of Total Plan	$millions	% of Total Plan	$millions	% of Total Plan	$Millions	% of Total Plan
Assets Under Management	$ 3,743	100%	$11	0.3%	$24	0.6%	$134	3.6%

As shown below, equities comprise the vast majority of VPIC's fossil fuel, thermal coal, and Exxon investments. Equities accounted for 79% of VPIC's total fossil fuel investments. In both thermal coal and Exxon, 92% of VPIC's investments were in the Equity asset class. Commingled funds made up the bulk of these investments. Equities in commingled funds garnered 50% of the total FF investments, 71% of the thermal coal exposure and 89% of VPIC's investments in Exxon.

VPIC Asset Class Exposure to XOM, Thermal Coal and Fossil Fuel Holdings
(June 30, 2016)

VPIC Assets Under Management								
	Total Plan		XOM		ThC		FF	
	$Millions	% of Total Plan	$millions	% of Total Plan	$millions	% of Total Plan	$Millions	% of Total Plan
Total Plan	$3,743	100%	$11	0.3%	$24	0.6%	$134	3.6%
VPIC Assets Under Management								
	$Millions	% of Total Plan	$Millions	% of Total XOM	$Millions	% of Total ThC	$Millions	% of Total FF
Total Plan	$3,743	100%	$10.9	0.3%	$23.9	0.6%	$134.0	3.6%
Asset Class								
Equities	$1,508	40%	$10.0	92%	$21.9	92%	$106.1	79%
Equities Commingeled	$878	23%	$9.7	89%	$17.0	71%	$66.9	50%
Fixed Income Total	$1,194	32%	$0.9	8%	$2.0	8%	$19.3	14%
Fixed Income Commingled	$694	19%	$0.9	8%	$0.4	2%	$12.7	9%
Absolute Return	$648	17%	$0.0	0%	$0.0	0%	$7.8	6%
Alternatives	$393	11%	$0.0	0%	$0.0	0%	$0.7	1%

The fixed income asset class held no positions in Exxon or thermal coal companies, and accounted for 2% of VPIC's exposure to fossil fuel companies. Absolute return strategies held no positions in Exxon or thermal coal companies. The absolute return asset class held $7.8 million, or 6% of VPIC's exposure to fossil fuel companies. Among the alternative investments – commodities, real estate and private equity, none of these asset classes held any of the fossil fuel companies under review. VPIC's private equity manager, Harbourvest, estimated that across all VPIC private equity funds, there were investments in private fossil fuel companies estimated at approximately $0.7 million of the total $48 million allocated to private equity within the $393 million allocated to Alternatives. Private equity accounted for approximately 1% of VPIC fossil fuel exposure. The commodities strategies do not invest in companies, but in commodities futures. VPIC's Real Estate managers only invest in real estate, not fossil fuel companies.

Due to the concentration of VPIC's fossil fuel investments in equities, SSGA holds the largest share of VPIC's fossil fuel investments. SSGA manages five passive equity funds for VPIC, and one passive bond fund. Combined, SSGA manages approximately 25% of VPIC's total assets, and held 100% of VPIC's exposure to XOM, 36% of the exposure to thermal coal, and 44% of its exposure to fossil fuel securities.

VPIC's total percentage exposure to fossil fuels, thermal coal and Exxon were each less than that of an equity reference benchmark presented in VPIC performance reports – the MSCI ACWI. At 3.6%, VPIC's actual exposure to fossil fuels was significantly lower than the benchmark. VPIC fossil fuel exposure was approximately half (54%) the 6.6% exposure of the MSCI ACWI exposure. Similarly, VPIC's Exxon exposure was 0.3% of its total portfolio, compared to 1.1% of the MSCI ACWI. VPIC's 0.6% exposure to thermal coal companies was below the 0.8% of the MSCI ACWI 0.8%.

VPIC Manager Exposure to XOM, Thermal Coal and Fossil Fuel Holdings
(June 30, 2016)

VPIC Total Actual Exposure to Fossil Fuels (June 30, 2016)	Total number of ACWI IMI companies	VPIC Market Value ($millions)	Percent of VPIC Market Value
VPIC Total		$3,743.2	100%
	Number of companies removed from ACWI	Assets reallocated within ACWI ($millions)	Percent of VPIC Market Value Reallocated
MSCI ACWI ex-Exxon	1	$10.0	0.3%
MSCI ACWI ex-Thermal Coal		$ 22.2	0.6%
MSCI ACWI ex-Fossil Fuels		$ 134.0	3.6%

VPIC Equity Reference Benchmark Exposure to Fossil Fuels (June 30, 2016)	Total number of companies	VPIC Market Value ($millions)	Percent of VPIC Market Value
MSCI ACWI	2,481	$2,433.0	100%
VPIC Equity Reference Fossil Fuel Divestment Scenarios			
	Number of companies removed from ACWI	Assets reallocated within ACWI ($millions)	Percent of VPIC Market Value Reallocated
MSCI ACWI ex-Exxon	1	$ 26.5	1.1%
MSCI ACWI ex-Thermal Coal	42	$ 20.0	0.8%
MSCI ACWI ex-Fossil Fuels	128	$ 161.3	6.6%

Source: MSCI and VPIC managers.

VPIC passive equity funds, consistent with their mandates, hold the greatest number of fossil fuel and thermal coal companies (Appendix 5). XOM, a U.S. large cap security, was held by the two VPIC large cap mandated passive accounts. VPIC had no assets allocated to large cap U.S. active managers, a highly efficient market. Thus, no active equity managers held Exxon securities.

The VPIC S&P500 index account held the largest dollar amount of fossil fuel investments. The SSGA MSCI ACWI ex-US passive account held positions in 147 fossil fuel companies, the highest number of fossil fuel companies. The two SSGA S&P500 accounts held the second highest number of fossil fuel companies - 27 in each portfolio.

VPIC active managers held modest to zero fossil fuel and thermal coal positions. No active equity manager held over 12 fossil fuel companies or over four thermal coal companies. Commingled Emerging Market active manager, Aberdeen, held the largest assets in fossil fuels among active equity managers, with $24.3 million aggregate invested in six fossil fuel holdings (0.65% of VPIC total portfolio AUM), and $9.8 million in three thermal coal companies. Among the active fixed income managers, Guggenheim high yield held the most (eight) fossil fuel companies with combined $4.4 million in fossil fuel assets.

Potential Impacts of Divestment

The information presented below on the potential financial impacts of divestment seeks to incorporate each individual VPIC manager's assessment of these impacts. This approach allowed us to analyze estimates of a hypothetical impact on historic returns had VPIC mandated divestment, and estimate costs based on each manager's detailed information on their mandate and strategy for VPIC. We confine our financial estimates to the impacts reported by VPIC's managers. Thus, this report excludes estimates of potential returns foregone due to the future value of costs or return losses that cannot be reinvested.

Financial Risk and Returns

By definition, divestment reduces diversification and thus increases risk. Divestment of a broad set of securities typically introduces a greater reduction in diversification. Among the three divestment tracks, fossil fuels carry the greatest diversification risk, followed by thermal coal, then ExxonMobil. Because of the minimal exposure to thermal coal and ExxonMobil in the VPIC portfolio, in our opinion, the impact of increased diversification risk of either of divestment strategy is not material.

Most of the information we received from the VPIC managers on risk and returns that we found comparable enough to report, concentrated on each manager's historical actual return results compared to the hypothetical results had they excluded fossil fuels, thermal coal, or ExxonMobil from their VPIC investment portfolios.

In our opinion, going forward, rates of return differences between VPIC's actual portfolio and its hypothetical portfolios under divestment cannot be estimated. Future returns and the timing of different returns cannot be projected based on historic returns, either for the fossil fuel industry, or for individual companies, such as ExxonMobil. In our opinion, carbon prices in particular are heavily influenced by government policies. Without consistent international policy frameworks that support a transition to a low carbon economy, we will face continued uncertainty in fossil fuel markets generally. Within that, thermal coal most likely faces the most immediate risks from a global transition to a low carbon economy.

PCA analyzed VPIC managers' hypothetical historic rates of returns for trailing one-year and five-year under the three divestment scenarios. The results show that under divestment VPIC managers would have had mixed results compared to their actual historic performance for VPIC – some marginally better and some marginally worse rates of return than their actual returns.

The VPIC manager managers provided estimates of the impact on returns under the three different divestment scenarios for the trailing one year and five years ending June 30, 2016 (Appendix 6). The equity managers each had a five-year track record for VPIC. Few managers had 10-year or longer term track records with VPIC for the current strategies. The fixed income, absolute return, and alternatives managers often had shorter VPIC track records.

Because each manager determined their hypothetical return estimates under divestment based on assumptions that they felt made the most sense for the fund/s they manage for VPIC, an aggregate total VPIC portfolio return estimate is not available. To provide some VPIC-wide portfolio estimates of divestment returns, we used the VPIC reference portfolio for its overall equity exposure from all asset classes – MSCI ACWI. As shown below, trailing one year returns ending June 30, 2016 for the MSCI ACWI were -3.7%. The MSCI ACWI ex-thermal coal and ex-fossil fuel indexes generated marginally better returns than the underlying benchmark during this period.

MSCI ACWI Trailing Returns Compared to MSCI ACWI ex-Thermal Coal and ex-Fossil Fuel Indexes

Asset Class	Account	Assets Under Mgt		Trailing Returns							
				1-Year				5-Year			
		(%)	(Millions)	ACWI	x-XOM	x-ThC	x-FF	ACWI	x-XOM	x-Thc	x-FF
Total Plan		**100.0%**	**$3,743.2**								
MSCI ACWI (65% of VPIC Reference Portfolio)				-3.7	-	-3.5	-3.4	5.4	-	5.7	8.0

Source; MSCI

For the five-year period ending June 30, 2016, the ex-thermal coal and ex-fossil fuel indexes show better returns than the underlying benchmark, with the ex-fossil fuel outperforming by over 2.5 percentage points during this period which was marked by a dramatic drop in oil prices.

The table below identifies the number of VPIC managers that estimated under divestment that they would have generated trailing rates of return below the actual rate of return they generated for VPIC. For the trailing one-year period, both passive managers holding XOM estimate that the returns had they excluded XOM would have been below the actual rates of return for VPIC. Two of the three managers holding thermal coal, and four of the 10 equity managers that held fossil fuels, estimate their returns would have been reduced had they excluded the thermal coal companies they held during that period.

Number of Managers with Trailing x-XOM, x-ThC or x-FF returns below actual						
	1 Year			5-Year		
	x-XOM	x-ThC	x-FF	x-XOM	x-ThC	x-FF
Equities						
Total Number of funds	10	10	10	10	10	10
Number of funds holding some FF securities	2	6	10	2	6	10
Number of funds with x-FF below actual return	**2**	**4**	**4**	**0**	**2**	**3**
Fixed						
Total Number of funds	9	9	9	5	5	5
Number of funds holding some FF securities	0	3	5	0	1	2
Number of funds with x-FF below actual return	**0**	**2**	**2**	**0**	**1**	**0**
Absolute Return						
Total Number of funds	4	4	4	4	4	4
Number of funds holding some FF securities	0	1	1	0	1	1
Number of funds with x-FF below actual return	**0**	**0**	**1**	**0**	**0**	**1**

The trailing five-year estimates by VPIC managers show that during this trailing period, a minority of managers would have hypothetically generated returns under these divestment scenarios below their actual returns.

We note that the estimates of fixed income securities historic returns can be more challenging than that for equities because bonds have specific maturity dates and issue dates. We confirm that VPIC's passive core bond manager, SSGA, which held fossil fuel securities historically during the trailing five-year period, conducted the additional analysis to identify corporate bonds by the fossil fuel companies identified for this report that may have expired before June 30, 2016, but that were part of the VPIC portfolio during the trailing 1-year or 5-year period.

In PCA's opinion, the hypothetical return estimates based on historic divestment scenarios cannot be used to project future returns. Overall market dynamics can shift the performance of fossil fuel stocks compared to the broader economic index and would affect all managers, passive and active. Potential performance going forward of active managers, without fossil fuel restrictions, and with fossil fuel security restrictions by VPIC will also be affected by how their security selection without restrictions will compare to a restricted portfolio.

Costs

Management Fees from Portfolio Restructuring

Based on the structure of the VPIC portfolio, the largest measurable explicit costs of divestment for the VPIC portfolio are expected to be ongoing increased management fees. Management fees would increase under any of these divestment scenarios because VPIC commingled funds held the bulk of VPIC's fossil fuel. VPIC cannot divest from individual securities in commingled funds. VPIC's commingled funds would have to be closed, and the assets reallocated into materially higher-cost SMA funds. The

ongoing higher fees would be proportionally higher for divestment scenarios with the lowest amount of assets to be divested because the fee changes would be the same, whether VPIC restructured to divest just from ExxonMobil, or to divest from all fossil fuels.

VPIC held fossil fuel securities in a total of nine commingled funds that held public securities The private equity portfolio also held fossil fuel assets. Among the nine commingled funds with publicly held securities, manager responses indicate that three of the funds would be cost prohibitive to move to an SMA structure, due to the relatively small AUM in each fund (Appendix 7). These commingled funds were the SSGA S&P Mid Cap, SSGA MSCI ACWI ex-US, and SSGA Barclays Aggregate. The managers of five other commingled funds indicate that fees would be meaningfully increased under a SMA structure. In addition to higher management fees, VPIC would have to pay its custodian to open and maintain custody of any securities held in an SMA that, in comingled funds, are part of the manager fees. Not all VPIC managers offered estimates of fee changes for this report.

As an example, VPIC's largest exposure to fossil fuels in a single account was $27.4 million (20% of VPIC's total fossil fuel exposure) held in the SSGA S&P500 comingled passively managed account. In total, this account held $453 million VPIC assets on June 30, 2016. SSGA's preliminary fee estimates indicate that, should VPIC restructure this comingled account into an SMA, the annual fee increase per annum would be approximately $65,000, added to VPIC's current annual fee of $137,500 per year. Over 30 years, divestment from VPIC's largest fossil fuel holding would result in $1.95 million net additional fees that would be costs rather than invested.

VPIC's largest exposure to thermal coal in a single account was $9.8 million (44% of total thermal coal exposure) was found in Aberdeen's Emerging Market Equity commingled fund. Aberdeen managed $247 million VPIC assets in this account. Aberdeen's preliminary fee estimates indicate that, should VPIC restructure this comingled account into an SMA, the annual fee increase per annum would be approximately $132,500, added to VPIC's current annual fee of $1,867,000 per year. Over 30 years, divestment from VPIC's largest thermal coal holding would result in $3.98 million net additional fees that would be costs rather than invested. These management fees do not include the additional ongoing cost to open and maintain a separate account at VPIC's custodian to house these emerging market securities. Emerging market custodial fees are meaningfully higher than those for large developed markets.

One commingled fund, (GAM fixed income unconstrained portfolio), suggested that the cost would be minimal to move VPIC to a different class without fossil fuels. GAM, which managed 3.5% of VPIC assets, held no XOM, and such a minimal exposure to thermal coal and fossil fuels that they responded that the exposure would be de minimis. VPIC's SMA managers reported that fees would remain largely unchanged.

VPIC's private equity manager, Harbourvest, indicated that fossil fuel divestment would require selling all holdings on the secondary market, likely at a significant discount to Net Asset Value (NAV). To reinvest those assets without fossil fuel exposure, Harbourvest suggested that VPIC would have to move their assets to a co-investment fund with opt-out provisions to opt out of any fossil fuel related securities.

Transaction Costs

For this report, we identify transaction costs strictly as the costs to sell (divest) securities that were in the VPIC portfolio. This definition differs from the broader use of transaction costs in the VPIC staff divestment report. The VPIC report includes direct security transaction costs and the portfolio restructuring costs discussed above in transaction costs. Transaction costs as defined here are not relevant to VPIC's comingled fund managers, where the vast majority of VPIC's fossil fuel positions were held because they cannot divest individual securities.

VPIC could divest from its SMAs, so transaction costs for selling these securities are relevant to VPIC's SMAs. VPIC SMA managers estimated the transaction costs to divest. Combined together for all VPIC SMA managers, the transaction costs for SMA divestment were estimated at, $185,422 for fossil fuels, $35,914 for thermal coal, and $68 for ExxonMobil divestment (Appendix 8). In our opinion, these small numbers are consistent with the small exposure to fossil fuels in VPIC SMAs and the market dynamics for the fossil fuel companies in the MSCI ACWI. These securities IMI trade in highly liquid markets.

We note that estimating transaction costs for corporate bonds is more difficult than estimating these costs for equities. Bonds trade based on the bid-ask spread at any given moment, thus, depending on when the manager assumes the divestment would occur, the estimate can vary. In total, we find that SMA manager estimates of transaction costs to divest from VPIC fossil fuels, thermal coal or Exxon would be de minimis.

In addition to restructuring and transaction costs, VPIC monitoring costs would increase under divestment scenarios to insure compliance throughout the portfolio of VPIC manager's compliance with VPIC-specific divestment lists. Opportunity costs are expected to vary depending on the manager's target market, and timing.

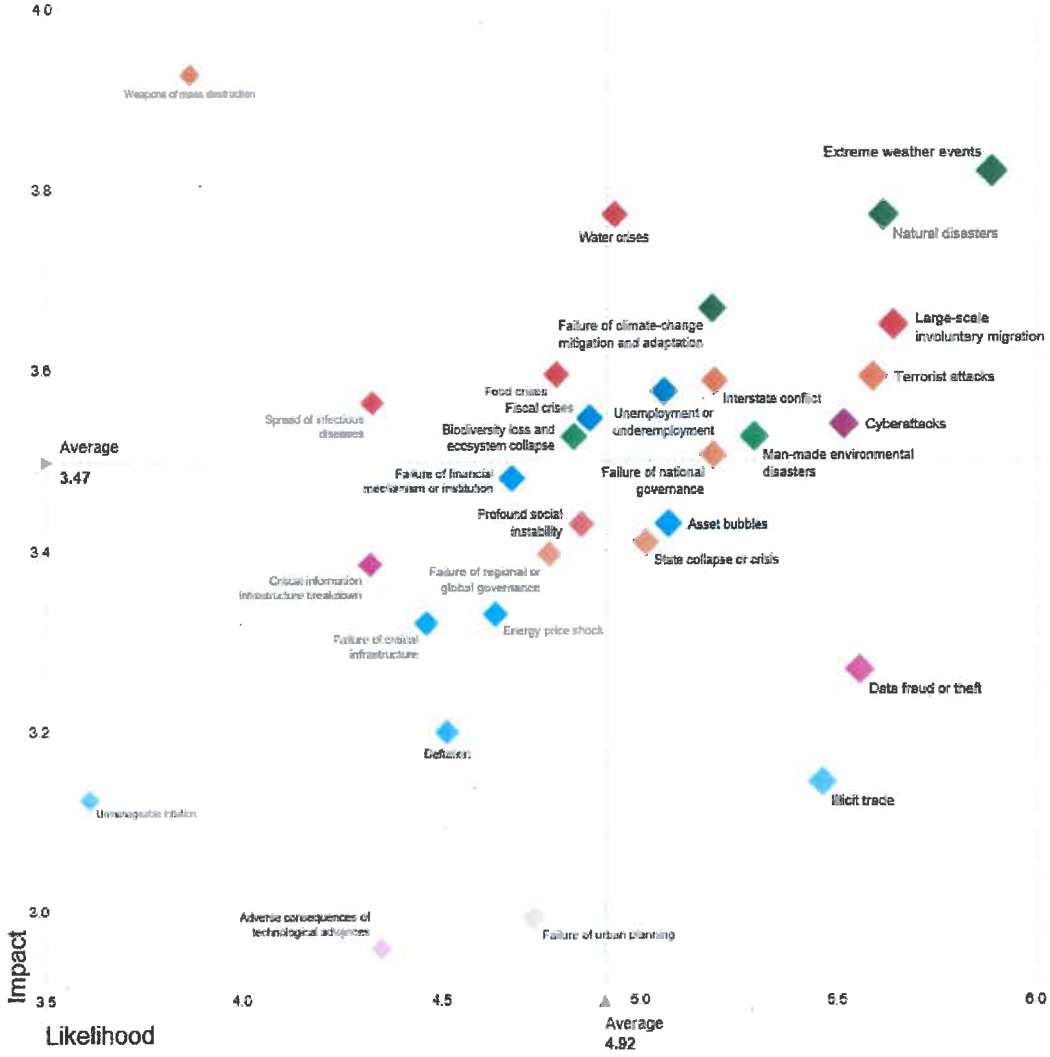
Climate Risks

The above analysis focused on divestment impacts, including costs, returns and diversification risk. In this section, we provide background on the climate risks that motivate portfolio management efforts to assess, monitor and manage these risks, including fossil fuel divestment. We then consider the potential impact of divestment in managing these risks.

There is growing evidence that significant risks face the global economy and investors from climate change. As reported in "Assessing the Global Climate in 2016" by the NOAA National Centers for Environmental Information ("NCEI"): "the globally averaged temperature over land and ocean surfaces for 2016 was the highest since record keeping began in 1880,"..."surpassing the previous record set the previous year".

In January, 2017, ahead of its annual meeting of global political and business leaders in Davos, Switzerland, the World Economic Forum ("WEF") reported climate change is growing in prominence as "humanity's biggest threat". The WEF surveyed 750 experts on what the most likely and impactful risks facing humanity are in 2017. Extreme weather events ranked as the highest likelihood, second only to weapons of mass destruction in severity of impact. Three of the 2017 top five risks in terms of impact were environmental related: extreme weather events, water crises, and failure of climate-change mitigation and adaptation.

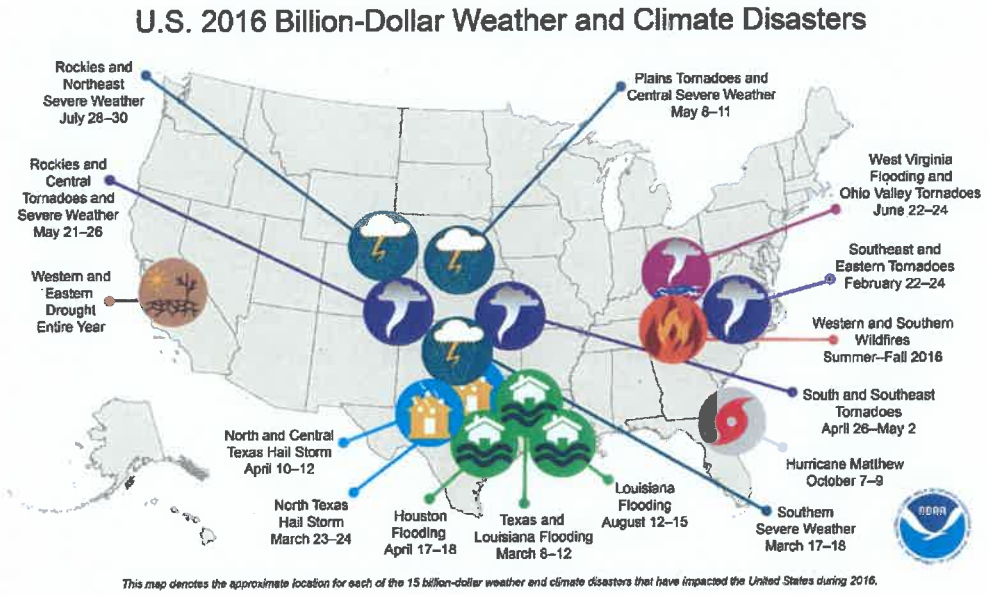
World Economic Forum: 2017 Global Risks Landscape



Source: World Economic Forum

Data reported from the United States shows the recorded physical effects of weather and climate disasters are increasing. The NCEI reported in "Assessing the Global Climate in 2016":

> "In 2016, there were 15 weather and climate disaster events with losses exceeding $1 billion each across the United States. These events included a drought event, 4 flooding events, 8 severe storm events, a tropical cyclone event, and a wildfire event...The U.S. 4 billion-dollar inland flood events during 2016, doubled the previous record, as no more than 2 inland flood events have occurred in a year since 1980… Overall, these events resulted in the deaths of 138 people and had significant economic effects on the areas impacted. The 1980–2016 annual average is 5.5 events (CPI-adjusted); the annual average for the most recent five years (2012–2016) is 10.6 events (CPI-adjusted)."



Source: National Centers for Environmental Information

The information above illustrates that there appears to be a growing consensus, and increasing factual information indicating that global climate-related risks are increasing. In a paper published in *Nature* in 2015, Marshall Burke, Solomon Hsiang, and Edward Miguel, economists based at Stanford and the University of California Berkeley, presented a new analysis that found that:

> business as usual emissions throughout the 21st century will decrease per capita GDP by 23% below what it would otherwise be, with the possibility of a much larger impact. Secondly, they conclude that countries with an average yearly temperature greater than 55°F will see decreased economic growth as temperatures rise. For cooler countries, warming will be an economic boon. This non-linear response creates a massive redistribution of future growth, away from hot regions and toward cool regions, with countries like those in Scandinavia likely experiencing substantial benefits, while those in hot regions through Asia, Africa, and the Americas, as well as island nations, facing potentially huge losses.

Research from different perspectives illustrates that climate change may impact many industries, but in different ways. For example, SASB's October, 2016 Climate Risk Technical Bulletin finds that climate risk is ubiquitous. SASB identified material financial impacts from climate change for companies in 72 out of 79 industries, representing $27.5 trillion, or 93% of the U.S. equity market. In the forward to the SASB bulletin, Henry M. Paulson, 74th United States Secretary of the Treasury, Co-Chair, Risky Business Project, and Robert E. Rubin, 70th United States Secretary of the Treasury, Member, Risky Business Project highlight that: "As this new report from SASB makes clear, no matter what actions we take tomorrow, there are real, material climate risks that have already been "baked in" to the economy." Paulson and Rubin cite three examples out of the many areas SASB found to be vulnerable to climate risk.

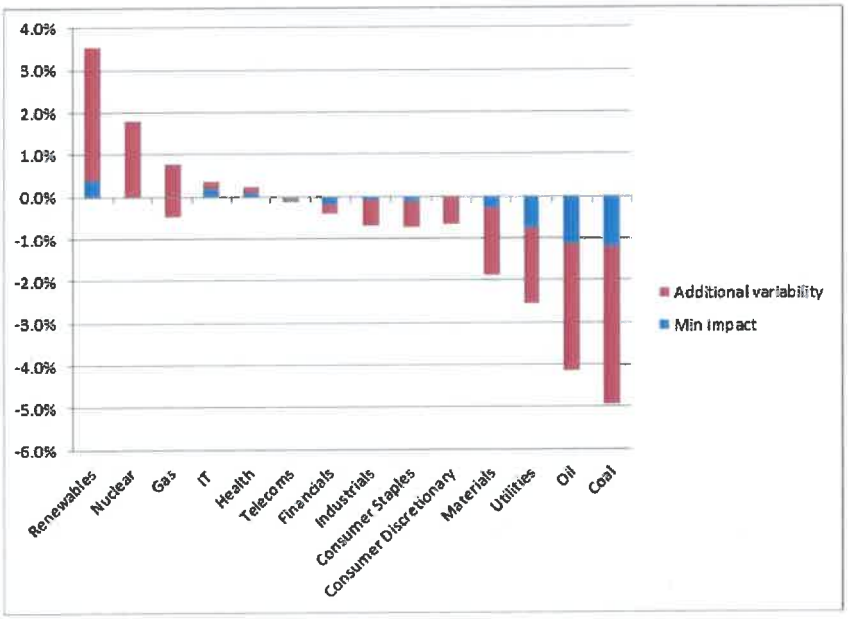
> Agricultural companies: Extreme weather events, heat, and humidity can materially affect the industry's production efficiency and supply chain.
>
> Commercial and residential real estate: Sea level rise and increased storms are expected to have significant consequences on coastal property and infrastructure.

> Manufacturing industry: Dangerous levels of extreme heat and rising seas may cause large disruptions in supply chain operations and labor productivity--especially as many manufacturing plants are located in high-risk areas such as the Southeast.

The non-renewable energy sector can be materially affected by a global shift toward renewables. Government energy policies can exert a material influence on energy markets. Governments are adopting different energy policy approaches to potential climate risks. Some governments are actively moving to support a transition to a low carbon economy. For example, France passed a law mandating that investors and banks report on the carbon risks and climate friendliness of their portfolios, with disclosures separated between carbon risk and friendliness objectives. In December 2016, France inaugurated the world's first 'solar highway', a road paved with solar panels that are expected to provide enough energy to power the street lights of the small Normandy town of Tourouvre. According to Bloomberg, Colas SA, a subsidiary of France's construction firm, Bouygues Group, has plans to test the technology across four continents at 100 sites in 2017. Saudi Arabia, one of the world's biggest oil producers is seeking up to USD 50 billion of investment in solar and wind energy. U.S. policy may support fossil fuels longer than other countries. In that event, U.S. fossil fuel companies may fare better, and U.S. low carbon technologies may fare worse in the near to medium term than their respective non-U.S. counterparts from countries that provide a policy framework aimed at supporting a transition to a low carbon economy. Over the long term, if the global markets transition to low carbon energy, U.S. companies may be less competitive than counterparts from countries whose governments developed clear energy transition policies.

Mercer finds in its 2015 report "Investing in a Time of Climate Change", that:

> climate risk impacts may vary considerably among industries...The figure below shows the potential climate impact on median annual returns for industry sectors over the next 35 years... The energy sector is broken into its sub-sectors, as one of the most negatively impacted industries in Mercer estimates.



Source: Mercer

Results such as Mercer's can be used as reinforcement of an argument for sector-wide fossil fuel divestment based on the potential for stranded fossil fuel assets. UBS's 2016 paper, "Stranded Assets:

What lies beneath" provides an analytical framework for thinking about the stranded assets debate, based on a study led by Dr. Dinah Koehler and Bruno Bertocci of the UBS Sustainable Investors team. Using scenario analysis, they isolate how publicly traded oil and gas companies may be affected by a steep drop in future consumption of oil and gas.

The author's key conclusions include:

> "Any analysis of the investment implications of the stranded assets hypothesis must take market pricing and dynamics into account; Not all asset value associated with reserves are automatically lost. It depends on whether the price of oil justifies the effort to extract and produce a barrel of oil; at any moment in time a certain amount of known oil and gas reserves cannot be economically produced; even under the most extreme scenarios of reduced oil/gas consumption, many oil/gas companies in the MSCI World Index retain value in the next 10-20 years; There are some oil/gas companies that are not an attractive investment today, and continue to lag behind their peers at various future scenarios; If divestment is chosen as an investment strategy, it should be targeted at those oil/gas companies where the investment is unlikely to be recovered or exceeded in the next 10-20 years."

In our opinion, climate risks to investments, including potentially stranded assets, have become a potentially material investment issue. We believe divestment of fossil fuels, based on the definition employed here, could directly address the risk of potentially stranded assets, primarily in public equities. Divestment of thermal coal could directly address potential stranded asset risk within the sub-sector of fossil fuels that is perhaps at highest risk of becoming stranded. Thermal coal is viewed as a type of fossil fuel that is at highest risk of becoming stranded due to its relatively high carbon emissions. Divestment from Exxon would not significantly reduce VPIC's total exposure to stranded assets.

We believe divestment of all fossil fuels is a blunt tool to apply across a large industry that exhibits varied outlooks for each type of fossil fuel. As one VPIC manager stated "with regard to the stranded asset thesis, Mondrian does not believe the risk of stranded assets applies equally across the fuels as the world must consider the substitutability of each fuel, and the cost to implement substitution. Mondrian believes coal is most at risk, given its higher carbon intensity and the ease of substituting its use in generating electricity. Oil, while next in line in terms of carbon intensity, is primarily used in transportation, and despite multi-year investments in alternatives, the world still has not found an economically viable substitute. Finally, gas, with its lower carbon intensity, would appear to have the lowest risk of stranded reserves."

Divesting from a single fossil fuel company, in this case ExxonMobil, in our opinion, raises additional company-level investment questions. In our opinion, it is not already determined which energy companies will become obsolete, and which will manage to transition to a new energy economy over time. It is conceivable that a dominant fossil fuel company of the 20th century transitions to become a powerful force in a 21st century (or beyond) low carbon energy global economy.

For example, in January 2017, oil and gas majors, Royal Dutch Shell and Total SA announced, along with Toyota Motor Corp. and four of its biggest car-making peers, plans to invest a combined $10.7 billion in hydrogen-related products within five years. In all, 13 energy transport and industrial companies are forming a hydrogen council to consult with policy makers and highlight its benefits to the public as the world seeks to switch from dirtier energy sources, according to a joint statement issued from Davos, Switzerland. The wager demonstrates that batteries aren't the only way to reduce pollution from cars, homes and utilities that are contributing to climate change.

On another front, Royal Dutch Shell, SABIC and Dow/DuPont have made strategic moves to change how petroleum is used, from mostly combustion, which generates carbon emissions, to mostly materials (polymers). Shell's chief oil and gas scientist, Joe Powell, told colleagues at Massachusetts Institute of

Technology that there is no reason the industry could not completely flip the ratio, with 80 percent of oil and gas going to material feedstocks. Such a move could, on the one hand, make use of a stranded resource (oil and gas), and on the other fill a resource vacuum (low carbon building materials). Buildings account for about 30 percent of emissions, about half of which comes from the "embodied" carbon emissions of the building itself -the energy it takes to make the building materials, transport them and build the building. Portland cement alone accounts for five percent of all carbon emissions worldwide. Steel and aluminum require intense industrial heat to manufacture. Lumber, in general, needs to stay in the ground as trees to sequester as much atmospheric carbon as possible. With the world in the midst of an unprecedented period of urbanization, and three billion people set to enter the global middle class in the coming decades, emissions from construction are at an all-time high.

In our opinion, divestment from a single fossil fuel company does little to reduce VPIC's stranded asset risk overall, and raises company selection risks in a period of enormous energy transition. In our opinion, because of the global dependence on fossil fuels, divestment of all fossil fuels could expose VPIC to technological shift risks if divestment is not phased in over a long, for example, 30-year period.

Phasing in Various Fossil Fuel Divestment Strategies

A short-term divestment phase-in would likely incur essentially the same magnitude of costs as immediate divestment, and may be at a poor time in the energy market. In our opinion, divestment of fossil fuels over a business cycle time frame would not address the key long-term divestment risk of global dependence on fossil fuel energy. A long term, for example, 30-year divestment, geared toward implementation over a technological change cycle that was taken in incremental steps throughout the portfolio, with regular review and reassessment, could smooth out divestment impacts. The increases in management fees required to dismantle VPIC's inexpensive commingled funds and restructure those assets into more expensive SMA's would still be borne by VPIC, just spread out over time. However, a long-term strategy might increase VPIC's asset allocation analyses costs and staff and Board review time.

Financial analysts vary on near-term prospects for fossil fuel companies, as they do on other market investments and the market as a whole. For example, VPIC International Equity manager Mondrian responded to this survey with the overview perspective that "Our analysis indicates that fossil fuel companies, despite low long term growth, are undervalued. We believe the portfolio would lose exposure to the potential real returns offered by these companies, should they be divested". Macquarie Research (October 13, 2016) held a different opinion: "The [integrated oil] sector still looks expensive versus global markets, with forward PERS [price earnings ratios] at historical highs relative to normal levels despite the recent sharp fall (the integrateds traditionally trade at 20-30% discounts to the key indices)."

Long term outlooks for the carbon energy market also range widely. The U.S. Energy Information Administration, International Energy Outlook 2016 estimates fossil fuels to have accounted for 84% of world energy consumption in 2012, nuclear 4%, and other, which includes renewables, at 12%. Overall world energy consumption is projected to grow at an annual average rate of 1.4% through 2040. By 2040, fossil fuels, combined (liquids, natural gas and coal) are projected to account for 78% of total world energy consumption.

World Energy Consumption			
	History	Projections	
Fuel	2012	2040	Average Annual Percent Change, 2012-40
Liquids	33%	30%	1.1
Natural Gas	23%	26%	1.9
Coal	28%	22%	0.6
Nuclear	4%	6%	2.3
Other (renew)	12%	16%	2.6
Total	**100%**	**100%**	**1.4**

Source: U.S. Energy Information Administration

Optimistic predictions, such as in the International Energy Association's ("IEA") 30-year forecasts expect continued strong global demand for oil and gas, based on increasing population, and expected inability of the global economy to meet those demands with renewables and energy efficiency.

Because PCA's mandate for this research involved discussion of potential divestment from a single company – ExxonMobil, for this report, we asked ExxonMobil and three competing integrated oil and gas majors (Chevron, Royal Dutch Shell and BP) to provide us with answers to specific questions regarding the potentially material risks regarding environmental concerns. Specifically, we asked each firm to provide data according to SASB's accounting standards and metrics for this industry sector. We received no response from Chevron, Shell or BP. Exxon's responses to our questionnaire for this report echo the long-term optimistic assumptions of the IEA (Appendix 9).

At the other extreme, as reported by Responsible Investor, Lou Allstadt, former Executive Vice President at Mobil Oil involved in the ExxonMobil merger in 1999, and current town trustee of Cooperstown, N.Y. which divested its de minimis exposure to fossil fuels, questions the survival of the oil majors "I don't think they are going to survive, I personally divested from ExxonMobil three years ago and reinvested in renewables. Allstadt also referred more broadly to the weak financial conditions that fossil fuels companies are facing. He stated they are being "squeezed from all sides", low prices which force them to increase borrowing, reduce share buybacks, dividends and investments in new projects, OPEC's ability to destroy their profitability by driving down oil prices through output fluctuation, or increasing government regulation and competition from cleaner sources of energy, among other factors.

Some observers feel that the reason the 2015 Paris Agreement succeeded was because the technological advances and potential competitiveness of renewables make them economically viable in a way they were not even five years prior. From this latter perspective, Carbon Tracker Executive Director Mark Campanale argues that from an engagement perspective, shareholders and regulators should put fossil fuel companies into an 'orderly wind down' while increasing investment in renewables.

More generally, the Risky Business November 2016 report, "From Risk to Return: Investing in a Clean Energy Economy" finds that "seriously addressing climate change requires reducing greenhouse gas emissions by at least 80 percent by 2050 in the U.S. and across all major economies". The report finds that this goal is "technically and economically achievable using commercial or near-commercial technology". The report is a product of the Risky Business Project, co-chaired by financial leaders involved in efforts to reduce climate change risks - Michael Bloomberg, Henry M. Paulson, Jr. and Thomas Steyer. The 2014 inaugural report "Risky Business: The Economic Risks of Climate Change in the United States" found that the economic risks from unmitigated climate change to American business and long-term investors are large and unacceptable. This second report turns to the question: how to respond to those risks. Risky Business modeled four different potential approaches, without endorsing

any approach, including: 1) Rely heavily on renewable energy, 2) Significantly expand reliance on nuclear energy, 3) Include a substantial amount of fossil fuel power plants with carbon capture and storage, and 4) generate electricity from a relatively even mix of these three zero- and low-carbon resources. "Given an appropriate policy framework, we expect these investments to be made largely by the private sector and consumers, and to yield significant returns." The report argues that "the large investment needs of a transition to a clean energy economy are manageable, especially when compared to the costs that would be imposed by unmitigated climate change and continued fossil fuel dependence, and comparable to other recent investments, such as in unconventional oil and gas production, and in computers and software. Those investments have transformed the American economy, yielding huge returns to those businesses that led in the development of new technologies and products."

In our opinion, a long-term divestment strategy would likely bear less market risk than an immediate fossil fuel divestment strategy that cannot incorporate longer-term changes in technology and global policy.

Divestment within the Context of VPIC Governance Structure

Divestment of fossil fuels, thermal coal, or ExxonMobil should be considered in relation to the VPIC's governance structure, including its relation to VPIC's asset allocation, its equity investment strategy, and VPIC's approach to proxy voting and engagement.

VPIC Asset Allocation

As discussed above, divestment from fossil fuels, thermal coal, or ExxonMobil would require significant restructuring of the VPIC investment manager structure because of the dominant share of fossil fuel, thermal coal, and ExxonMobil exposure in commingled funds. To divest from fossil fuels, VPIC would likely have to conduct an asset allocation analysis that addressed how VPIC would restructure to accomplish divestment in its SSGA S&P Mid Cap 400 fund, its SSGA MSCI ACWI ex-U.S. fund, and its SSGA Barclays Aggregate Bond Index fund that each hold too few assets for VPIC to be able to transition to a SMA.

VPIC's overall investment strategy is designed to diversify among asset classes. As discussed above, we believe divestment of fossil fuels can be a tool primarily in public equities to remove exposure to potentially stranded fossil fuel assets. Divestment does not help VPIC manage other climate change material risks evident in other industries, or provide enhanced exposure to companies involved in energy efficiency and renewable energy. Divestment within VPIC's public equity asset class adds diversification risks if all fossil fuels are divested, and introduces technological shift risks if stocks are not divested over a long period. In our opinion, VPIC's limited exposure to thermal coal and to ExxonMobil would result in minimal diversification or technological changes risks from either of these divestment paths. Thermal coal and ExxonMobil divestment offer equally limited reduction in exposure to potentially stranded assets, compared to VPIC's overall investment portfolio.

In our opinion, divestment, with a proportional reallocation to non-fossil fuel companies increases investments in economic sectors:

- whose products and services generate demand for fossil fuel energy including utilities and transportation;
- that generate significant CO2 emissions, such as construction;
- that finance fossil fuel development; and

- face material physical risks of climate change including agriculture, real estate and consumer goods.

Divestment does not overweight VPIC's exposure to companies potentially stimulating and benefitting from low-carbon and renewable energy solutions.

Divesting from fossil fuel suppliers, in our opinion, has limited direct impact on fossil fuel corporate policies. PCA's 2014 review of the impacts of divestment found that studies suggest that the measurable financial impact on the companies targeted for divestment has been largely minimal. A comprehensive review (Oxford, 2013) found that divestment campaigns' successes have not been through the direct impact on the company's financials, but through a larger 'stigmatization' impact which resulted in successful lobbying of governments for restrictive legislation, which in turn could have meaningful effects on the business practices of targeted companies/industries. This study does not compare engagement strategies with divestment strategies.

Divestment from fossil fuels in the publicly listed bond market can be expected to have the same types of benefits and constraints as in equities. Because of VPIC's minor fixed income exposure to fossil fuel, thermal coal, or ExxonMobil, divestment impacts would be more muted than in equities. One difference between equities and bonds is that because new bonds are regularly issued, while divestment doesn't increase green bond exposure, investments in new green bonds can directly help provide financing for green initiatives.

Real Estate holds no fossil fuels as defined in this report. Divestment from fossil fuels does nothing in the real estate market to address the real physical risks that have become of increasing concern with climate change. Divestment and restrictions on future fossil fuel investments in private equity markets could protect VPIC from any stranded asset risk in its private equity portfolio. Divestment does not increase investments in green privately held companies. Unlike public equity, investment in green companies could directly provide financing to green initiatives.

VPIC's commodities asset class exposes VPIC to fossil fuel commodity markets through commodity futures investments. Divestment based on the definitions of used here for fossil fuels and thermal coal, is not relevant because the VPIC commodities asset class gains exposure through commodities futures, not holdings of any individual securities that own fossil fuel reserves. Any divestment from VPIC's commodities asset class would necessitate eliminating this asset class from VPIC's portfolio. Such an action would conflict with VPIC's current asset allocation strategy.

VPIC's absolute return asset class exposure to stranded assets, and to broader climate change risks, cannot be easily assessed. These assets are invested in some cases through fund of funds, and often through derivatives rather than direct holdings of securities of individual companies. In our opinion, the estimates that result from this study provide little insight into the potential risks to VPIC's absolute return managers in the event of any significant disruptive climate change risk.

In our opinion, addressing potential climate change risks and opportunities in the VPIC portfolio is best accomplished through a bottom up analysis within each asset class.

VPIC Equity Investment Strategy

VPIC allocates its publicly held equity assets primarily through passive investments to gain overall market exposure. As of June 30, 2016, 53% of VPIC equities were passively managed ($806.5 million). VPIC complements these investments with actively managed investments in discrete market segments where VPIC believes active management can increase its risk adjusted returns.

In our opinion, the risk of stranded assets is one of many potential long-term risks that VPIC must consider, including other climate risks in its passively managed equity funds, as discussed above. Today, VPIC's equities are managed against market-cap weighted indexes. These indexes do not explicitly account for potentially stranded asset risks. Market cap weighted indexes also include other biases. There exist a multitude of market wide benchmarks that seek to improve the overall risk adjusted return to investors over market-cap weighted indexes, including fundamental, equal-weighted, smart-beta, and a burgeoning plethora of ESG indexes. We believe other benchmarks may better balance potential stranded asset risk with other macro risks than can divestment.

Divestment constrains active managers in their mandate to find the best opportunities to invest. Thus divestment conflicts with the underlying reason VPIC pays active managers higher management fees than passive management. In the responses from VPIC equity managers, examples of this conflict with a divestment of fossil fuels were evident. For example, one manager, that held only a few fossil fuel stocks for limited periods during the trailing five-year period reports that, its 17-month overweight holding of one fossil fuel stock contributed 74 basis points to the VPIC portfolio, and its 22-month overweight holding of another fossil fuel stock contributed 46 basis points to the VPIC portfolio. In general, if VPIC active managers were prohibited from owning fossil fuels, rather than being allowed to selectively choose geographic, sector, and company weights, and buy/sell timing of each security, VPIC could not receive the full benefits of its active manager's selection expertise.

VPIC Monitoring, Proxy Voting and Engagement

VPIC monitors its investment active managers for exposure to climate change risks. VPIC acts as an active shareholder, and has developed robust governance efforts focused on climate change as part of its overall approach to governance. This includes development of VPIC's custom proxy voting guidelines which bring a strong and coherent approach to voting its proxies, co-filing shareholder proxy proposals, and corporate and public policy and regulatory engagement actions. Appendix 2 lists VPIC engagements in 2015 and 2016. These included actions at XOM and other oil majors, coal companies, and efforts to effect regulatory change around climate change risks and disclosure. VPIC's most recent activity regarding Exxon was in November 2016 when it co-filed with NY State an Exxon Mobil Resolution 2 degree reporting for the 2017 annual meeting.

In our opinion, divestment from fossil fuels would materially undermine VPIC corporate governance strategies. VPIC's actions to promote regulatory and policy changes regarding climate change risks could remain intact. However, divestment would negate VPIC's shareholder governance voting efforts in fossil fuel companies. In our opinion, VPIC and the Vermont Treasurer, supported by the VPIC staff, stand out as a leader in climate change proxy voting and engagement. Through such actions, VPIC has exerted influence beyond its size, in our opinion.

Market Options for Institutional Investors to Manage Climate Change Risks

Divestment as a strategy for exerting political influence to bring about social change has been influential in the modern economy back to the anti-apartheid campaigns that began in the 1970s. The anti-apartheid divestment campaigns, like today's fossil fuel divestment campaigns, began on university campuses, and influenced many endowments and foundations. U.S. public pensions plans today are subject to the same fiduciary obligations that they were during the anti-apartheid movement forty years ago. However, public pension plans have undergone major transformations, along with the U.S. economy. In the 1970s, Vermont pension plans, and most U.S. public pension plans were confined

to investing in high quality (not high yield) bonds, and were younger, growing plans. Today, Vermont and many U.S. public plans are mature plans that face many funding challenges. Like other plans, VPIC's asset allocation is now diversified to equities, globally, and across private investments, commodities, and absolute return strategies that didn't exist in the 1970s.

The institutional investment market and the organizations that exist to foster collaboration among like-minded institutional investors has evolved significantly since the well-known divestment movement surrounding South African Apartheid. In the 1970's, institutional investors, specifically U.S. public pension funds did not have the benefit of collaborative organizations to work together for common investment goals. Forty years ago, there was minimal coordinated effort by U.S. public pension funds on proxy voting or engagement with the companies in which they may have been invested. In our opinion, the organizational capacity of institutional investors has advanced materially since then. To mention a few examples, the U.S. Council of Institutional Investors was founded in 1985. In 2006, the Principles for Responsible Investment joined institutional investors globally. CERES was launched in 1989, with a mission to "mobilize investor and business leadership to build a thriving, sustainable global economy". Institutional investor organizations have grown surrounding accounting standards and reporting on ESG issues, including the Global Reporting Initiative. In the U.S., SASB incorporated in 2011 to develop and disseminate sustainability accounting standards.

Alongside these changes, financial markets developed multiple tools for institutional investors to address Environmental, Social and Governance ("ESG") concerns, including climate change risks and opportunities. Market forces continue to rapidly evolve the approaches available to address climate change risks. In our opinion, VPIC should consider divestment of fossil fuels, thermal coal, and Exxon within the context of the full set of options available. Each approach offers its own usefulness and limits, and each approach can reinforce other strategies to varying degrees. We consider the following approaches applied to climate change risks:

- divest
- monitor investment managers
- vote proxies
- engage with companies
- engage on regulatory issues
- invest in index funds or active managers

Peer Pension Plan Climate Change Survey Results

PCA surveyed VPIC peer U.S. public pension funds on climate change related investing strategies. We received twenty-six responses, representing a combined $887 billion AUM. The respondents range in size from $1.2 billion AUM to $195 billion AUM as of June 30, 2016, including nine plans under $5 billion AUM, 14 plans with between $5 -$100 billion AUM, and three plans over $100 billion AUM. The plan's dedicated investment staff range from 0 to 150. Fourteen respondents were state public employee plans.

Survey of VPIC Peers on Climate Change					
	VPIC	Under $5B AUM	$5-$100B AUM	Over $100B AUM	All Peer Plans
Number of Plans	1	9	14	3	**26**
Assets Under Management ($Billions)	$4	$1.2B-$4	$8-$68	$179-$195	**$1.2-$195**
Combined AUM ($Billions)	$4	$18	$315	$554	**$887**
Dedicated Investment Staff	2	0-4	Jan-52	59-150	**0-150**
			Number of Plans that responded 'Yes'		
Divested in relation to Climate Change Risk?	0	0	0	1	**1**
Exxon	0	0	0	0	0
Thermal Coal	0	0	0	1	1
Fossil Fuel	0	0	0	0	0
Stranded Assets	0	0	0	0	0
CO2 Emissions	0	0	0	0	0
Climate Risk	0	0	0	0	0
Measured Climate Change Risk and/or Opportunity of Total or Part of Portfolio?	0	1	0	2	**3**
Monitor Managers on Climate Change Risk and/or Opportunity of Total or Part of Portfolio?	1	1	1	2	**4**
Voted Proxies to Mitigate Climate Change Risk and/or increase Opportunity of Total or Part of Portfolio?	1	1	1	3	**5**
Engagement with individual companies on Climate Change Risk and/or Opportunities?	1	0	0	2	**2**
Action to make recommendations to regulators on Climate Change Risk and/or Opportunities?	1	1	0	2	**3**
Member of Institutional Investor organization/s that include a focus on climate change?	1	2	3	2	**7**
Adopted Climate Change Related Benchmark for Total or Part of Portfolio?	0	0	0	1	**1**
Invested in low carbon portfolio	0	0	0	2	**2**
Invested in Climate Change Opportunity	0	1	2	2	**5**

None of these pension plans have divested from Exxon individually, all fossil fuel companies, companies based on high stranded carbon reserve assets, high carbon emissions, or broader climate risk. One plan reported that under their Iran/Sudan policy they had a few fossil fuel related divestments. One plan with over $100 billion in AUM reported divestment from U.S. thermal coal companies.

We found a greater number of plans pursue proxy voting and/or investments in green/climate change opportunities than divest from any definition of fossil fuels. Five plans report voting proxies to mitigate climate change risk (three plans larger than $100 billion in AUM, one plan between $5 billion and $100

billion AUM, and one plan under $5 billion AUM). Five plans reported investments in green/climate change opportunities within different asset classes that include public securities, private equity and infrastructure, while two plans over $100 billion AUM have invested in a low carbon portfolio.

Seven of the 26 plans noted that they are members of institutional investor organizations that address climate risk related topics –including CERES/INCR, Council of Institutional Investors, Sustainable Accounting Standards Board ("SASB"), and UN Principles for Responsible Investing.

The September 2016 survey by the North Carolina Department of the State Treasurer entitled: "Long Term Stewardship: A pragmatic Approach for ESG Integration for Institutional Investment", included responses from 61 U.S. public pension plans ranging in size from less than $5 billion to greater than $100 billion. The survey concentrated on institutional approaches to ESG. The results were similar to those of this VPIC peer survey. Among the 61 public pension plans in the North Carolina study, 15% were found to be active on ESG factors, 26% were categorized as work in progress, and 59% were inactive. An investor was categorized as being "active" if it had an established ESG policy, incorporated ESG factors into either its investment or risk management process or had a systematic approach to corporate governance issues such as shareholder activism. One of the key observations based on the responses of the U.S. public pension plans touched on divestment, and reported similar results as this VPIC peer survey:

> "For most of the active plans, engagement with companies on ESG issues is viewed as being more impactful than divestment. This viewpoint is supported by empirical studies and the pensions' direct experience. Impactful corporate engagement is both time and staff intensive. Consequently, smaller plans are interested in collaborating with larger ones on certain shareholder resolutions. Plans may also outsource this activity to external firms that provide corporate engagement services." (Long Term Stewardship, page 9).

Divestment

To supplement our survey on divestment of fossil fuels by U.S. public pension funds, we reviewed other sources of U.S. public pension fund divestments. The December 2016 Arabella Advisors report: "The Global Fossil Fuel Divestment and Clean Energy Movement" made headlines in December 2016 by stating that the value of assets represented by institutions and individuals committing to some sort of divestment from fossil fuel companies has reached $5 trillion". The report states that "pension funds and insurance companies now represent the largest sectors committing to divestment, reflecting increased financial and fiduciary risks of holding fossil fuels in a world committed to stay below 2 degrees Celsius warming". PCA sought to identify which U.S. public pension plans were included in these numbers. We secured the list of U.S. pension plans from one of Arabella's partners who is credited with helping gather and analyze the data for the Arabella report – the Divest/Invest Network. The Divest/Invest organization identified seven U.S. public pension plans that have divested from some version of fossil fuel securities. We checked the information on each of the seven plans and found that only four of those seven plans have divested from any version of fossil fuels. For example, CalPERS, the largest plan among the seven, and the largest U.S. public pension plan, was included as having divested. To date, CalPERS has not divested from any fossil fuels, and has the issue under review. The largest U.S. public pension plan in the Divest/Invest list that has made any fossil fuel divestments is CalSTRS – a respondent to our survey.

The total market value of the fossil fuel divestments made by the four plans identified by Divest/Invest that have in fact made a fossil fuel divestment has been approximately $24 million, or 0.013% of their combined total plan assets of $193 billion. The plans include:

1) CalSTRS divested approximately $1.5 million in U.S. thermal coal, or 0.0008% of its $186 billion portfolio. CalSTRS is now analyzing whether non-US thermal coal divestment makes sense,

including looking at whether in some areas of developing countries, the only alternative to coal is even worse polluting wood burning fuels).

2) The District of Columbia divested roughly $21 million from the "Carbon Underground Top 200", or 0.03% of its $6.4 billion portfolio.
3) Providence, Rhode Island divested about $1.5 million in direct investments, or 0.6% of its $282 million portfolio, from the "Filthy 15" (mostly companies that own coal-burning power plants or coal mining companies).
4) The Village of Cooperstown, N.Y. reallocated approximately $8,386, or 0.9% of their total $900,000 AUM, when they moved their $140,000 investment in an S&P500 index fund to the SPYX ETF, which drops 29 fossil fuel stocks from the S&P500.

We conclude that divestment from fossil fuels is a sparsely used strategy among U.S. public pension plans, including by those plans, large and small, that are active on potential climate change risks to their investment portfolios.

In our opinion, divestment as a strategy is most closely aligned with traditional socially responsible investing (which often rests on 'negative' screening out of particular social outcomes) to impact investing. Negative screening seeks to achieve a social impact, and can seek both market or below or above market performance. While all investors typically prefer a competitive return, not all are legally bound to seek such returns. For example, individuals may decide they prefer investing in stocks that meet their social criteria, even with the expectation that their portfolio may generate below market investment returns. U.S. endowments and foundations are not bound by the same fiduciary framework as U.S. public pension funds.

As a strategy, in our opinion, divestment undermines institutional investor's ability to exercise their right to proxy votes and engagement with individual companies. For institutional investors actively voting proxies and/or engaging corporations, divestment's lack of consistency with such efforts can be meaningful. In cases where it is determined that proxy voting and engagement strategies are not useful, divestment may not pose a conflict with other institutional investor efforts. Such a determination can only be made, in our opinion, on a case by case basis, looking at the long-term potential for engagement. As with investment strategies, such a determination can and should be expected to differ among different institutional investors.

Invest in Low Carbon or Green Tilted Index Fund(s)

Index providers and investment managers are developing new products to address climate change concerns of investors. Most major index providers now offer ex-fossil fuel indexes. The major index providers also created low carbon and green indexes, and broader ESG indexes that incorporate governance and social factor ratings alongside environmental ratings. Instead of removing specific stocks from an underlying benchmark, these indexes seek to reduce the tracking error of the climate change related index to its underlying benchmark by reweighting the stocks in the index to reduce, for example, carbon emissions exposure, or increase, for example, exposure to non-carbon and carbon reduction energy products, while maintaining a narrow tracking error to the underlying benchmark.

We use as an example below, MSCI's climate risk related indexes as compared to the MSCI ACWI, an equity reference benchmark for VPIC. As shown below, the MSCI ACWI Low Carbon Index maintained a 0.4 tracking error to the MSCI ACWI during the trailing five-year period ending June 30, 2016, while the MSCI ACWI ex-Fossil Fuel deviated from the underlying passive benchmark by 1%. During this five-year period, the MSCI ACWI ex-Fossil Fuels index outperformed both the MSCI ACWI and the MSCI ACWI Low Carbon indexes in returns, as oil prices plummeted. In periods of rising oil prices, such as began in 2016 and are anticipated to continue in 2017 and 2018, the removal of fossil fuels may well be a drag on the portfolio returns.

For passive investments seeking market wide exposure, a key advantage of low carbon indexes such as MSCI's is that deviations from the underlying benchmark are kept within a narrow range by design. MSCI's ESG Index ranks companies based on ESG scores and key ESG controversies, and also sets a range for deviation from the underlying benchmark. The tracking error for MSCI's ESG index is designed to be somewhat wider than that of its Low Carbon Target Index. The MSCI ACWI ESG outperformed the ACWI and ACWI Low Carbon Target during this period.

Performance and Risk Data (periods ending June 30, 2016)					
Name of Index	**ACWI**	**ACWI ESG**	**ACWI LOW CARBON TARGET**	**ACWI ex COAL**	**ACWI ex FOSSIL FUELS**
Annualized Return Gross of License Fees)					
5-year Return	5.95%	6.71%	6.28%	6.28%	7.15%
Volatility (Standard Deviation)					
5-Year Risk	13.54%	13.07%	13.53%	13.42%	13.19%
5-Year Tracking Error	0.00%	1.10%	0.41%	0.26%	1.03%
5-Year Sharpe Ratio	47.85%	54.54%	50.15%	50.50%	57.32%
5-Year Maximum Drawdown	17.33%	15.98%	17.19%	17.06%	16.75%
No. of Constituents	2,481	1,221	1,786	2,439	2,353
Average Mkt Cap	$14,397	$14,667	$17,629	$14,525	$14,174
Comparative Carbon Exposure					
Carbon Emissions (tons CO2e/$M invested)	184		45	170	145
Carbon Reserves as Potential Emissions	2094		19	1438	0
ExxonMobil Share of Index	2nd (1.1%)	Below top 50	86th (0.6%)	2nd (0.1%)	Excluded

Source: MSCI

MSCI also publishes carbon metrics for its MSCI ACWI, MSCI ACWI Low Carbon Target Index, and its MSCI ACWI ex-Fossil Fuels Index. As shown, MSCI's ACWI Low Carbon Target Index reduces carbon emissions per million dollar invested by 76%, as compared to the ex-fossil fuel reduction of 5%. Measuring potential carbon emissions per million dollar invested, the MSCI ACWI Low Carbon Index reduces the MSCI ACWI exposure by 99%, as compared to the ex-Fossil Fuel Index reduction of 100%. When measuring fossil fuel reserves, the Low Carbon Index generated a 60% reduction from the MSCI ACWI, as compared to 78% for the ex-Fossil Fuels Index.

The reweighting of individual securities can be significant when comparing the MSCI low carbon and ESG indexes to the underlying MSCI ACWI. For example, for the period ending June 2016, ExxonMobil's was the second largest holding in the MSCI ACWI. This compares to ranking 86th in the MSCI ACWI Low Carbon Target Index, and below the top 50 largest holdings among MSCI's ACWI ESG Index.

Institutional investors, including U.S. public pension funds, have invested a portion of their passive equity allocations in funds benchmarked to such indexes. For example, in July, 2016, CalSTRS, the second largest pension fund in the US, committed up to $2.5 billion to low-carbon strategies in U.S., non-U.S. developed and emerging equity markets based on MSCI's ACWI Low-Carbon Target Index. The passive index portfolio will be internally managed by the CalSTRS Global Equity investment staff and implementation will be phased in beginning with U.S. equity followed later by developed markets and then eventually emerging markets.

The $185 billion New York State Common Retirement Fund ("NYSCRF") is the third largest pension fund in the US. NYSCRF intends to double its exposure to $4 billion in a low carbon index strategy that it launched with Goldman Sachs Asset Management (GSAM) just prior to the Paris COP21 conference in 2015, after what it said were positive environmental and financial results. The NYSCRF low carbon passive equity investment is based on index data from FTSE Russell. Peter Grannis, the First Deputy Comptroller in the Office of the New York State Comptroller, noted in December 2016 that performance so far had been encouraging: "It's been in line with our expectations and with a tracking error of 0.25%. On the environmental side we've reduced the carbon emissions of this asset portion by 70%.

In June, 2016, FTSE released a new FTSE Green Revenue Index that seeks to increase the exposure to green product and services in all companies large and small, even should those products and services be sold by fossil fuel companies, while maintaining a close tracking error to the underlying benchmark. This index measures the green product exposures in companies in an underlying benchmark, and then reweights constituents based on their green weighting. As with the low carbon indexes, no securities are excluded. However, some companies can go to a 'zero weight', thus effectively being reduced to a zero weight as compared to the underlying benchmark.

As shown below, the FTSE Russell 1000 Green Revenue Index closely tracked the underlying Russell 1000 benchmark on risk and return metrics, the number of constituents, and average market cap for the period ending December 31, 2016. The Green Revenue index shows 2.17% exposure to green revenue, up from 1.47% in the Russell 1000.

FTSE Russell 1000 Green Revenue Index Compared to Underlying Benchmark (Periods ending December 31, 2016)

Name of Index	Russell 1000 Green Revenue	Russell 1000
Annualized Return Gross of License Fees		
1-Year Return	2.95%	2.93%
5-year Return	11.74%	11.88%
Volatility (Standard Deviation)		
1-Year Risk	14.56%	14.62%
5-Year Risk	12.36%	12.33%
5-Year Tracking Error	0.16%	
5-Year Sharpe Ratio	0.94	0.96
5-Year Maximum Drawdown	-14.89%	-14.68%
No. of Constituents	1001	1001
Average Mkt Cap	$20,318MM	$20,271MM
Measure of Green Revenue Exposure	2.17	1.47
Measure of ESG (0-5, highest)	2.79	2.79

Source: FTSE Russell

FTSE designed the Green Revenue Index to make modest changes based on green revenue exposure, so typically, an individual company's share of the R1000 doesn't change dramatically based on the reweighting for their Green Revenue Index.

The underlying concept – that green revenues are being generated by very large companies, that often have wide-ranging product lines in addition to green revenues, including publicly listed companies, and even oil and gas companies. For example, SASB states that industrial conglomerates General Electric (U.S.) and Siemens (Germany) each generated 7.3% of their revenues ($9 billion and $6.1 billion respectively) from the renewable energy segment as defined by SASB in 2016. Archer Daniel

Midland, U.S. agricultural product processing and trading company generated 9.3% of its revenue ($6.3 billion) from 'bio-products' ethanol segment in 2016. Valero, an energy oil and gas refining company, generated 3.9% of its revenue ($3.4 billion) from ethanol biofuel in 2015.

Climate related, and ESG benchmarks first emerged in equities. Barclay's December 2016 report shows that:

- ESG need not be an "equity-only" phenomenon and can be applied to credit markets without being detrimental to bondholders' returns.
- A positive ESG tilt resulted in a small but steady performance advantage.
- No evidence of a negative performance impact was found.
- ESG attributes did not significantly affect the price of corporate bonds. No evidence was found that the performance advantage was due to a change in relative valuation over the study period.
- When applying separate tilts to E, S and G scores, the positive effect was strongest for a positive tilt towards the Governance factor, and the weakest for social scores.
- Issuers with high Governance scores experienced lower incidence of downgrades by credit rating agencies.
- Broadly similar results were observed using ratings from the two ESG providers considered in this report (MSCI and Sustainalytics) despite the significant differences between their methodologies.

Barclay's research findings underscore the potential importance of systematic biases that can be introduced when developing any ESG benchmark compared to its underlying market wide benchmark, and the potential negative impacts of exclusion of entire industries. As reported:

> "In research conducted in 2015, Barclays Research analyzed the historical returns of both its Socially Responsible ("SRI") corporate bond index that is based on negative screening, and Barclays Sustainability index that uses a 'best-in-class' approach based on ESG ratings to choose the best-rated subset of index bonds within each industry.
>
> While both had underperformed in terms of nominal returns, some of that underperformance was traced to systematic biases unrelated to ESG criteria. Once they were corrected, we found that the return impact due specifically to the ESG tilt in security selection was positive for the Sustainability index, but negative for the SRI one. We concluded that the wholesale exclusion of entire industries from the investment universe, while it may be desirable based on ethical considerations, is not justified based on purely financial criteria."

Low carbon, green revenue and broader ESG Indexes are relatively new products that offer institutional investors alternatives to simple divestment and the related tracking error complications of divestment strategies that can be critical to passive investment strategies. In our opinion these strategies complement proxy voting and engagement efforts in that they do not reduce the shareowner's position in fossil fuel companies to zero. Thus shareholders maintain a vote on proxy proposals. We note that low carbon indexes will often reduce the shareowner position in fossil fuel companies, thus reducing the investor's weight in any given fossil fuel company proxy vote. Currently, passive investments vehicles that track an ESG index, including low carbon/green revenue indexes, have higher management fees than those of widely used standard benchmarks. The higher all in management fees will include slightly higher index licensing fees than the licensing fees for core benchmarks.

Invest in Active Manager(s) Emphasizing Climate Risks/Opportunities

The active manager institutional investment market has evolved to include both managers explicitly targeting renewables, or low carbon markets, and managers who incorporate ESG metrics into their

stock selection, including climate change material risks. These efforts encompass both fundamental and quantitative management strategies. Most recently, active managers began more systematically incorporating ESG risk factors alongside traditional financial factors seeking to improve active management returns, labeled below as ESG Integration.

ESG Active Investment Management Approaches

Investment Approach to ESG Factors	Description	Social Outcome	Competitive Performance Outcome
Negative Screening	Exclude companies based on non-financial concerns such as tobacco, firearms, more recently, fossil fuels.	REQUIRED	NOT ALWAYS REQUIRED
Impact Investing	Incorporate social outcome and seek to make a market return.	REQUIRED	VARIED
Positive Screening	Select a portfolio of companies with desirable characteristics to form an investment universe.	REQUIRED	VARIED
ESG Integration	Integrate ESG material risks into traditional financial analysis, independent of seeking any specific social/environmental outcome to improve portfolio performance.	NOT EXPLICITLY REQUIRED	REQUIRED

The growth in ESG investment demand is fueling an expansion of the ESG investment manager universe. Historically ESG was primarily the purview of specialized ESG managers, and some managers that offered both traditional investment products and ESG products. Today, large global investment firms are developing ESG products, both through acquisition and increased hiring and reorganization. In some cases, a new ESG profile means emphasizing what a manager believes they have always done regarding these risks.

Similar to the passive investment market, active management around climate risk concerns grew first in equity markets. Today green bonds are being measured, rated, and targeted for specific investment strategies to boost their share in an overall bond portfolio.

In our opinion, active manager products that integrate climate risks or broader ESG risks into their security selection, bear the same active selection risks of the broader active manager market. Typically, the risk increases as the manager's universe of securities narrows. Such products are compatible with monitoring, proxy voting and engagement. To the degree that such a strategy replaces a strategy that doesn't account for climate risks, including stranded asset risk, the move to an ESG strategy incorporating these risks may reduce or remove the investor's proxy voting weight in such companies. ESG active manager fees are typically similar to fees charged by comparable non-ESG active managers.

Monitoring

Monitoring of a portfolio for ESG, including climate change, risks can be undertaken portfolio wide and by monitoring of individual managers. The tools for such analysis are rapidly being developed and marketed in response to institutional investor demand. There is widespread evidence of a concerted push for disclosure, standardization, quantification and systematic risk analysis to integrate sustainability into risk/return analysis across the market.

The December 2016 release of the recommendations from the Task Force on Climate-related Financial Disclosures ("TCFD") marked a prominent step in seeking consistent disclosure, without which investors cannot appropriately assess and price the risks involved. The TCFD's, which was assembled by Mark Carney as Chairman of the Financial Stability Board, and chaired by Michael Bloomberg, aims to help integrate better understanding of the risks and opportunities presented by climate change into

investment and insurance underwriting decisions. There are four key features to the TCFD's recommendations:

- Adoptable by all organizations.
- Included in financial filings rather than other reports such as corporate social responsibility reports.
- Designed to solicit decision-useful, forward looking information on financial impacts.
- A Strong focus on risks and opportunities related to the transition to a lower-carbon economy.

Crucially, the report recommends that companies use different scenarios to report on governance, strategy, risk management, and metrics and targets, including a 2degree scenario.

Portfolio-wide monitoring might involve looking at a plan's overall carbon footprint, or assessing a plan's overall exposure, compared to its benchmark, to E, S and or G, or combined ESG ratings of companies in their portfolio. Carbon footprint analysis today contains many inconsistencies and holes due to lack of consistent data reported by companies, but is improving as reporting improves. Firms such as MSCI and Sustainalytics provide ESG company ratings. ESG ratings can provide meaningful insights into individual company risks. These ratings are not quantitative metrics, such as a standard deviation that can be aggregated and reported as an overall portfolio risk exposure metric. All ESG ratings involve the judgement of the researchers conducting the analysis. Ratings can and do differ meaningfully among providers. For example, Northern Trust observed in January 2017 that they found MSCI and Sustainalytics gave similar ESG ratings for approximately 60% of the companies that they both rated.

Broader, portfolio-wide climate risk frameworks are being developed. Mercer sought to measure climate risk by asset class, and identify differing industry impacts in its ongoing work. Towers Watson announced in January 2017 that it is rolling out a new sustainability framework that seeks to link sustainability analysis with investment returns. As reported by Responsible investor, a pillar of their analysis is:

> "industry level research to determine how business profit pools are likely to change and how private and public capital will be allocated. When its complete, the framework will allow investors to seamlessly integrate the same financial, sustainability and ESG metrics into all aspects of portfolio management. i.e., from risk management, through portfolio construction, all the way down to security selection."

The prominence of concerns over environment-related risks is generating new quantitative metrics too, that did not exist a decade ago. For example, a decade ago, a typical institutional investor interested in the energy sector would not necessarily consider a firm's track record on environmental issues. Today, regulatory changes facing the energy sector make such non-financial issues potentially material. Investment consultants to institutional investors have increased their efforts to monitor managers on environmental, social, and governance ("ESG") issues, including climate change risks, incorporating such questions into regular monitoring activities, and into requests for proposals when new managers are being considered.

Recent research indicates that distinguishing between material and immaterial ESG issues can be meaningful in capital allocation. Khan, Serafeim and Yoon's 2015 analysis:

> "Corporate Sustainability: First evidence on Materiality", finds that "firms with good ratings on material sustainability issues significantly outperform firms with poor ratings on these issues. In contrast, firms with good ratings on immaterial sustainability issues do not significantly outperform firms with poor ratings on the same issues. These results are confirmed when we analyze future

changes in accounting performance. The results have implications for asset managers who have committed to the integration of sustainability factors in their capital allocation decisions."

Manager monitoring on ESG issues including climate risk can often be accomplished by a pension plan's investment consultant, without adding costs to the plan's overhead. Monitoring can signal managers that these issues concern their institutional clients and can complement proxy voting and regulatory activities. Monitoring in itself is often a first step in understanding the climate change issues facing the portfolio, without taking specific actions through voting, engagement, investment or divestment. As noted above, only a handful of U.S. public pension funds in the survey currently monitor their investment managers on climate change related risks. VPIC does monitor its managers on ESG issues. For example, VPIC reported the manager responses to staff's survey of managers on ESG integration in the State of Vermont Treasury Staff Divestment Memo, July 28, 2015.

Proxy Voting

As shown below, the number of shareholder proposals on environmental issues, and the average number of votes for shareholder proposals on environmental and environmental disclosure related issues, including climate change, trended upward for the Russell 3000, energy stocks, and for XOM since 2000. During the first 10 years of the 21st century (2000-2009), Russell 3000 stocks averaged 23 environmental-related shareholder proposals each year. During the most recent period (2010-16), this number more than doubled to an average of 57 environmentally related shareholder proposals each year. Similarly, during these periods, the average number of votes for environmentally related shareholder proposals among the Russell 3000 companies rose from 13% to 22%.

Shareholder Proposals on Environmental issues, 2000-2016*								
	Num. Went to Vote			Num. Passed		Avg Votes For		
Period	R3000	Energy	XOM	R3000	XOM	R3000	Energy	XOM
2000-2009	23	8	1.8	0.2	0	13%	16%	8%
2010-16	57	12	2.9	0.6	0	22%	22%	13%

Sources: CalSTRS and CII information based on ISS data.

Institutional investors anticipate re-filing a high profile shareholder resolution for the 2017 proxy season at ExxonMobil, which was filed in 2016 to urge Exxon to publish an annual assessment of the long-term portfolio impacts of public climate change policies. In 2016, this shareowner proposal got the support of 38% of shareholders, as part of a campaign of similar high-scoring resolutions at oil majors around the world, many of which received majority support.

Recent research finds that the impact of shareholder proxy voting proposals on material environmental and social issues have affected corporate financial performance. Grewal, Serafeim and Yoon's 2016 report "Shareholder Activism on Sustainability Issues" finds (based on SASB's industry level definitions of materiality) that:

> "42 percent of the shareholder proposals in their sample were filed on financially material issues. We document that filing shareholder proposals are related to subsequent improvements in the performance of the company on the focal environmental or social issue, even though such proposals nearly never received majority support. Improvements occur across both material and immaterial issues. Proposals on immaterial issues are associated with subsequent declines in firm valuation, while proposals on material issues are associated with subsequent increases in firm value. We show that managers increase performance on immaterial issues in companies

with agency problems, low awareness of the materiality of sustainability issues, and poor performance on material issues."

Shareholder proxy proposals that are not explicitly related to carbon may exert influence at fossil fuel companies on carbon-related issues. A key example is the rising support for proxy access. At Exxon in 2016, a shareholder proposal passed that gives shareholders greater power to propose director candidates. Institutional investors anticipate using these steps to advocate for Exxon board members who are "climate competent". As reported by Sidley Austin LLP, in "Sidley Corporate Governance Report" (January 3, 2017):

> "In late December 2016, proxy access reached the tipping point in terms of adoption by large companies – just over 50% of S&P 500 companies have now adopted proxy access. Through the collective efforts of large institutional investors, including public and private pension funds, and other shareholder proponents, shareholders are increasingly gaining the power to nominate a portion of the board without undertaking the expense of a proxy solicitation. By obtaining proxy access (the ability to include shareholder nominees in the company's own proxy materials), shareholders will have yet another too to influence board decisions."

Proxy voting can complement manager and portfolio monitoring, engaging with companies and regulators. In a targeted low carbon fund, proxy voting at fossil fuel companies can still be useful, but to a smaller degree because the exposure to fossil fuel companies is reduced compared to a market wide fund. Divestment would negate VPIC's proxy efforts at fossil fuel companies because fossil fuel companies would be eliminated from the portfolio.

Summary of Market Options in Relation to Divestment

The table on the following page seeks to summarize key parameters for institutional investors of various tools available to control the climate change risks and opportunities. As shown, straight divestment strategies, by excluding companies from any given fund or universe, make a strong public statement and rely on a transparent and simple methodology.

Divestment does not consider short-term financial risks or long-term diversification risks, which increase as the universe of divested stocks increases. Divestment from fossil fuels, suppliers of fossil fuel energy, will, if simply reweighting the rest of the portfolio, result in an increased exposure to companies on the demand side of fossil fuel energy, and in the companies financing fossil fuels. Transaction, restructuring and opportunity costs may vary according to the assets being divested, and the fund structure from which they are being divested. Divestment removes an institution's ability to influence corporate behavior by voting proxies and engagement.

Approaches to Addressing Climate Risk Key Parameters for Institutional Investors*					
Approach	**Short-term Financial Risk***	**Long-term Investment Thesis***	**Costs**	**Shareholder Communication***	**Public Stance***
Divest	Not-considered	Based on individual security selection; or long-term stranded assets thesis; diversification risks not considered	Transaction costs, portfolio restructuring, and opportunity costs vary with assets being divested and with fund structure.	Transparent and simple methodology	Makes strong public statement; but cannot directly influence corporate behavior; removes proxy and engagement access to influence companies.
Monitor funds	None	Alert managers	Minimal	Highlight concerns	Shows concerns
Vote Proxies	None	Improve underlying fundamentals of individual public equity investments	Staff and board time; proxy service provider costs. Requires costly in-house or SMA passive management to control all votes.	Generally simple; specific proxies can be complex	Voting proxies makes public statement; can directly influence corporate behavior
Engage with Companies	None	Improve underlying fundamentals of individual public equity investments	Requires minimal to high staff and board time depending on the number and complexity of issues.	General simple; specific efforts can be private process; communication can be detailed	Makes statement. Often private during engagement process; can directly influence corporations
Engage on Regulatory Issues	None	Improve regulatory fundamentals	Requires minimal to high staff and board time.	Generally simple. Specific issues can be complex.	Makes statement and can influence regulatory environment
Invest in Low carbon or green tilted index funds	Optimizes to reduce tracking error to parent index	Optimize to reduce carbon increase green, and retain full opportunity set	Typically, a few basis points more in fees than underlying benchmark.	Sophisticated methodology, could be more difficult to explain	Makes statement for low carbon/high green economy. Allows voting proxies, engagement.
Invest in active focus on climate risks/ opportunities	Risk depends on fund strategy	Relies on active manager skills to outperform	ESG active manager fees in line with non-ESG active manager counterparts	Transparent and simple to explain	Makes statement for low carbon/high green economy. Allows voting proxies; engagement;

** PCA developed this chart of approaches to climate change risk from MSCI's March 2015 key parameters for institutional investors for assessing different public equity index options. PCA's adaptation including adding the cost parameter.*

Conclusion

In our opinion, divestment of fossil fuels, thermal coal, or Exxon is one possible approach for VPIC to mitigate a potentially significant climate risk – possible stranded assets of fossil fuel suppliers. Given the financial and governance costs that come with fossil fuel divestment, in PCA's opinion, divestment of fossil fuels, thermal coal, or Exxon has not been shown to be in the best interests of VPIC pension beneficiaries, and conflicts with VPIC governance structure. In our opinion, markets now offer meaningful tools to address climate risk other than divestment, from coordinated proxy voting and

corporate and public policy engagement, to passive and active low carbon alternatives that avoid the broad market exit risk inherent in near-term divestment approaches. We believe VPIC should continue its effort to address and manage climate and other ESG risks and opportunities. In our opinion, VPIC should continue to stay abreast of, and consider, the ongoing changes in assessments of climate risks, and approaches to managing these risks.

References

2i Investing Initiative, United Nations Environment Programme Finance Initiative ("UNEP-FI") and World Resources Institute (2016) "Climate Strategies and Metrics: Exploring Options for Institutional Investors", World Resources Institute, UNEP-FI and 2 degrees Investing Initiative Portfolio Carbon Initiative.

Amenc, Noel, Erik Christiansen, Felix Goltz, and Kumar Gautam (June, 2016). "Scientific Beta Low Carbon Multi-Beta Multi-Strategy Indices", Scientific Beta, An EDHEC-Risk Institute Venture.

Ansar, Atif, Ben Caldecott and James Tilbury (2013). "Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets?", *University of Oxford, Smith School of Enterprise and the Environment, Stranded Assets Programme.*

Bernstein, Sarah (October, 2015). "ESG/Sustainability: Institutional Investor Market Developments", *Pension Consulting Alliance.*

BlackRock Investment Institute (October 2015). "The Price of Climate Change: Global Warming's Impact on Portfolios", BlackRock.

Burke, Marshall, Solomon Hsiang and Edward Miguel (12, November, 2015). "Global non-linear effect of temperature on economic production", *Nature, 527, pages 235-239.*

Center for international Environmental Law (December 2016). "Trillion Dollar Transformation: Fiduciary duty, Divestment and Fossil Fuels in an Era of Climate Risk", Center for Environmental Law.

Considine, Matt, CFA, Katie Green and Nick Foss (July 28, 2015). "Fossil Fuel Divestment Analysis), Staff Memo to VPIC, State of Vermont Office of the State Treasurer.

Considine, Matt, CFA, Katie Green and Nick Foss (July 28, 2015). "Fossil Fuel Profile in VPIC", Staff Memo to VPIC, State of Vermont Office of the State Treasurer.

Desclee, Albert, Lev Dynkin, Jay Hyman and Simon Polbennikov (2016) "Sustainable investing and bond returns: Research study into the impact of ESG on credit portfolio performance", "01 Impact Series, Research Department, Barclays.

DivestmentFacts (2016). Divestment Compendium, DivestmentFacts.com and IPAA.

Koehler, Dinah A., Dr. and Bruno Bertocci (October, 2016). "Stranded Assets: What lies beneath", UBS

Mercer (2015). "Investing in a Time of Climate Change", Mercer.

Moseley, Doug, Partner (February 22, 2013). "Preliminary Analysis of Potential Impact of Energy Sector Divestment", Consultant Memo to VPIC, NEPC.

National Centers for Environmental Information ("NCEI"), National Oceanic and Atmospheric Administration ("NOAA") (December, 2016). "Global Analysis 2016", NOAA-NCEI.

North Carolina Department of the State Treasurer (September, 2016). "Long Term Stewardship: A pragmatic Approach for ESG Integration for Institutional Investment – Draft", North Carolina Department of the State Treasurer.

Reid, Iain, Giacomo Romeo, CFA, David Farrell, CFA, and Kate Sloan (October, 2016). "Integrate Oil", Macquarie Research, Macquarie Capital (Europe) Limited.

Risky Business (2014). "Risky Business: The Economic Risks of Climate Change in the United States", The Risky Business Project.

Risky Business (2016). "From Risk to Return: Investing in a Clean Energy Economy", The Risky Business Project.

SASB (2014). "Oil &Gas Exploration & Production Sustainability Accounting Standard – Provisional Standard", SASB.

SASB (October 18, 2016). "Climate Risk Technical Bulletin", SASB.

Serafeim, George, Jody Grewal, and Aaron Yoon ((2015). "Corporate Sustainability: First Evidence on Materiality", Working Paper 15-073, Harvard Business School.

Serafeim, George, Mozaffar Khan, and Aaron Yoon ((2015). "Shareholder Activism on Sustainability Issues", Harvard Business School.

Sustainable Insight Capital Management (Week Ending January 13, 2017). "Insights for the Mainstream Investor", Sustainable Insight Capital Management.

Task Force on Climate-related Financial Disclosures ("TCFD"), (December, 2016). Recommendations of the Task Force on Climate Related Financial Disclosures", TCFD.

U.S. Energy Information Administration (2016). "International Energy Outlook 2016", U.S. Energy Information Administration, Department of Energy.

Zindler, Ethan and Ken Locklin (27, January 2016). "Mapping the Gap: The Road from Paris", CERES and Bloomberg New Energy Finance.

Appendix 1) List of Peer Pension Plans that Responded to Climate Risk Survey

We thank the pension plans listed below for participating in this survey. The plans are listed according to their total assets under management.

2016 Climate Change Survey of VPIC peer U.S. Public Pension Plans	
Name of Pension Plan	**Assets Under Management ($ Billions)**
Total	$887
East Bay Muunicipal Utility District Retirement System	$1
San Luis Obispo County Pension Trust	$1
Luisiana Public Employees Retirement System	$2
Municipal Fire and Police Retirement System of IOWA	$2
San Juaquin County Employees Retirement Association	$2
Seattle City Employees Retirement System	$2
Sonoma County Employees Retirement Association	$2
Fresno City Employees' Retirement System	$3
Fresno County Employees' Retirement Association	$4
Employees' Retirement System of Rhode Island	$8
Arkansas Public Employees Retirement System	$9
Municipal Employees Retirement System of Michigan	$9
Oklahoma Public Employees Retirement System	$9
Los Angeles City Employees Retirement System	$14
Employees' Retirement System of Georgia	$15
Employees' Retirement System of the State of Hawaii	$15
West Virginia Investment Management Board	$17
Kansas Public Employees' Retirement System	$18
Los Angeles Fire and Police Pension Fund	$19
South Carolina Retirement Systems	$29
Public School & Education Employee Retirement Systems of Missouri	$39
Maryland State Retirement and Pension System	$45
Oregon Public Employees' Retirement System	$68
New York State Common Retirement Fund	$179
Florida State Board of Administration	$180
California State Teachers Retirement System	$195

Appendix 2) VPIC and Vermont Treasurer Climate Change Engagement Activities

VPIC and Vermont Treasurer Engagement Activities on Climate Change (April 2015 - December 2016)	
4/16/2015	BP resolution that VPIC co-filed on received 98.28% of the vote to get better disclosure and get an A from CDP
4/17/2015	TRE & VPIC signed-on to letter to the SEC on better disclosure regarding climate change risks
4/21/2015	TRE signed-on to letter to the SEC to strengthen disclosure of corporate political contributions.
5/5/2015	Declare vote for the XOM resolution for GHG reduction targets
5/21/2015	Signed on to Letter: The New York State Common Retirement Fund and Green Century Capital Management, together with over $1.5 trillion AUM from signatories, are calling on the Roundtable on Sustainable Palm Oil (RSPO) to strengthen its standards to support deforestation-free and exploitation-free palm oil.
5/27/2015	Treasurer attended XOM AGM. Beth introduced resolution and spoke in capacity as treasurer
7/6/2015	Signed on to letter to SEC re: proxy access
7/10/2015	Treasurer sent letter on behalf of VPIC & TRE to SEC re: proxy access proposal rulings 14a-8(i)(9) for proxy access (if mgmt brings similar resolution shareholder's is thrown out)
7/13/2015	TRE signed on to SEC letter asking for stronger private equity fee disclosure to public pension LPs. RI Treasurer was lead on letter
7/21/2015	TRE meets with ISS to discuss policy on Environmental resolutions and how we can get their support re: Exxon
7/22/2015	TRE meets with INCR members to create a work plan for the 2016 proxy season
7/27/2015	VMERS votes to reject divestment of fossil fuels
7/27/2015	Vermont Retired Teachers Association votes to reject divestment of fossil fuels
7/28/2015	VPIC votes unanimously to reject divestment of fossil fuels
7/29/2015	Follow-up with Investment Managers re: their UN PRI grade on fulfilling the principles
7/29/2015	Follow-up with Australia's SuperEnergy Fund re: PE disclosure laws, research, requests, etc
8/5/2015	Call with Exxon to discuss questions regarding transparency
9/4/2015	Treasurer hosted an informational session about Pensions and included an ESG session in the afternoon where Ceres presented to legislators
10/30/2015	Treasurer signed on to a letter to the Indonensian President urging him to support private-sector forest conservation policies (part of the Palm Oil deforestation movement)
1/27/2016	Treasurer Pearce is serving as a Convener of the 2016 Investor Summit on Climate Risk at the UN Headquarters in NYC
12/2/2015	VPIC co-files with As You Sow and Calvert on resolution with FirstEnergy requesting they create a report quantifying the potential financial losses associated with stranding of its coal generation facilities under a range of climate change driven regulation scenarios mandated by the Clean Power Plan.
12/11/2015	VPIC co-filed with Tri-State Coalition on a resolution at Chevron requesting they create GHG targets for the long-term.
12/14/2015	VPIC co-filed with NY State Common Retirement Fund and the Endowment of the Church of England at Exxon on a CAR resolution
2/10/2016	Treasurer Pearce, on behalf of VPIC, participated in a filer call with Exxon to discuss the resolution along with NYState, Church of England, Boston Trust, UC Davis and CDA
3/28/2016	Director of Investments sends Dear Colleague letter on Beth's behalf to Investment Managers, Vendors (NEPC, JPM, ISS, etc), and public fund sponsors requesting they declare their support publicly for CAR resolutions.
3/30/2016	ISS and Glass Lewis call with investors to discuss supporting the Chevron Resolution
4/5/2016	Vermont State Treasurer and VPIC sign on to "Declaration of Support" for 2D resolutions
4/6/2016	Staff attended webinar on EU Non-Financial reporting Directive (reporting on ESG factors requirement for companies)
4/21/2016	OT sent on behalf of VPIC a memo to ISS & Glass Lewis in support of the Exxon Resolution Item No. 12
4/21/2016	Dear Treasurer's Memo sent from Treasurer Pearce requesting their support for Exxon, Chevron & FirstEnergy proposals on the proxy vote.
6/13/2016	Signed on to a letter through CII directed to Honorable Maxine Waters (Ranking Member) and Honorable Jeb Hensarling (Chairman) of the House Committee on Financial Services to voice our concern with HR 5311. TRE then sent a letter to VT Congressional delegation to tell them we are not happy with section g of this bill and that we have signed on to CII letter concerning HR 5311.
7/8/2016	CII sends letter to SEC for comment period "Business and Financial Disclosure Required by Regulation S-K".
7/20/2016	State of VT Treasurer sends letter to SEC during their request for Comment period for "Business and Financial Disclosure Required by Regulation S-K".
9/1/2016	TRE signed on to a Ceres letter sent to House and Senate party leadership and relevant Appropriations Committeee leadership to help preserve the Climate Risk Disclosure text that is under attack due specifically to Amendment #44 to the House of Represetnatives' Financial Services and General Government (FSGG) Appropriations bill, which passed on July 7, 2016.
9/2/2016	TRE signed on to Trillium/CalSTRS/NYComptroller/Croatan Institute letter regarding the NC HR2 bill
11/10/2016	VPIC co-files with Mercy Investment Services at Marathon Petroleum on resolution 2 degree reporting
11/21/2016	VPIC co-files with NY State on Dominion Resources resolution 2 degree reporting
11/30/2016	VPIC co-files with NY State on Exxon Mobil resolution 2 degree reporting
12/7/2016	VPIC co-files with Wespath Investment Management & Hermes EOS on Chevron resolution 2 degree reporting
12/7/2016	VPIC co-files with As You Sow and Arjuna Capital on Chevron resolution low carbon transition
12/7/2016	VPIC co-files with the Community of the Sisters of St. Dominic of Caldwell, NJ on Southern Company resolution 2 degree reporting

Appendix 3) SSGA preliminary estimates for possible commingled fund recommendations

Please note that the information below is preliminary, and for general information, not to be considered an official response to a request for proposals.

Option 1 – Launch commingled fund with custom proxy voting policies

- Not an option at this time. We believe our policy is strong on ESG/Climate issues. Happy to discuss our policy and approach to engagement.

Option 2 – Launch commingled fund that utilizes a 3rd party's proxy voting policies

- We will not be able to launch a commingled fund that utilizes a 3rd party proxy voting policy.

Option 3 – Transfer $500M from SP500 Commingled to SP500 Ex Fossil Fuel Separately Managed Account

- Fee Schedule – 5 bps Flat fee
- $65k would be added to current relationship minimum
- Vermont provide screens for SSGA to implement and would also be responsible for sending updates to SSGA
- Proxy options at this fee level: (1)Vermont votes or (2) SSGA votes in accordance with the SSGA policy
- Additional fees: Any additional index licensing fees may also apply

Option 4 – $500 mm MSCI ACWI Low Carbon Target Index or MSCI ACWI Low Carbon Target IMI Index Separately Managed Account

- Fee Schedule – 12 bps for ACWI based benchmark, 15 bps for an ACWI IMI benchmark
- Minimum annual fee of $125,000 per account to be added to current relationship minimum
- Proxy options at this fee level: (1)Vermont votes or (2) SSGA votes in accordance with the SSGA policy
- Additional fees: Any additional index licensing fees may also apply

Option 5 – SSGA opens an MSCI ACWI Low Carbon Target Index or MSCI ACWI Low Carbon Target IMI Index Commingled Fund

- Seed Capital - ~$200M for an ACWI benchmark and ~$300 mm for an ACWI IMI benchmark
- Fee Schedule – 10 bps for ACWI, 13 for ACWI IMI (not inclusive of licensing fees)
- Minimum annual fees of $25,000 per commingled fund
- Proxies would follow SSGA policies and SSGA would vote – no custom voting would be available

Option 6 – SSGA opens an S&P 500 using MSCI Low Carbon Target for Index Commingled Fund

- Seed Capital - ~$500M for a $S&P500 benchmark
- Fee Schedule – 4 bps (subject to potential additional licensing fees)
- Minimum annual fees of $25,000 per commingled fund
- Proxies would follow SSGA policies and SSGA would vote – no custom voting would be available

Appendix 4) Northern Trust and Rhumbline estimates for commingled fund recommendations

Please note that the information below is preliminary, and for general information, not to be considered as an official response to a request for proposals.

Northern Trust

Comingled vehicle to vote proxies along ISS specialized (such as Public Fund, or ESG) guidelines.

Northern Trust provided a few options for a commingled fund structure that might offer better alignment with VPIC proxy voting guidelines than their current passive equity investments offer. For each option, Northern Trust would manage the assets; outsource the proxy voting to ISS according to one of ISS's specialized guidelines. The pricing presented below is for lending options. Northern Trust notes that the fees quoted are for asset management services, and any operating expenses such as administration, audit, and ISS fees will be born within the fund NAV.

Option 1) Use NT's existing Russell 3000 Labor Select index fund. The primary objective of the Northern Trust Labor Select Russell 3000 Index Fund is to approximate the risk and return characteristics of the Russell 3000 Index. This Index is commonly used to represent the broad U.S. equity market. Proxies for securities held in the fund shall be voted in accordance with the AFL-CIO proxy voting guidelines. The proxy voting for this fund is outsourced to ISS and follows ISS Taft Hartley guidelines. This fund currently manages approximately $500 million. The fee schedule is 3.5 basis points per annum for $25 million to $100 million; 2 basis points per annum for a $100 - $500 million; or 1.5 basis points per annum for $500 million or above investment.

Option 2) Seed a commingled vehicle tracking the S&P500 and engage ISS to report proxies along their Public Fund (or other) guideline. NT could launch a new vehicle with a minimum of $250 million. The fee schedule would be 4 basis points per annum for $25 million to $100 million; 3 basis points per annum for a $100 -$500 million; or 2 basis points per annum for $500 million or above investment.

Option 3) Seed a commingled vehicle tracking the MSCI World-ex US Index (could use Low Carbon) and engage ISS to report proxies along their Public Fund policies. NT could launch a new vehicle with a minimum of $250 million. The reason Northern Trust suggests the World Ex-US here rather than World only is to give your clients more flexibility in weighting between US and non-US by combining these two funds. The fee schedule would be 8 basis points per annum for $25 million to $100 million; 6 basis points per annum for a $100 -$500 million; or 4 basis points per annum for $500 million or above investment.

Option 4) Seed a commingled vehicle to vote in line with a custom public fund proxy voting framework. Northern Trust offered the following thoughts for VPIC to consider if they were to establish their own board/governance structure for voting proxies jointly with other public pension plans through a commingled fund.

Custom Option a) The client could launch their own vehicle in a LP format, hire a sub-advisor to manage the investment portfolio, retain service providers to administer and conduct the legal and audit work around pooling investor assets. They could then hire a proxy service provider such as ISS or Glass Lewis to implement a custom proxy voting policy that the client/board governing this pool would establish and monitor.

Custom Option b) A second, less expensive path, would be to gather a collection of public funds who, together, wish to develop and adopt a public fund custom proxy

voting framework; have them agree on a custom proxy voting policy; agree to request the same passive equity investment manager to invest their assets according to this custom public fund proxy voting policy; and direct an agreed upon proxy voting service provider to vote and report the proxies according to their custom public fund proxy voting framework.

Under this option, each public pension fund would invest directly in the new vehicle that a passive equity manager establishes for this custom public fund proxy voting framework, similar to the process undertaken to launch NT's R3000 Labor Select Index Fund. For Northern Trust, the minimum assets to launch such a fund would be $250 million, with fee schedules in line with those stated above, where a U.S. domestic fund is less expensive to implement than a non-U.S. or world.

Rhumbline

To open an additional passive comingled fund, it would take approximately 30-60 days for the legal work to be completed. The summary features and costs for launching a new fund with the objective of tracking the **MSCI ACWI Low Carbon Index** are as follows:

- Estimated Portfolio size - $100 million.
- Estimated holdings – 1,500 companies across 46 countries.
- Number of trades per year – 500 to 1,000 depending on index turnover, corporate actions, liquidity needs, etc.
- Daily NAV and daily liquidity.
- Investment Management Fee – 10 basis points on the first $100 million, 9 bps on next $200 million, 7 bps on excess (inclusive of MSCI index licensing fee).
- $25,000 minimum annual fee.
- Custody and Administration Fee (State Street) – 3 to 5 basis points depending on trading volume.

Appendix 5) VPIC Manager Exposure to XOM, Thermal Coal and Fossil Fuel Holdings (June 30, 2016)

Asset Class/Investment Mana	Account Type		Assets Under Mgt		Exposure to							
					XOM		ThC		FF		# of Firms	
			(%)	($Millions)	% of Total	$millions	% of Total	$millions	% of Total	$Millions	XOM ThC	FF
Total Plan			**100.0%**	**$3,743.2**	**0.27%**	**$10.0**	**0.59%**	**$22.2**	**3.12%**	**$117.0**		
Equities	**Total**		**40.0%**	**$1,507.7**	**0.27%**	**$10.0**	**0.58%**	**$21.9**	**2.83%**	**$106.1**		
Equities	**Commingled**		**23.5%**	**$877.9**	**0.26%**	**$9.7**	**0.45%**	**$17.0**	**1.79%**	**$66.9**		
SSGA S&P 500 Cap Weighted	Commingled	Passive	12.1%	$453.4	0.26%	$9.7	0.07%	$2.6	0.73%	**$27.4**	1 4	27
Aberdeen Emerging Mkt Equi	Commingled	Active	6.6%	$247.1	0.00%	$0.0	0.26%	$9.8	0.65%	$24.3	0 3	6
Mondrian Intl Equity	Separate	Active	4.0%	$149.6	0.00%	$0.0	0.07%	$2.5	0.42%	$15.8	0 1	4
SSGA MSCI ACWI ex-US	Commingled	Passive	4.2%	$156.4	0.00%	$0.0	0.12%	$4.5	0.39%	**$14.7**	0 56	147
Acadian Intl Equity	Separate	Active	4.0%	$149.1	0.00%	$0.0	0.04%	$1.6	0.34%	$12.8	0 4	12
SSGA S&P500 Eq. Wtd Ex Tob	Separate	Passive	4.2%	$158.7	0.01%	$0.3	0.02%	$0.8	0.23%	**$8.8**	1 3	27
Wellington Smal Cap Value	Separate	Active	2.0%	$73.9	0.00%	$0.0	0.00%	$0.0	0.03%	$1.1	0 0	1
SSGA S&P Mid Cap 400	Commingled	Passive	0.6%	$21.0	0.00%	$0.0	0.00%	$0.2	0.02%	**$0.6**	0 3	12
Champlain Mid Cap	Separate	Active	2.2%	$81.5	0.00%	$0.0	0.00%	$0.0	0.01%	$0.5	0 0	1
SSGA Russell 2000 ex-Tobacc	Separate	Passive	0.5%	$17.0	0.00%	$0.0	0.00%	$0.0	0.00%	**$0.1**	0 0	7
Fixed Income	**Total**		**32.0%**	**$1,194.4**	**0.00%**	**$0.0**	**0.01%**	**$0.3**	**0.06%**	**$2.3**		
Fixed Income	**Commingled**		**18.5%**	**$694**	**0.00%**	**$0.0**	**0.00%**	**$0.0**	**0.05%**	**$1.7**		
SSGA Barclays Aggregate Ind	Commingled	Passive	3.1%	$117.7	0.00%		0.00%		0.00%			
Guggenheim High Yield	Separate	Active	4.0%	$147.9	0.00%	$0.0	0.03%	$1.2	0.12%	$4.4	0 2	**8**
Wellington EMD	Commingled	Active	5.1%	$192.7	0.00%	$0.0	0.00%	$0.0	0.05%	$1.7	0 0	**1**
PIMCO Core Plus	Separate	Active	5.8%	$216.3	0.00%	$0.0	0.00%	$0.0	0.03%	$1.2	0 0	**2**
PIMCO Unconstrained Bond	Separate	Active	2.5%	$92.9	0.00%	$0.0	0.00%	$0.0	0.01%	$0.3	0 0	**1**
KDP High Yield	Separate	Active	1.1%	$39.7	0.00%	$0.0	0.01%	$0.3	0.02%	$0.8	0 1	3
Wellington DAS Plus Beta 10y	Commingled	Active	2.9%	$108.9	DU	DU	DU	DU		DU	DU DU	DU
GAM Unconstrained Bond	Commingled	Active	3.5%	$130.8	0.0%	$0.0	de mini	de minimus		de minimus	DU DU	DU
BlackRock TIPS	Commingled	Passive	3.8%	$144.0	NA	NA	NA	NA	NA	NA	NA NA	NA
Absolute Return	**Commingled**		**17.0%**	**$647.8**	**0.0%**	**$0.0**	**0.0%**	**$0.0**	**0.21%**	**$7.8**		
AQR Glbl Risk Prem Fd Mode	Commingled	Active	8.3%	$309.0	NA	NA	NA	NA	NA	NA	NA NA	NA
Grosvenor GIPMS HFOF	Commingled	Active	5.2%	$193.0	DU	DU	DU	DU	0.19%	$7.0	DU DU	DU
Allianz Structured Alpha	Commingled	Active	1.9%	$70.0	NA	NA	NA	NA	NA	NA		
Mellon Global Expanded Alpl	Commingled	Active	2.0%	$75.3	0.0%	$0.0	0.0%	$0.0	0.02%	$0.8	0 0	3
Alternatives (Real Estate, Commodities, Private Equity			**11.0%**	**$393.2**	**0.0%**	**$0.0**	**0.0%**	**$0.0**	**0.02%**	**$0.7**		
Total Private Equity- Habourv	Commingled	Active	1.3%	$48.9	0.0%	$0.0	0.0%	$0.0	0.02%	$0.7	0 0	89

Appendix 6) VPIC Manager Trailing Return Estimated Impacts of Divestment

Asset Class/Investment Manager	Account Type	Assets Under Mgt		Trailing Returns									
				1-Year					5-Year				
		(%)	(Millions)	Bnmk	Actual	x-XOM	x-ThC	x-FF	Bnmk	Actual	x-XOM	x-Thc	x-FF
Total Plan		**100.0%**	**$3,743.2**										
Equities		**40.0%**	**$1,507.7**										
SSGA S&P500 Eq. Wtd Ex Tobacco	Separate	4.2%	$158.7	2.5	2.5	2.4	2.4	2.9	11.9	11.9	11.9	11.9	12.6
SSGA S&P 500 Cap Weighted	Commingled	12.1%	$453.4	4.0	4.1	3.7	3.9	4.1	12.1	12.1	12.5	12.4	13.3
Champlain Mid Cap	Separate	2.2%	$81.5	0.6	4.7	-	-	5.3	10.9	12.6	-	-	13.7
SSGA S&P Mid Cap 400	Commingled	0.6%	$21.0	1.3	1.4	-	1.0	1.3	10.5	10.6	-	9.9	10.3
SSGA Russell 2000 ex-Tobacco	Separate	0.5%	$17.0	-70.8	-10.8	-	-	-10.9	8.5	8.5	-	-	8.6
Wellington Smal Cap Value	Separate	2.0%	$73.9	-2.6	-0.8	-	-	-1.4	8.1	11.2	-	-	10.9
Acadian Intl Equity	Separate	4.0%	$149.1	-9.3	-5.4	-	-4.9	-4.6	2.1	4.2	-	4.3	4.6
Mondrian Intl Equity	Separate	4.0%	$149.6	6.5	8.1	-	7.5	6.6	7.4	7.3	-	7.7	8.1
SSGA MSCI ACWI ex-US	Commingled	4.2%	$156.4	-10.2	-10.0	-	-9.7	-9.6	0.5	1.7	-	-2.3	-2.1
Aberdeen Emerging Mkt Equity	Commingled	6.6%	$247.1	-3.7	-2.9	-	-	-1.9	-0.4	0.3	-	-	2.7
Fixed		**32.0%**	**$1,194.4**										
PIMCO Core Plus	Separate	5.8%	$216.3	6.0	5.4	-	-	5.3	3.8	4.1	-	-	4.1
PIMCO Unconstrained Bond	Separate	2.5%	$92.9	-0.4	-0.4	-	-	-0.5	No VPIC 5-Year Track Record				
GAM Unconstrained Bond	Commingled	3.5%	$130.8	0.5	1.0	de minimus			No VPIC 5-Year Track Record				
SSGA Barclays Aggregate Index	Commingled	3.1%	$117.7										
Guggenheim High Yield	Separate	4.0%	$147.9	1.7	0.8	-	0.8	0.9	No VPIC 5-Year Track Record				
KDP High Yield	Separate	1.1%	$39.7	1.6	0.6	-	0.4	2.4	5.8	5.2	-	5.1	5.3
Wellington EMD	Commingled	5.1%	$192.7	10.3	10.0	-	de min	mixed+/-	No VPIC 5-Year Track Record				
Absolute Return		**17.0%**	**$647.8**										
Mellon Global Expanded Alpha I	Commingled	2.0%	$75.3	0.8	-0.9	-	-0.9	-1.3	4.3	6.1	-	6.1	5.7
Alternatives (Real Estate, Commodities, Private Equi		**11.0%**	**$393.2**										
Total Private Equity- Habourvest		1.3%	$48.9	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

Appendix 7) Divestment Impacts on Transaction Costs

Asset Class/Investment Manager	Account Type	Assets Under Mgt (%)	($Millions)	Transaction Costs to Divest						# of firms		
				XOM		ThC		FF		XOM	ThC	FF
				XOM $M)	Trnsct ($)	AUM ($M)	Trnsct ($)	AUM ($M)	Trnsct $s ($)			
Total Plan		**100.0%**	**$3,743.2**	**$10.0**	**$68**	**$22.2**	**$51,191**	**$117.0**	**$185,422**			
Equities Total		**40.0%**	**$1,507.7**	**$10.0**	$68	**$21.9**	$8,683	**$106.1**	$132,593			
Equities Commingled		**23.5%**	**$877.9**	**$9.7**	CannotD	**$17.0**	CannotD	**$66.9**	CannotD			
Equities Separately Managed		**16.8%**	**$629.8**	**$0.3**	**$68**	**$4.9**	**$20,638**	**$39.1**	**$132,593**			
SSGA S&P 500 Cap Weighted	Commingled	12.1%	$453.4	$9.7	CannotD	$2.6	CannotD	$27.4	CannotD	1	4	26
Aberdeen Emerging Mkt Equity	Commingled	6.6%	$247.1	$0.0	NA	$9.8	CannotD	$24.3	CannotD	0	3	6
Mondrian Intl Equity	Separate	4.0%	$149.6	$0.0	$0	$2.5	$16,141	$15.8	$103,481	0	1	4
SSGA MSCI ACWI ex-US	Commingled	4.2%	$156.4	$0.0	NA	$4.5	CannotD	$14.7	CannotD	0	56	136
Acadian Intl Equity	Separate	4.0%	$149.1	$0.0	NA	$1.6	$4,187	$12.8	$27,204	0	4	12
SSGA S&P500 Eq. Wtd Ex Tobacco	Separate	4.2%	$158.7	$0.3	$68	$0.8	$310	$8.8	$432	1	3	27
Wellington Smal Cap Value	Separate	2.0%	$73.9	$0.0	NA	$0.0	NA	$1.1	-	0	0	1
SSGA S&P Mid Cap 400	Commingled	0.6%	$21.0	$0.0	NA	$0.2	NA	$0.6	CannotD	0	0	12
Champlain Mid Cap	Separate	2.2%	$81.5	$0.0	NA	$0.0	NA	$0.5	$1,312	0	0	1
SSGA Russell 2000 ex-Tobacco	Separate	0.5%	$17.0	$0.0	NA	$0.0	NA	$0.1	$164	0	0	7
Fixed Income - Total		**32.0%**	**$1,194.4**	**$0.0**	**NA**	**$0.3**	**$15,277**	**$2.3**	**$52,829**			
Fixed Income -commingled w/FF		**11.8%**	**$441.2**	**$0.0**	**CannotD**	**$0.0**	**CannotD**	**$1.7**	**CannotD**			
Fixed Income - SMA - w/FF		**10.9%**	**$ 403.9**	**$0.0**	**NA**	**$1.5**	**$15,277**	**$6.3**	**$52,829**			
SSGA Barclays Aggregate Index	Commingled	3.1%	$117.7									
Guggenheim High Yield	Separate	4.0%	$147.9	$0.0	NA	$1.2	$12,000	$4.4	$44,000	0	2	8
Wellington Emerging Market Debt	Commingled	5.1%	$192.7	$0.0	NA	$0.0	NA	$1.7	CannotD	0	0	1
PIMCO Core Plus	Separate	5.8%	$216.3	$0.0	NA	$0.0	NA	$1.2	$600	0	0	2
GAM Unconstrained Bond	Commingled	3.5%	$130.8	$0.0	NA	$0.0	CannotD	$0.3	CannotD	0	de min	
KDP High Yield	Separate	1.1%	$39.7	$0.0	NA	$0.3	$3,277	$0.8	$8,229	0	1	3
Absolute Return		**17.0%**	**$647.8**	**$0.0**		**$0.0**		**$7.8**	**DU**			
Grosvenor GIPMS HFOF	Commingled	5.2%	$193.0	DU	DU	DU	DU	$7.0	DU	DU	DU	DU
Mellon EB DV Dynamic Growth Fund	Commingled	2.0%	$75.3	$0.0	NA	$0.0	NA	$0.8	CannotD	0	0	3
Alternatives		**11.0%**	**$393.2**	**$0.0**		**$0.0**		**$0.7**				
Total Harbourvest Partners	Commingled	1.3%	$48.9	$0.0	0	$0.0	$0	$0.7	Sell entire portfolios on secondary market, likely at steep discount to NAV, to eliminate about 1% AUM	0	0	89

Appendix 8) Divestment Restructuring Fee Implications

Asset Class/Investment Manager	Account Type	Assets Under Mgt		Divest Retructuring	
		(%)	($Millions)	Possible to divest in current fund	Fee Change to divest
Total Plan		**100.0%**	**$3,743.2**		
Equities		**40.0%**	**$1,507.7**		
SSGA S&P 500 Cap Weighted	Commingled	12.1%	$453.4	NO	Increased fees to move to SMA
Aberdeen Emerging Mkt Equity	Commingled	6.6%	$247.1	NO	SMA operating costs meaningfully higher
SSGA S&P Mid Cap 400	Commingled	0.6%	$21.0	NO	Prohibitively costly to move to SMA- too small $AUM
SSGA MSCI ACWI ex-US	Commingled	4.2%	$156.4	NO	Prohibitively costly to move to SMA- too small $AUM
Wellington Smal Cap Value	Separate	2.0%	$73.9	YES	Requires discussion of fees, benchmark, guidelines.
SSGA S&P500 Eq. Wtd Ex Tobacco	Separate	4.2%	$158.7	YES	Fees unchanged
Champlain Mid Cap	Separate	2.2%	$81.5	YES	Fees unchanged
SSGA Russell 2000 ex-Tobacco	Separate	0.5%	$17.0	YES	Fees unchanged
Acadian Intl Equity	Separate	4.0%	$149.1	YES	Fees unchanged
Mondrian Intl Equity	Separate	4.0%	$149.6	YES	Fees unchanged
Fixed		**32.0%**	**$1,194.4**		
Wellington DAS Plus Beta 10yr	Commingled	2.9%	$108.9	NO	Cost to move out of this pool; create new fund of 1.
Wellington Emerging Market Debt	Commingled	5.1%	$192.7	NO	Work with VPIC on most appropriate SMA
SSGA Barclays Aggregate Index	Commingled	3.1%	$117.7	NO	Prohibitively costly to move to SMA- too small $AUM
GAM Unconstrained Bond	Commingled	3.5%	$130.8	NO	Minimal costs to move to different class without FF.
PIMCO Core Plus	Separate	5.8%	$216.3	YES	Fees unchanged
PIMCO Unconstrained Bond	Separate	2.5%	$92.9	YES	Fees unchanged
Guggenheim High Yield	Separate	4.0%	$147.9	YES	Fees Unchanged
KDP High Yield	Separate	1.1%	$39.7	YES	Fees Unchanged
Absolute Return		**17.0%**	**$647.8**		
Mellon EB DV Dynamic Growth Fun	Commingled	2.0%	$75.3	NO	Requires SMA-meaningfully higher fees
Alternatives		**11.0%**	**$393.2**		
Total Harbourvest Partners	Commingled	1.3%	$48.9	NO	Co-invest fund with opt-out; seek non-Harbourvest.

Appendix 9) Exxon-Mobil Response to Vermont Pension Investment Committee Questionnaire (November 2016)

Question-1: Gross global Scope 1 emissions, percentage covered under a regulatory program, percentage by hydrocarbon resource

A combined response to Questions 1 and 2 is below

Question-2: Amount of gross global Scope 1 emissions from: (1) combustion, (2) flared hydrocarbons, (3) process emissions, (4) directly vented releases, and (5) fugitive emissions/leaks

In 2015, ExxonMobil's net equity greenhouse gas emissions were 122 million CO2-equivalent metric tons. Relative to our 2014 performance, our 2015 emissions decreased by approximately 1 million CO2-equivalent metric tons. This decrease was primarily driven by energy efficiency improvement and asset divestment. The net equity greenhouse gas metric includes direct and imported greenhouse gas emissions and excludes emissions from exports (including ExxonMobil's interest in Hong Kong power through mid-2014, when it was sold). ExxonMobil reports greenhouse gas emissions on a net equity basis for all our business operations, reflecting our percent ownership in an asset.

Energy efficiency

In 2015, energy used in our operations totaled 1.7 billion gigajoules. Energy consumed in our operations generates more than 80 percent of our direct greenhouse gas emissions and is one of our largest operating costs. As such, we have focused on energy efficiency for several decades. Since 2000, we have used our Global Energy Management System in the Downstream and Chemical businesses, and our Production Operations Energy Management System in our Upstream businesses to identify and act on energy savings opportunities.

Through our commitment to energy efficiency, application of structured processes and continued use of a bottom-up approach, we continue to yield industry-leading results. For example, in 2010, 2012 and 2014 refining industry surveys, ExxonMobil's global refining operations achieved first quartile energy efficiency performance.

Flaring

ExxonMobil has invested more than $3.8 billion at our Upstream facilities around the world on emission reduction efforts, including flare mitigation since 2000. As a result, hydrocarbon flaring volumes from our combined operations in 2015 were 35 percent lower than 2006 levels.

In 2015, flaring volume from our combined Upstream, Downstream and Chemical operations totaled 5.3 million metric tons. This represents an increase of 0.8 million metric tons compared with our 2014 performance.

The increase in flaring was primarily due to operations in Angola, where a third-party-operated liquefied natural gas (LNG) plant was not operating. The increase was partially offset by flaring reductions resulting from the completion of commissioning work at our Papua New Guinea LNG plant and operational improvements at the Usan production field in Nigeria.

ExxonMobil is a charter member of the Global Gas Flaring Reduction Partnership. In addition, we put in place our own parameters, the Upstream Flaring and Venting Reduction Environmental Standard for Projects, in 2005. Our goal is to responsibly avoid routine flaring in new Upstream projects and reduce "legacy" flaring in our existing operations.

For example, our joint venture operations in Qatar have recently begun using a jetty boil-off gas recovery facility to recover natural gas that was previously flared during LNG vessel loading at the marine berths located at the Ras Laffan Port. Approximately 1 percent of the LNG loaded onto the ships evaporates due to the difference in temperature between the LNG and the ship tank. The recovery facility collects the boil-off gas and returns it to the LNG plants to be used as fuel or converted back into LNG. During one year of operation, the facility has recovered more than 500,000 metric tons of gas and reduced LNG vessel loading-related flaring by around 90 percent.

Venting and fugitive emissions

Our venting and fugitive emissions in 2015 totaled 6 million CO2-equivalent metric tons, which is essentially the same as our 2014 performance. While venting and fugitive emissions, most of which are methane, represent approximately 5 percent of our direct greenhouse gas emissions, we recognize the importance of reducing these emissions. We continue to look for ways to reduce methane and other hydrocarbon emissions in our operations, such as replacing high-bleed pneumatic devices with lower-emission technology and conducting green well completions in targeted Upstream operations.

Cogeneration

ExxonMobil has invested more than $2 billion since 2001 in support of Upstream and Downstream cogeneration facilities to more efficiently produce electricity and reduce greenhouse gas emissions.

Cogeneration technology captures heat generated from the production of electricity for use in production, refining and chemical processing operations. Due to its inherent energy efficiency, the use of cogeneration leads to reduced greenhouse gas emissions. ExxonMobil's cogeneration facilities enable the avoidance of approximately 6 million metric tons per year of greenhouse gas emissions.

We have interests in approximately 5,500 megawatts of cogeneration capacity in more than 100 installations at more than 30 locations around the world. This capacity is equivalent to the annual energy needed to power 2.5 million U.S. homes. Over the past decade, we have added more than 1,000 megawatts of cogeneration capacity and continue to develop additional investment opportunities.

For example, ExxonMobil began the construction of a new 84-megawatt cogeneration facility at our Singapore refinery's Jurong site. When this facility is completed in 2017, ExxonMobil will have more than 440 megawatts of cogeneration capacity in Singapore, enabling our integrated refining and petrochemical complex to meet all its power needs.

ExxonMobil provides detailed reporting on our greenhouse gas emissions each year in our Corporate Citizenship Report. The following table is from the 2015 report:

Performance data table*	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Page #
Managing climate change risks											
*Greenhouse gas emissions, absolute (net equity, CO_2-equivalent emissions), millions of metric tons	139	135	126	123	126	128	126	127	123	122	35
*Direct (excluding emissions from exported power and heat)	129	125	117	114	117	119	118	119	115	114	N/A
*Emissions associated with imported power	10	10	9	9	9	9	8	8	8	8	N/A
Greenhouse gas emission constituents (excludes emissions from exported power and heat), millions of metric tons											
CO_2 (excluding emissions from exported power and heat)	134	131	122	119	122	124	120	119	116	115	N/A
Methane (CO_2-equivalent)	4	3	3	3	3	3	3	7	6	6	N/A
Other gases (CO_2-equivalent)	1	1	1	1	1	1	1	1	1	1	N/A
Emissions from exported power and heat	14	14	13	14	13	15	15	16	7	4	N/A
By-region greenhouse gas emissions (net equity, CO_2-equivalent emissions), millions of metric tons											
Africa/Europe/Middle East	50	50	45	43	45	45	44	44	43	44	N/A
Americas	69	65	62	62	64	66	68	70	66	65	N/A
Asia Pacific	20	20	19	18	17	17	14	13	14	13	N/A

By-division greenhouse gas emissions (net equity, CO_2-equivalent emissions), millions of metric tons											
Upstream	57	53	49	47	50	54	56	58	56	56	N/A
Downstream	60	59	57	56	55	54	51	49	47	45	N/A
Chemical	22	23	20	20	21	20	19	20	20	21	N/A
Carbon dioxide – captured for sequestration, millions of metric tons	N/A	N/A	N/A	N/A	N/A	5.0	4.8	5.9	6.9	6.9	34
[1]Greenhouse gas emissions, normalized (net equity, CO_2-equivalent emissions), metric tons per 100 metric tons of throughput or production											
Upstream	22.6	21.7	21.0	20.1	20.5	20.7	22.3	22.8	23.4	23.4	35
Downstream	21.8	21.5	21.0	21.0	20.8	20.0	19.6	19.7	19.2	18.9	35
Chemical	60.9	62.1	59.8	60.7	57.9	57.2	56.3	57.0	53.4	52.3	35
Energy use (billion gigajoules)	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.7	36
Energy intensity, normalized versus Global Energy Management System (GEMS) base year (2002) – refining	94.8	94.2	93.7	92.8	91.8	90.9	90.0	90.5	90.3	91.2	N/A
Energy intensity, normalized versus GEMS base year (2002) – chemical steam cracking	90.4	89.6	90.4	88.6	87.6	87.3	88.2	88.8	86.4	86.6	N/A
Hydrocarbon flaring (worldwide activities), millions of metric tons	8.2	8.0	5.7	4.4	3.6	4.1	3.6	3.7	4.5	5.3	36
[2]Cogeneration capacity in which we have interest, gigawatts	4.3	4.5	4.6	4.9	4.9	5.0	5.2	5.3	5.5	5.5	37

[1]The net equity greenhouse gas emissions metric was introduced in 2011 as a replacement for the direct equity greenhouse gas metric. Information has been restated back to 2005 according to the new metric. The net equity greenhouse gas metric includes direct and imported greenhouse gas emissions and excludes emissions from exports (including Hong Kong Power through mid-2014). ExxonMobil reports greenhouse gas emissions on a net equity basis for all our business operations, reflecting our percent ownership in an asset.

[2]The addition of direct emissions and emissions associated with exported power and heat is equivalent to World Resources Institute (WRI) Scope 1.

[3]These emissions are equivalent to WRI Scope 2.

Question-3: Description of long-term and short-term strategy or plan to manage Scope 1 emissions, emissions reduction targets, and an analysis of performance against those targets

As we seek to increase production of oil and natural gas to meet growing global energy demand, we are committed to continuing to take actions to mitigate greenhouse gas emissions within our operations.

ExxonMobil has strong processes designed to improve efficiency, reduce emissions and contribute to effective long-term solutions to manage climate change risks. These processes include, where appropriate, setting tailored objectives at the business, site and equipment levels, and then stewarding progress toward meeting those objectives. Based on decades of experience, ExxonMobil believes this rigorous bottom-up approach is a more effective and meaningful way to drive efficiency improvement and greenhouse gas emissions reduction than through high-level corporate targets. We believe that continuing to use this approach will yield further improvements in all sectors of our business.

In the near term, we are working to increase energy efficiency while reducing flaring, venting and fugitive emissions in our operations. In the medium term, we are deploying proven technologies such as cogeneration and carbon capture and sequestration where technically and economically feasible. Longer term, we are conducting and supporting research to develop breakthrough, game-changing technologies.

Since 2000, ExxonMobil has spent approximately $7 billion on technologies to reduce emissions and in the development of lower-emission energy solutions.

Question-4: Sensitivity of hydrocarbon reserve levels to future price projection scenarios that account for a price on carbon emissions

A combined response to Questions 4 and 6 can be found under Question 6 below

Question-5: Estimated carbon dioxide emissions embedded in proved hydrocarbon reserves

ExxonMobil does not estimate the potential quantity of carbon dioxide that may be created when our proved reserves are produced, converted to finished products and used by consumers. According to the International Energy Agency, approximately 90 percent of petroleum-related greenhouse gas emissions attributable to operations such as ours are generated when customers use our products (indirect emissions) and the remaining 10 percent are generated by industry operations (direct emissions).

Question-6: Discussion of how price and demand for hydrocarbons and/or climate regulation influence the capital expenditure strategy for exploration, acquisition, and development of assets

By 2040, the world's population is projected to reach 9 billion — up from about 7.2 billion today — and global GDP will have more than doubled. As a result, we see global energy demand rising by about 25 percent from 2014 to 2040. In order to meet this demand, we believe all economic energy sources, including our existing hydrocarbon reserves, will be needed. We also believe that the transition of the global energy system to lower-emissions sources will take many decades due to the system's enormous scale, capital intensity and complexity. As such, we believe that none of our proven hydrocarbon reserves are, or will become, stranded.

ExxonMobil's long-range annual forecast, The Outlook for Energy, examines energy supply and demand trends for approximately 100 countries, 15 demand sectors and 20 different energy types. The Outlook forms the foundation for the company's business strategies and helps guide our investment decisions. In response to projected increases in global fuel and electricity demand, our 2016 Outlook estimates that global energy-related CO2 emissions will peak around 2030 and then begin to decline. A host of trends contribute to this downturn — including slowing population growth, maturing economies and a shift to cleaner fuels like natural gas and renewables — some voluntary and some the result of policy.

ExxonMobil believes the long-term objective of effective policy is to reduce the risks posed by climate change at minimum societal cost, in balance with other societal priorities such as poverty eradication, education, health, security and affordable energy.

We fundamentally believe that free markets, innovation and technology are essential to addressing the risks of climate change. Success in developing and deploying impactful technologies will highly depend on governments creating a policy landscape that enables innovation and competition. Policies need to be clear and guard against duplicative, overlapping and conflicting regulations, which send mixed signals to the market and impose unnecessary costs on consumers. We believe that effective policies are those that:

- *Promote global participation;*
- *Let market prices drive the selection of solutions;*
- *Ensure a uniform and predictable cost of greenhouse gas emissions across the economy;*
- *Minimize complexity and administrative costs;*
- *Maximize transparency; and*
- *Provide flexibility for future adjustments to react to developments in climate science and the economic impacts of climate policies.*

Policies based on these principles minimize overall costs to society and allow markets to help determine the most effective and commercially viable solutions.

Given the wide range of societal priorities and limited global resources, all policies, including climate change policy, must be as economically efficient as possible. ExxonMobil believes that market-based systems that impose a uniform, economy-wide cost on greenhouse gas emissions are more economically efficient policy options than mandates or standards. This is because market-based policies more effectively drive consumer behavior and technology innovation, while mandates and standards eliminate consumer choice and can perpetuate ineffective technologies.

Since 2009, ExxonMobil has advocated the view that a properly designed, revenue-neutral carbon tax is a more effective market-based option than a cap-and-trade approach. A carbon tax is more transparent, can be implemented in existing tax infrastructure, avoids the complexity of creating and regulating carbon markets where none exist and reduces greenhouse gas emissions price volatility, thus delivering a clearer, more consistent long-term market price signal.

Only through a sound global policy framework will the power of markets and innovation enable society to find cost-effective solutions to address the risks of climate change, while at the same time continuing to address the many other challenges the world faces.

ExxonMobil addresses the potential for future climate change policy, including the potential for restrictions on emissions, by estimating a proxy cost of carbon. This cost, which in some geographies may approach $80 per ton by 2040, has been included in our Outlook for several years. This approach seeks to reflect potential policies governments may employ related to the exploration, development, production, transportation or use of carbon-based fuels. We believe our view on the potential for future policy action is realistic and by no means represents a "business-as-usual" case. We require all of our business lines to include, where appropriate, an estimate of greenhouse gas-related emissions costs in their economics when seeking funding for capital investments.

We evaluate potential investments and projects using a wide range of economic conditions and commodity prices. We apply prudent and substantial margins in our planning assumptions to help ensure competitive returns over a wide range of market conditions. We also financially stress test our investment opportunities, which provides an added margin against uncertainties, such as those related to technology development, costs, geopolitics, availability of required materials, services and labor. Stress testing further enables us to consider a wide range of market environments in our planning and investment process.

Question-7: Revenues from renewable and alternative energy, average annual during trailing three years ending June 30, 2016

Recognizing the limitations associated with most existing low greenhouse gas emissions energy technologies, particularly in delivering the necessary economy and scale, we are conducting fundamental research to develop low greenhouse gas emission energy solutions that have the potential to be economically feasible without subsidies, standards or mandates. As society transitions to lower greenhouse gas emission energy solutions, technological advancements that change the way we produce and use energy will be instrumental in providing the global economy with the energy it needs while reducing greenhouse gas emissions. ExxonMobil is pioneering scientific research to discover innovative approaches to enhance existing and develop next-generation energy sources.

Question-8: R&D spending on renewable, alternative and low-carbon energy and technologies (including natural gas, carbon capture technologies, and energy efficiency improvements, average annual during trailing three years ending June 30, 2016.

Since our merger with XTO Energy in 2010, ExxonMobil has been one of the largest natural gas producers in the world. Coupled with our leadership in the development and production of liquefied natural gas (LNG), ExxonMobil is well-positioned to meet growing demand for this clean energy source. We spend approximately a quarter of a billion dollars per year on research and development on technologies to enable the safe development of natural gas. In addition, since 2000, ExxonMobil has spent nearly $7 billion on technology to reduce greenhouse gas emissions, including on energy efficiency, cogeneration, flare reduction, carbon capture and sequestration, and to research lower-emission energy solutions.

Question-9: R&D spending on renewable energy technologies, Average Annual during trailing three years ending June 30, 2016

ExxonMobil's Emerging Technologies program brings together executives, scientists and engineers from across ExxonMobil's businesses to identify and evaluate technology research opportunities with a long-term strategic focus. The Emerging Technologies team seeks to understand a wide range of technology options and how they may impact the global energy system in the near term and as far as 50 years into

the future. Our evaluation extends well beyond our base business and near-term focus. If a technology could have a material effect on the future of energy, we insist on knowing about it and understanding the related science. Understanding the fundamental science serves as a basis for our broader research efforts and may lead to further technology development aimed at practical application, such as our work on biofuels. Additionally, this awareness informs our internal analysis of the global energy landscape as reflected and encapsulated in our annual Outlook for Energy.

At the center of our research is ExxonMobil's Corporate Strategic Research laboratory, a fundamental research institution with approximately 150 Ph.D. scientists and engineers focused on addressing the company's long-range science needs. The laboratory's scientists are internationally recognized experts in their field. Our research portfolio includes a broad array of programs, including biofuels, carbon capture and sequestration, alternative energy and climate science.

In addition to in-house research, the Corporate Strategic Research laboratory conducts strategic research with approximately 80 universities around the world on next-generation technology. For example, in 2014, ExxonMobil signed an agreement to join the Massachusetts Institute of Technology Energy Initiative, a collaboration aimed at working to advance and explore the future of energy. ExxonMobil was also a founding member in 2002 of the Global Climate and Energy Project at Stanford University, which included a $100 million commitment to develop fundamental, game-changing scientific breakthroughs that could lead to lower greenhouse gas emissions and a less carbon-intensive global energy system. Other university collaborations cover a wide range of scientific topics, from understanding the impacts of black carbon and aerosols at the University of California, Riverside to photovoltaics at Princeton University.

Advanced biofuels

ExxonMobil funds a broad portfolio of biofuels research programs including ongoing efforts to develop algae-based biofuels, as well as programs for converting non-food based feedstocks, such as whole cellulosic biomass, algae-based feedstocks and cellulose-derived sugars, into advanced biofuels. We believe that additional fundamental technology improvements and scientific breakthroughs are still necessary in both biomass optimization and the processing of biomass into fuels. Specifically, scientific breakthroughs are needed to ensure that advanced biofuels can be scaled up economically and produced with the desired environmental benefit of lower life cycle greenhouse gas emissions.

Our advanced biofuels research includes joint research collaborations with Synthetic Genomics Inc. (SGI), Renewable Energy Group, the Colorado School of Mines, Michigan State University, Northwestern University and the University of Wisconsin.

There are numerous benefits of using algae for biofuels production. Algae can be cultivated on land unsuitable for other purposes with water that cannot be used for food production. In addition to using non-arable land and not requiring the use of fresh water, algae could also potentially yield greater volumes of biofuels per acre than other sources. We also know that algae can be used to manufacture biofuels similar in composition to today's transportation fuels.

In addition, growing algae can provide an environmental benefit. Algae consume CO_2 and have the potential to provide greenhouse gas mitigation benefits versus conventional fuels. In 2012, researchers from MIT, ExxonMobil and SGI published an assessment of algal biofuels in the peer-reviewed journal Environmental Science and Technology, which concluded that if key research hurdles are overcome, algal biofuels will have about 50% lower life cycle greenhouse gas emissions than petroleum-derived fuel.

In contrast, there is a robust debate in the academic research community regarding the carbon footprint of first generation biofuels, which the EPA defines as those generated from edible crops (such

as corn). Many peer-reviewed papers in the scientific literature suggest that the direct life cycle greenhouse gas emissions are lower than fossil fuels, but that indirect consequences of first generation biofuel development, including changes in forest and agricultural land use change, may result in higher total greenhouse gas emissions than petroleum-derived fuels.

For these reasons, ExxonMobil is pursuing research into second generation biofuels to determine how they may best fit into our energy future. Second generation biofuels are defined as those produced from non-edible crops, crop residues, or biologically generated gas and therefore do not take away from the total food supply. Examples include algae, corn stover, switchgrass or methane emitted from microbial activity in landfills.

ExxonMobil and SGI are carrying out a basic research program to develop advanced biofuels from algae. Our objective is to develop advanced algae biofuels options and identify the best pathways to make these groundbreaking technologies available to consumers. We have been working with SGI since 2009.

We face some significant technical hurdles before biofuels production from algae will be possible at a significant commercial scale. To overcome these challenges, we are working to answer some basic questions such as:

- *Why do algae utilize a relatively small amount of available light energy?*
- *What tools can be used to improve light utilization efficiency of algae and to improve production characteristics?*
- *How do you develop an organism that will produce significantly more bio oil?*

The central challenge is that algae naturally harvest significantly more light than they can effectively convert to biofuels. Only a fixed amount of light hits the surface of a pond, and our goal is for the algae to use this light as efficiently as possible. The amount of wasted sunlight varies greatly depending on the algae species and growth conditions, but can be as high as 80 percent or more. ExxonMobil and SGI are conducting fundamental research to decrease the amount of wasted sunlight and increase biomass productivity by improving the photosynthetic efficiency of individual algae cells. To achieve this objective, the SGI team is working to engineer algae cells that will absorb only the amount of light that they can effectively use.

Carbon capture and sequestration

Carbon capture and sequestration (CCS) is the process by which CO2 gas that would otherwise be released into the atmosphere is captured, compressed and injected into underground geologic formations for permanent storage. With a working interest in approximately one-third of the world's total CCS capacity, ExxonMobil is a leader in one of the most important next-generation low-carbon technologies. In 2015, we captured 6.9 million metric tons of CO2 for sequestration.

Over the past 15 years, ExxonMobil has invested nearly $400 million in researching, developing and applying carbon capture and storage technology in association with our projects, with significant additional investment expected at our Gorgon project in coming years.

ExxonMobil believes the greatest opportunity for future large-scale deployment of CCS will be in the natural gas-fired power generation sector. While CCS technology can be applied to coal-fired power generation, the cost to capture CO2 from that source is about twice that of natural gas power generation. In addition, because coal-fired power generation creates about twice as much CO2 per unit of electricity generated, the geological storage space required to sequester the CO2 produced from coal-fired generation is about twice that associated with gas-fired generation.

ExxonMobil is conducting proprietary, fundamental research to develop breakthrough carbon capture technologies that have the potential to be economically feasible without government subsidies, standards or mandates.

As an example, ExxonMobil's scientists have been pursuing new technology that could reduce the costs associated with current CCS processes by increasing the amount of electricity a power plant produces while simultaneously delivering significant reductions in carbon dioxide emissions. At the center of ExxonMobil's technology application is a carbonate fuel cell.

Laboratory tests have demonstrated that the unique integration of carbonate fuel cells and natural gas power generation captures carbon dioxide more efficiently than current, conventional capture technology. During the conventional capture process, a chemical reacts with the carbon dioxide, extracting it from power plant exhaust. Steam is then used to release the carbon dioxide from the chemical – steam that would otherwise be used to move a turbine, thus decreasing the amount of power the turbine can generate.

Using fuel cells to capture carbon dioxide from power plants results in a more efficient separation of carbon dioxide from power plant exhaust and an increased output of electricity. Power plant exhaust is directed to the fuel cell, replacing air that is normally used in combination with natural gas during the fuel cell power generation process. As the fuel cell generates power, the carbon dioxide becomes more concentrated, allowing it to be more easily and affordably captured from the cell's exhaust and stored. ExxonMobil's research indicates that a typical 500 megawatt (MW) power plant using a carbonate fuel cell may be able to generate up to an additional 120 MW of power while current CCS technology consumes about 50 MW of power.

ExxonMobil's research indicates that by applying this technology, more than 90 percent of a natural gas power plant's carbon dioxide emissions could be captured. Natural gas is already the least carbon-intensive of the major hydrocarbon-based energy sources.

In addition, carbonate fuel cell technology has the potential to generate significant volumes of hydrogen. Simulations suggest that the new technology can produce up to 150 million cubic feet per day of hydrogen while capturing carbon dioxide from a 500 MW power plant. To put that in perspective, a world-scale steam methane reforming hydrogen plant produces around 125 million cubic feet per day. In addition, synthesis gas, or syngas, composed of hydrogen and carbon monoxide, can be produced that can be upgraded to other useful products such as methanol, olefins, or higher molecular weight hydrocarbons for transportation fuels or lubricants.

In May 2016, ExxonMobil and FuelCell Energy, Inc., announced an agreement to pursue this novel technology in power plant carbon dioxide capture through a new application of carbonate fuel cells, and in October of the same year, we jointly announced the selection of a location to test it at the James M. Barry Electric Generating Station in Alabama. This fuel cell carbon capture solution could substantially reduce costs and lead to a more economical pathway toward large-scale carbon capture and sequestration globally.

University Collaborations

ExxonMobil is working with approximately 80 universities around the world to explore next-generation energy technologies. Since 2002, we have supported long-term collaborative scientific research related to greenhouse gas emissions at Stanford University, and more recently, we have begun collaborations with Princeton University, Massachusetts Institute of Technology (MIT), the University of Texas at Austin, and Georgia Institute of Technology as part of our commitment to finding meaningful and scalable solutions to meet global energy demand.

Stanford University

In 2002, ExxonMobil made a $100 million commitment to Stanford's Global Climate and Energy Project (GCEP), which is focused on identifying breakthrough energy technologies. GCEP's strategy is to take a long view by supporting game-changing research with a 10- to 50-year time horizon; its goal is to keep the innovation pipeline filled with new ideas and new approaches that will ultimately make efficient, environmentally sustainable, low-cost energy available worldwide. Since its launch, GCEP has built a diverse research portfolio of innovative technologies in areas such as solar power, biomass energy, advanced combustion, carbon capture and sequestration, transportation and the electrical grid. GCEP-supported research has led to significant advances in cutting-edge energy technologies ranging from improved light management techniques and nanoscale designs for increasing the efficiency of photovoltaic systems, to novel microbial bioreactors that use renewable energy to produce methane and other fuels. Overall, GCEP has supported 80 scientific programs led by 165 faculty members and 39 research institutions across the globe. GCEP researchers have also published more than 500 papers in leading journals and given more than 700 presentations at conferences.

Massachusetts Institute of Technology

In October 2014, ExxonMobil became a founding member of the MIT Energy Initiative and will contribute $25 million over five years to support research and establish 10 graduate energy fellowship appointments each year. The MIT Energy Initiative is a unique collaboration aimed at working together to advance and explore the future of energy focused on new energy sources and more efficient use of conventional energy resources. Since launching the collaboration with MIT, the joint research program has made inroads into several areas, including bio-inspired catalysts for the petrochemical industry and computational modeling to better understand the properties of iron and iron-based alloys used in pipelines. The program has also enabled ExxonMobil to expand research efforts to emerging areas like photovoltaic and nuclear power, as well as enhance our understanding of energy options and the interactions between them.

ExxonMobil has also joined the MIT Energy Initiative's Carbon Capture, Utilization, and Storage (CCUS) Center, one of eight Low-Carbon Energy Centers first called for in MIT's Plan for Action on Climate Change in October 2015. It was established to advance research on specific, key technologies to address climate change such as electric power systems, energy bioscience, energy storage, materials for energy and extreme environments, advanced nuclear energy systems, nuclear fusion and solar energy, in addition to CCUS.

Princeton University

In September 2016, ExxonMobil and Princeton University announced the selection of five research projects associated with their partnership focused on energy technologies. The projects will center on solar and battery technologies, plasma physics, Arctic sea-ice modeling, and the impact of carbon dioxide absorption on the world's oceans. This announcement followed ExxonMobil's June 2015 commitment to contribute $5 million to Princeton E-ffiliates Partnership, a program administered by Princeton University's Andlinger Center for Energy and the Environment that fosters research in sustainable energy and environmental solutions. E-ffiliates promotes collaboration between industry and academia to search for energy and environmental breakthroughs. ExxonMobil scientists collaborated with Princeton professors to identify areas with the most scientific potential, particularly ones that build on the university's existing strengths and interests in emerging energy.

The University of Texas at Austin

In July 2016, ExxonMobil announced a $15 million investment as a leading member of the University of Texas at Austin Energy Institute to pursue technologies to help meet growing energy demand while reducing environmental impacts and the risk of climate change. The joint research initiative will study transformational energy innovations including integrating renewable energy sources into the current supply mix and advancing traditional energy sources in ways that improve efficiency and reduce impacts on water, air and climate. Research projects are expected to cover a range of emerging

technologies, and will take advantage of the university's capabilities in renewable energy, battery technologies, carbon capture and power grid modeling. Core strengths in advanced computing, environmental management and additive manufacturing may be applied to improve traditional energy sources.

Georgia Institute of Technology
Scientists from ExxonMobil and the Georgia Institute of Technology (GT) have developed a potentially revolutionary new technology that could significantly reduce the amount of energy and emissions associated with manufacturing plastics. Results of the research were published in the August 19, 2016, edition of the professional journal Science.

The new process uses a form of reverse osmosis to separate similarly sized organic molecules. It effectively relies on a molecular-level filter that separates chemical building blocks for plastics from complex hydrocarbons at low temperatures and pressures. Working with Dr. Ryan Lively, assistant professor in GT's School of Chemical & Biomolecular Engineering, and a GT post-doctoral researcher, the team successfully demonstrated that chemical compounds known as aromatics can be separated by pressing them through a synthetic membrane they developed that acts as a high-tech sieve.
The new process may enable chemical producers to separate aromatics without heating the chemical mixture, greatly reducing the amount of energy consumed and emissions generated during the current commercial manufacturing process. ExxonMobil believes the new membrane has potential for commercialization and integration into industrial chemical separation processes since it is made from common materials, known as polymer building blocks. The technology still faces a number of challenges before it can be considered for commercialization and use at an industrial scale. The membranes used in the process will need to be tested under more challenging conditions, as industrial mixtures normally contain multiple organic compounds and may include materials that can foul membrane systems. The researchers must also learn to make the material consistently and demonstrate that it can withstand long-term industrial use.

This breakthrough could reduce annual carbon dioxide emissions by 45 million tons, which is equivalent to the annual energy-related carbon dioxide emissions of about five million U.S. homes. It could also reduce global energy costs used to make plastics by up to $2 billion a year. As our research into this specific chemical process advances, we hope to learn more about how this technology could be used in other applications to achieve the same type of efficiency and emissions-reductions results, and potentially reduce our manufacturing footprint even further.

For additional information, please see the following:

- *Corporate Citizenship Report – Managing Climate Risks: http://corporate.exxonmobil.com/en/community/corporate-citizenship-report/managing-climate-change-risks*
- *ExxonMobil's perspectives on climate change: http://corporate.exxonmobil.com/en/current-issues/climate-policy/climate-perspectives*
- *ExxonMobil Outlook for Energy: A View to 2040 http://corporate.exxonmobil.com/en/energy/energy-outlook*
- *Credit natural gas for falling emissions, rising economy – ExxonMobil blog: https://energyfactor.exxonmobil.com/perspectives/natural-gas-falling-emissions/*
- *ExxonMobil's Collegiate Collaboration – ExxonMobil blog: https://energyfactor.exxonmobil.com/perspectives/exxonmobil-collegiate-collaboration/*

DISCLOSURES: This document is provided for informational purposes only. It does not constitute an offer of securities of any of the issuers that may be described herein. Information contained herein may have been provided by third parties, including investment firms providing information on returns and assets under management, and may not have been independently verified. The past performance information contained in this report is not necessarily indicative of future results and there is no assurance that the investment in question will achieve comparable results or that the Firm will be able to implement its investment strategy or achieve its investment objectives. The actual realized value of currently unrealized investments (if any) will depend on a variety of factors, including future operating results, the value of the assets and market conditions at the time of disposition, any related transaction costs and the timing and manner of sale, all of which may differ from the assumptions and circumstances on which any current unrealized valuations are based.

Neither PCA nor PCA's officers, employees or agents, make any representation or warranty, express or implied, in relation to the accuracy or completeness of the information contained in this document or any oral information provided in connection herewith, or any data subsequently generated herefrom, and accept no responsibility, obligation or liability (whether direct or indirect, in contract, tort or otherwise) in relation to any of such information. PCA and PCA's officers, employees and agents expressly disclaim any and all liability that may be based on this document and any errors therein or omissions therefrom. Neither PCA nor any of PCA's officers, employees or agents, make any representation of warranty, express or implied, that any transaction has been or may be effected on the terms or in the manner stated in this document, or as to the achievement or reasonableness of future projections, management targets, estimates, prospects or returns, if any. Any views or terms contained herein are preliminary only, and are based on financial, economic, market and other conditions prevailing as of the date of this document and are therefore subject to change.

The information contained in this report may include forward-looking statements. Forward-looking statements include a number of risks, uncertainties and other factors beyond the control of the Firm, which may result in material differences in actual results, performance or other expectations. The opinions, estimates and analyses reflect PCA's current judgment, which may change in the future.

Any tables, graphs or charts relating to past performance included in this report are intended only to illustrate investment performance for the historical periods shown. Such tables, graphs and charts are not intended to predict future performance and should not be used as the basis for an investment decision.

All trademarks or product names mentioned herein are the property of their respective owners. Indices are unmanaged and one cannot invest directly in an index. The index data provided is on an "as is" basis. In no event shall the index providers or its affiliates have any liability of any kind in connection with the index data or the portfolio described herein. Copying or redistributing the index data is strictly prohibited.

The Russell indices are either registered trademarks or tradenames of Frank Russell Company in the U.S. and/or other countries.

The MSCI indices are trademarks and service marks of MSCI or its subsidiaries.

Standard and Poor's (S&P) is a division of The McGraw-Hill Companies, Inc. S&P indices, including the S&P 500, are a registered trademark of The McGraw-Hill Companies, Inc.

CBOE, not S&P, calculates and disseminates the BXM Index. The CBOE has a business relationship with Standard & Poor's on the BXM. CBOE and Chicago Board Options Exchange are registered trademarks of the CBOE, and SPX, and CBOE S&P 500 BuyWrite Index BXM are servicemarks of the CBOE. The methodology of the CBOE S&P 500 BuyWrite Index is owned by CBOE and may be covered by one or more patents or pending patent applications.

The Barclays Capital indices (formerly known as the Lehman indices) are trademarks of Barclays Capital, Inc.

The Citigroup indices are trademarks of Citicorp or its affiliates.

The Merrill Lynch indices are trademarks of Merrill Lynch & Co. or its affiliates.

FTSE is a trademark of the London Stock Exchange Group companies and is used by FTSE under license. All rights in the FTSE indices and/or FTSE ratings vest in FTSE and/or its licensors. No further distribution of FTSE data is permitted with FTSE's express written consent.

NEPC Fossil Fuel Divestment Commentary
January 28, 2018

ATTACHMENT 4

"Investment Policy for Mitigating Environmental, Social, and Geopolitical Risks (ESG)"
CalSTRS

Attachment A:
Investment Policy for Mitigating Environmental, Social, and Geopolitical Risks (ESG)

PRINCIPLES

The fiduciary responsibility of the Board, as described in detail within the overall Investment Policy and Management Plan, is to discharge its responsibility in the sole and exclusive interest of the participants and beneficiaries in a manner that will assure the prompt delivery of benefits and related services.

CalSTRS invests a multi-billion dollar fund in a unique and complex social-economic milieu and recognizes it can neither operate nor invest in a vacuum. The System's investment activities impact other facets of the economy and the globe. As a significant investor with a very long-term investment horizon and expected life, the success of CalSTRS is linked to global economic growth and prosperity. Actions and activities that detract from the likelihood and potential of global growth are not in the long-term interests of the Fund. Therefore, consideration of environmental, social, and governance issues (ESG), as outlined by the CalSTRS 21 Risk Factors, are consistent with the Board fiduciary duties.

Consistent with its fiduciary responsibilities to our members, the Board has a social and ethical obligation to require that the corporations and entities in which securities are held meet a high standard of conduct and strive for sustainability in their operations. As an active owner, CalSTRS incorporates ESG into its ownership policies and practices.

Since CalSTRS is a long-term investor and may hold an investment in a corporation or entity for decade after decade, short-term gains at the expense of long-term gains are not in the best interest of the Fund. Sustainable returns over long periods are in the economic interest of the Fund. Conversely, unsustainable practices that hurt long-term profits are risks to the System's investment.

Since CalSTRS must invest huge sums of moneys for long periods of time to pay for future benefits promised to California Teachers, our actions to invest in securities of a corporation predominately reflects a judgment that the ownership will produce a sustainable rate of return which will make it an attractive investment and help CalSTRS meet its long-term obligations. It is important to note that CalSTRS ownership of a security in a company does not signify that CalSTRS approves of all of the company's practices or its products or that CalSTRS believes a particular company is an attractive

investment since the security may be owned due to its membership in a particular index or for risk mitigation purposes.

Since 1978, CalSTRS has used a written policy, the Statement of Investment Responsibility (SIR), to navigate the complex landscape of ESG issues. The long history of this document is testimony to the national leadership of CalSTRS among pension funds in addressing ESG matters through a written policy. The SIR will continue its longevity as guidance on proxy voting; however this Policy now replaces the SIR as CalSTRS's preeminent policy on ESG matters.

POLICY

Geopolitical Risks and Social Risks: To help manage the risk of investing a global portfolio in a complex geopolitical environment, CalSTRS has developed a series of procedures to follow when faced with any major geopolitical and social issue as identified by the 21 risk factors. It is important to note that fiduciary standards do not allow CalSTRS to select or reject investments based solely on social criteria.

When faced with a corporate decision that potentially violates CalSTRS Policies; the Investment Staff, CIO and Investment Committee will undertake the following actions:

A. The CIO will assess the gravity of the situation both as an ESG risk and as to the System. The extent of the responsibility of the System to devote resources to address these issues will be determined by: 1) the number of shares held in the corporation, and 2) the gravity of the violation of CalSTRS Policies.

B. At the CIO's direction, the Investment Staff will directly engage corporate management to seek information and understanding of the corporate decision and its ramifications on ESG issues.

C. The CIO and investment staff will provide a report to the Investment Committee of the findings and recommend any further action of engagement or need to commit further System resources. The Investment Committee can marshal further resources given the gravity of the situation.

To assist CalSTRS Staff and external investment managers in their investment analysis and decision-making, CalSTRS has developed a list of 21 risk factors that should be included within the financial analysis of any investment decision. This list is not exhaustive and does not attempt to identify all forms of risk that are appropriate to consider in a given investment transaction; however they do provide a framework of other factors that might be overlooked. These risk factors should be reviewed for an investment in any asset class whether within the U.S. or across the globe.

CalSTRS expects all investment managers, both internal and external to assess the risk of each of the following factors when making an investment. The manager needs to balance

the rate of return with all the risks including consideration of the specific investments exposure to each factor in each country in which that investment or company operates.

CALSTRS 21 RISK FACTORS
Monetary Transparency The long-term profitability by whether or not a country or company has free and open monetary and financial data, and its observance of applicable laws.
Data Dissemination The long-term profitability by whether or not a country is a member of the IMF (or similar organization) and satisfies the conditions for access, integrity, and quality for most data categories.
Accounting The long-term profitability by whether or not the accounting standards are formulated in accordance with International Accounting Standards or the U.S. Generally Accepted Accounting Principles.
Payment System: Central Bank The long-term profitability by whether the activities of a country's central bank encompass implementing and ensuring compliance with principles and standards which are established to promote safe, sound, and efficient payment and settlement systems.
Securities Regulation The long-term profitability by exposure to operations in countries that have not complied with IOSCO objectives, which provide investor protection against manipulation and fraudulent practices.
Auditing The investment's long-term profitability by whether or not the country uses International Standards on Auditing in setting national standards.
Fiscal Transparency The investment's long-term profitability by its exposure or business operations in countries that do not have not some level of fiscal transparency such as publication of financial statistics, sound standards for budgeting, accounting, and reporting.
Corporate Governance The investment's long-term profitability by whether or not the government recognizes and supports good corporate governance practices and whether it generally adheres to OECD principles.
Banking Supervision The investment's long-term profitability from its exposure to countries that have not endorsed/complied with the Basel Core Principles. An endorsement includes an agreement to review supervisory arrangements against the principles and bring legislation in line with the principles where necessary.

Payment System: Principles The investment's long-term profitability by whether a country complies with the 10 Core Principles for Systemically Important Payment Systems, which includes operational reliability, efficiency, real time settlement, final settlement in central bank money; and whether rules and procedures are clear and permit participants to understand the financial risks resulting from participation in the system.
Insolvency Framework The investment's long-term profitability from its business operations and activities in specific countries with regard to bankruptcy reform or insolvency legislation.
Money Laundering The investment's long-term profitability from exposure and whether or not a country has implemented an anti-money laundering regime in line with international standards; consideration should be given to compliance with the 40 recommendations in the Financial Action Task Force (FATF) on Money Laundering; and whether it is a member of FATF.
Insurance Supervision Whether or not a country has a regulatory framework in line with International Association of Insurance Supervisors (IAIS) Principles.
Respect for Human Rights The investment's long-term profitability from its business operations and activities in countries that lack or have a weak judicial System. Assess the risk to an investment's long-term profitability from its business operations and activities in a country that engages in or facilitates the following: arbitrary or unlawful deprivation of life, disappearance, torture and other cruel, inhuman, or degrading treatment or punishment, arbitrary arrest, detention, or exile, arbitrary interference with privacy, family, home, or correspondence, use of excessive force and violations of humanitarian law in internal conflicts. Consideration should be given to governmental attitude regarding international and non-governmental investigation of alleged violations of human rights.
Respect for Civil Liberties The investment's long-term profitability from operations, activities, and business practices in countries or regions that do not allow freedom of speech and press, freedom of peaceful assembly and association, freedom of religion, freedom of movement within the country, allowance for foreign travel, emigration, and repatriation.
Respect for Political Rights The investment's long-term profitability from business practices and activities in countries that do not allow their citizens the right to advocate for change to their government.
Discrimination Based on Race, Sex, Disability, Language, or Social Status The investment's long-term profitability from business practices and activities on discrimination, such as discrimination against women, children, and persons with disabilities, national/racial/ethnic minorities, or indigenous people.

Worker Rights The investment's long-term profitability from management and practices globally in the area of worker's rights; specifically the right of association, the right to organize and bargain collectively, prohibition of forced or bonded labor, status of child labor practices and minimum age for employment, acceptable work conditions, or human trafficking.
Environmental The investment's long-term profitability from activities and exposure to environmental matters such as; depleting or reducing air quality, water quality, land protection and usage, without regard for remediation. Consideration should be given to how a company is dealing with the impact of climate change, including whether the government is taking steps to reduce its impact, exacerbating the problem, or oblivious to the risk.
War/Conflicts/Acts of Terrorism The investment's long-term profitability from business exposure to a country or region that has an internal or external conflict, war, acts of terrorism or involvement in acts of terrorism, and whether the country is a party to international conventions and protocols.
Human Health The risk to an investment's long-term profitability from business exposure to an industry or company that makes a product which is highly detrimental to human health so that it draws significant product liability lawsuits, government regulation, United Nations sanctions and focus, and avoidance by other institutional investors.