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MINNESOTA STATE BOARD OF INVESTMENTS (SBI)

CLIMATE RISK INVESTMENT DISCUSSION

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SBI Climate Risk Investment Discussion:

Executive Summary

INTRODUCTION

The Minnesota State Board of Investment ("SBI") engaged Meketa Investment Group ("Meketa") to review the potential impact that climate change may have on the long-term investment risks to the SBI's Investment portfolio and indicate approaches that the SBI may take to address and mitigate identified investment risks. In what follows, we discuss the potential impact of climate change on investments; highlight peer pension plan current approaches to climate risks and opportunities; review the SBI's current approach to climate issues; and provide insights on how the SBI's portfolio is currently exposed to the risks and opportunities of transition to a low carbon economy—specifically the Plan's exposure to fossil fuel companies, including the coal subsector, and exposure to energy transition opportunities. Finally, we offer recommendations for the SBI's evolution in its approach to climate change issues.

We thank the SBI Staff for their insights and information. We thank the SBI's investment managers for responding to Meketa's survey on climate energy transition risks and opportunities in the SBI investment portfolio.

KEY FINDINGS

Climate Risk and Investments

- Climate change investment risks and opportunities will continue to escalate, from both physical effects and from the transition toward a low carbon economy.
- We believe these factors pose potential material long-term investment risks to the Minnesota State Board of Investment ("SBI") investment portfolio and offer potentially material long-term investment opportunities.
- Measuring the low carbon economy is not simple. Low carbon growth opportunities are being successfully pursued by large established enterprises, including firms that offer carbon based products and services, and new firms.
- These facts make the low carbon economy a difficult pure-play investment for a large institutional investor. Often, low carbon products and services are intermingled with fossil fuel based energy products and services. The transportation and utilities sectors both exemplify such developments.
- Stand alone, financially desirable, low carbon economy investment opportunities are in relatively limited supply, though growing. Opportunities extend beyond the energy sector to utilities, transportation and many other goods and services.
- Corporate management of climate change risks vary widely geographically, by economic sector, and by company.

Climate Risk and the SBI Investments

- In our opinion, the SBI actions on climate change place them among the more engaged U.S. public pension plans.
- The SBI has taken multiple initial steps to analyze and address climate change risks across its investment portfolio, including:
  - adopted Investment Beliefs that include a belief regarding engagement on 'Environmental, Social and Governance' ("ESG") issues;
  - developed proxy voting guidelines and practices that encourage corporate reporting on climate change risks and opportunities;
  - engaged on climate change risk issues through active participation in prominent institutional investor organizations, including The Council of Institutional Investors ("CII"), the Principles for Responsible Investment ("PRI"), Ceres, the Institutional Limited Partners Association ("ILPA"), and Climate Action 100+;
  - signed institutional investor letters urging action on climate change.
- We find that, even if the SBI changes nothing in their investment strategy, their investment funds will likely be incorporating assessments of climate risks and opportunities.

- Meketa surveyed all of the SBI's investment funds across all asset classes. Please note that the some investment firms manage more than one fund for the SBI. Thus, some managers responded for more than one fund's investment strategy that they manage for the SBI. In Meketa's survey, we found that 91% and 87% respectively of the SBI's actively managed public domestic equity and international equity assets are currently managed with some accounting for climate risks (Figure 13).
- Because the SBI's passively managed equity funds are designed to replicate market cap weighted benchmarks, and thus invest solely based on market capitalization, the overall percent of the SBI's total public market assets that account for climate change material risks is lower: 44% of the SBI's public markets assets are currently managed with some accounting for climate change risks (Figure 14).
- SBI actively managed public markets funds that represent 83% of the SBI's public market assets responded that they account for low carbon investment opportunities in their normal analysis (Figure 13). These percentages reflect the diversification in the SBI's portfolio to include and fixed income. The SBI fixed income portfolio is approximately 70% government debt securities.
- Funds that manage 63% of SBI private market assets reported that these funds are managed with some degree of accounting for climate change risks. Investment funds representing 25% of the SBI's private markets portfolio responded that they account for low carbon investment opportunities (Figure 15).
- The SBI's actively managed International Equity funds reported the highest share of AUM (70%) reporting and disclosing carbon emissions among the SBI's public market assets (Figure 16. This compared to 48% in active Domestic Equity, and 26% in Fixed Income that disclose carbon emissions. Including passive equity, 28% of the SBI's total AUM in public markets funds disclose emissions. The Euro Zone has been an early adopter on climate change and moving to a low carbon economy.
- Funds representing 7% of the SBI's private markets assets stated that they disclose the carbon footprint of their portfolio companies (Figure 18).
- The SBI's investments include exposure to low carbon products and services, particularly in public markets. These range from automakers that sell electric and internal combustion vehicles, real estate with energy efficient attributes, utilities that use both renewable and non-renewable energy, and companies in the energy sector that offer renewable energy products and services
- We found 31 of the 45 investment funds in the SBI public markets had some exposure to fossil fuel exploration and extraction companies, including passively managed funds. In total, the share of SBI public market assets invested in companies with exploration and extraction of fossil fuels was 3% (Figure 14). This seems generally in line with the broad market, although there was no precise definition that each fund followed in answering the question.

- Among the 218 SBI private market funds that responded, 68 indicated that they have exposure to fossil fuel exploration and extraction companies. The SBI had 8% of its private markets investment in companies with fossil fuel extraction and exploration (Figure 17).
- The SBI private markets funds reported 6% invested in companies involved in renewable energy (Figure 17).
- In public markets, 1% of the SBI Domestic Equity assets were reported invested in renewable energy, 7% of international equity assets, and 1% of fixed income assets (figure 14).
- We find these results in keeping with the current evolution of the global economy.

RECOMMENDATIONS

To conduct this analysis, Meketa reviewed academic, manager, scientific, institutional investor organization, and market literature. Our review of other U.S. public pension plans that are active on climate change issues included but was not limited to California Public Employee Retirement System ("CalPERS"), California State Teachers Retirement System ("CalSTRS"), New York State Common Retirement System ("NYSCRS"), New York City Retirement Plans, San Francisco Employees Retirement System ("SFERS"), Vermont Pension Investment Committee ("VPIC"), and Washington State Investment Board ("WSIB"). Based upon our review, we recommend that the SBI consider:

Investment Fund due diligence and portfolio monitoring

- Continue to regularly update investment fund due diligence specific to each asset class to ensure that material physical and energy transition climate risks and opportunities are vetted.
- Consider incorporating key indicators on climate risk exposure into annual performance reports.
- Consider periodically generating a climate risk report, including climate scenario analysis, consistent with the Task Force on Climate Related Financial Disclosures ("TCFD") recommendations.

Proxy Voting and Engagement

- Continue annual review of the SBI's proxy voting guidelines for climate issues.
- Continue participation in coordinated institutional investor efforts.
- Consider improving the consistency of proxy voting in the SBI's international equity portfolio. This might be accomplished by retaining a proxy service provider to vote all international proxies on the SBI's behalf.
- Continue deepening the SBI's engagement on climate risk with its investment managers, companies and public policy regulators, when feasible, and in keeping with applicable fiduciary duty such as the SBI becoming an active member of Climate Action 100+.

Investment Allocations

- Be Proactive: Consider shifting a portion of the SBI assets to strategies that are expected to benefit from long-term shifts to a low carbon economy (e.g. carbon capture technology and many others), in keeping with applicable fiduciary duty.

In our opinion, divestment of fossil fuels: does not impact the demand for non-renewable energy and, therefore, does not directly impact carbon emissions; gives up the SBI's shareowner voting rights and transfers those rights to parties that may not share the SBI's investment beliefs and proxy voting policies; and risks divestment from firms that may be actively transitioning to renewable energy as they continue to own non-renewable assets.

SBI Resources Needed to Continue Acquiring Knowledge on Climate Change

The resources required to adjust the SBI's investment fund due diligence to incorporate material climate issues and to evolve its proxy voting policy, can vary depending on the level of activity. Taking additional steps to increase the SBI's engagement activities, develop portfolio reporting in line with TCFD recommendations, and possibly proactively allocate capital to low carbon/green alternatives, could require significant resources.

SBI Climate Risk Investment Discussion:

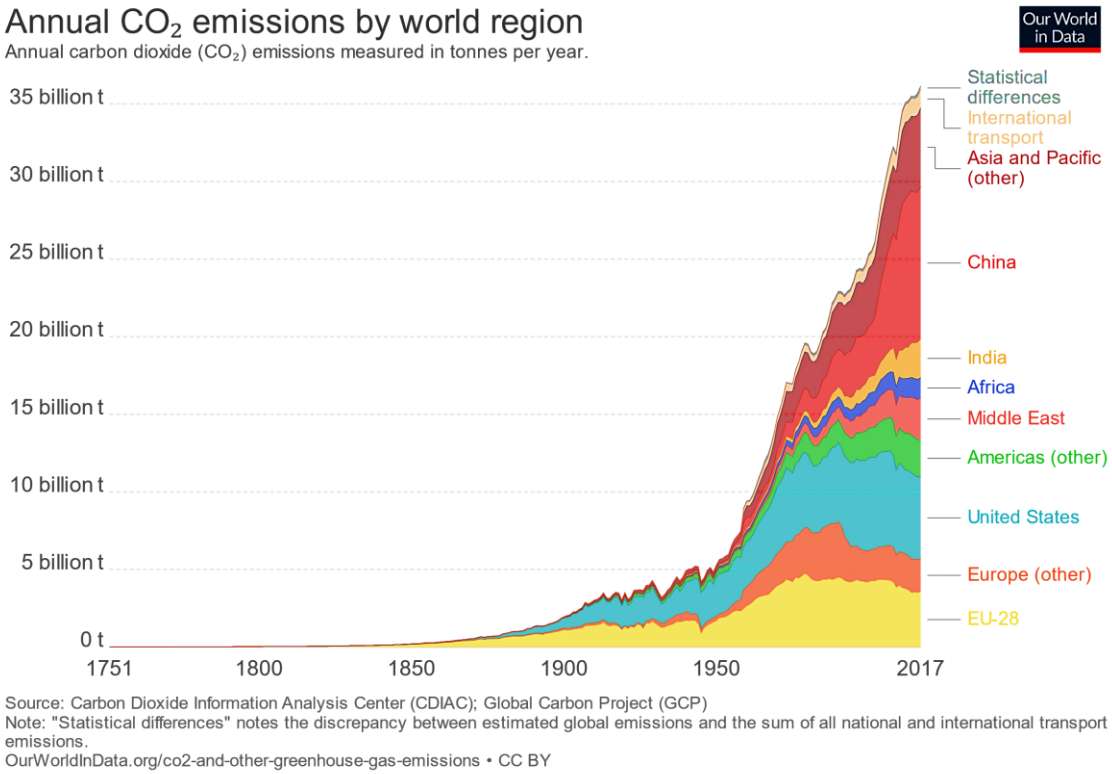
Report

CLIMATE CHANGE RISK AND INVESTMENT PORTFOLIOS

Climate change is generally defined as the statistical change in weather patterns and distribution that lasts for an extended period of time – decades to millions of years. Currently, there is nearly unanimous agreement in the global scientific community that human activity since the industrial revolution contributed to materially higher atmospheric carbon levels that trap additional heat and caused the appearance of the global warming trend. The Intergovernmental Panel on Climate Change ("IPCC") concluded in 2017 that it is extremely likely that human influence was the dominant cause of warming since the mid-20th century.[1]

The concentration of carbon dioxide in earth's atmosphere over the last 2,000 years illustrates a sudden and massive rise of atmospheric CO_2 since the Industrial Revolution. Today, China and the United States are by far the largest single country CO_2 emitters (Figure 1).

Figure 1:



Because CO_2 emissions remain in the atmosphere for generations, most of the CO_2 released since the 1800s by the United States and European countries remains in the atmosphere,

[1] *The IPCC established in 1988 under the auspices of the United Nations Environment Programme and the World Meteorological Organization to assess "the scientific, technical and socioeconomic information relevant for the understanding of the risk of human-induced climate change. It does not carry out new research nor does it monitor climate-related data. It bases its assessment mainly on published and peer reviewed scientific technical literature." The goal of these assessments is to inform international policy and negotiations on climate-related issues.*

contributing to the greenhouse effect responsible for climate change. Even if humanity ceased burning fossil fuels today, the effects of climate change would continue at current levels for decades to come. Because of the lag between CO_2 release and its physical impact, some effects, such as ocean acidification, are expected to rise for decades before stabilizing.[1]

The 2018 report by the IPCC warned that limiting the global mean temperature rise to less than 1.5 degrees Celsius is essential if humanity is to avoid the worst consequences of climate change. Should CO_2 emissions stay at their current level, it is most likely that we would reach a 1.5 degrees Celsius temperature increase by 2030. To stay within 1.5 degree C, CO_2 emissions would need to be cut dramatically by 2030 and achieve net zero by 2050.

Climate Change Investment Risks

Climate change investment risks include physical risk and transition risk toward a low carbon economy. Evidence indicates that both risks are escalating. Each broad climate risk affects economic sectors differently, and changes investment opportunities.

Physical Risks of Climate Change

Regardless of how successful humans are at limiting the causes of global warming, society faces significant physical impacts such as sea level rise, ocean warming and acidification, more frequent and severe flooding, cyclones, extended periods of drought, and extreme temperatures. These changes can increase disruptions to supply chains, real assets, health and movement of people, and incur legal liabilities. Investments are being impacted.

Real estate assets pose obvious physical risks of climate change. Increasingly powerful and destructive storms and wildfires are resulting in the damage and destruction of property. Coastal areas are likely to be more and more vulnerable to rising sea levels, affecting demand and pricing. The 2018 IPCC report indicates that the U.S. is expected to lose 1.2 percentage points of GDP for every 1 degree Celsius of warming. At 1.5 degrees Celsius of warming, the U.S. and other populous nations, including Japan, China, Indonesia, India, could see more than 50 million coastal residents displaced due to rising sea levels.

The financial costs of physical climate risks continue to escalate. In 2019, the Swiss Re Institute reported[2]:

> Global insured losses from natural catastrophe events in 2018 were $76 billion, the fourth highest on *sigma* records. More than 60% resulted from so-called "secondary" perils (Figure 2). The combined insurance losses from natural disasters in 2017 and 2018, meanwhile, were $219 billion, the highest-ever for a two-year period. Here too, more than half of the losses were due to secondary perils.

[1] Source: Candriam, and Archer, David, et. al. 2009.

[2] Swiss Re Institute (2019). "Sigma 2/2019: Natural catastrophes and man-made disasters in 2018: "secondary" perils on the frontline."

Figure 2: Defining Primary and Secondary Perils[1]

Primary Perils	Peak perils with known severe loss potential for the insurance industry. Traditionally well-monitored risks in developed re/insurance markets.	Examples: tropical cyclones, earthquakes, winter storms in Europe.
Secondary Perils	Independent secondary perils. Often not modelled and receive little monitoring by the industry. Secondary-effect of a primary peril: not always well-captured in primary perils modelling, not in proportion to their severity potential.	Prominent examples: river floods, torrential rainfall, landslides, thunderstorms, winter storms outside of Europe, snow and ice storms, drought and wildfire outbreaks. Prominent examples: hurricane-induced precipitation, storm surges, tsunamis, liquefaction and fire following earthquake.

Losses from secondary perils have been rising due to rapid development in areas exposed to severe weather and warmer temperatures. The Swiss Re Institute expects this trend to continue, given ongoing urbanization in areas exposed to flooding and fire risk among others, and because of climate change.

Energy Transition Risks and Opportunities

The transition to a low carbon economy continues to accelerate. Market changes are more and more supported by policy and regulatory changes to reduce greenhouse gas ("GHG"), including carbon emissions, and encompass efforts such as introducing carbon pricing.

Developments in Minnesota provide examples of global efforts to support a shift to a low carbon economy in both energy for transportation and for stationary power sources, and more broadly, to a low greenhouse gas emissions economy. In 2007, Minnesota established its first greenhouse gas emissions-reduction goal: *"It is the goal of the state to reduce statewide greenhouse gas emissions across all sectors producing those emissions to a level at least 15 percent below 2005 levels by 2015, to a level at least 30 percent below 2005 levels by 2025, and to a level at least 80 percent below 2005 levels by 2050. The levels shall be reviewed based on the climate change action plan study."* The January 2019 report highlights that emissions from electricity were down, Minnesota's utilities have committed to additional coal plant closures, transportation is now the largest source of Minnesota's GHG emissions, forest growth reduced total GHG emissions, and agricultural nutrient management is the largest source of nitrous oxide emissions, but many best management practices that protect water quality from nutrients and sediment also can help reduce GHG emissions.

Gov. Tim Walz set a goal in March 2019 for Minnesota to get 100 percent of its electricity from carbon-free sources by 2050. St Paul, Minnesota is committed to 100% renewable electricity community-wide by 2030. Rochester, Minnesota aims to achieve 100% renewable electricity by 2031.

[1] Source: Swiss Re Institute.

Regarding energy for transportation, Minnesota joined a coalition of 17 states and the District of Columbia in suing the U.S. Environmental Protection Agency (EPA) to preserve the greenhouse gas emission standards in place from the Obama Administration for model year 2022-2025 vehicles. The standards would save drivers money at the pump, reduce oil consumption, and curb greenhouse gases. This coalition represents approximately 44% of the U.S. population and 43% of the new car sales market nationally.

In July 2019, four automakers (Ford, Honda, Volkswagen, and BMW of North America) from three continents, entered into an agreement with the California Air Resources Board to adhere to the state's emissions standards, far exceeding the Federal EPA standards. The four automakers agreed to a fleet average of 51 mpg for light-duty vehicles by the 2026 model year. That's slightly lower and longer than the fuel economy standards of 54.5 miles per gallon by 2025 set by the Obama administration in 2012. The agreement can end conflicting state and federal standards for these four automakers, which represent 30% of the U.S. car market. Additional signees could bring an industry-driven new national standard.

The scale of climate change efforts continues to increase domestically and globally. For example, in July 2019, the European Investment Bank ("Bank"), the largest multilateral investment bank, announced that the Bank will focus its lending on decarbonizing the energy supply and increasing low carbon energy. By the end of 2020, the Bank will phase out support for energy projects reliant on fossil fuels: oil and gas production, infrastructure primarily dedicated to natural gas, power generation, or heat based on fossil fuels. The Bank provided loans for projects that involved fossil fuels for six decades.

July 2019 also marked a significant move forward for the world's biggest solar plant project when it won Major Project Status from the Australian Northern Territory (NT) government. The proposed Australia-Singapore Power Link is a $20 billion project. Australia's solar power will be transported via high voltage direct current submarine cables and cover 20% of Singapore's power demand.

Climate change now garners the attention of macroeconomic and finance policy makers. Research from the University of London examined the directives of over 100 Central Banks and found that 16 central banks explicitly mentioned a sustainability target. For example, the March 25, 2019 Economic Letter from the Federal Reserve Bank of San Francisco, states: "*To help foster macroeconomic and financial stability, it is essential for Federal Reserve policymakers to understand how the economy operates and evolves over time. In this century, three key forces are transforming the economy: a demographic shift toward an older population, rapid advances in technology, and climate change.*"

The energy transition affects industries differently. The energy sector and utilities are expected to be most strongly disrupted, particularly companies heavily dependent on the extraction, refinement, distribution and combustion of fossil fuels. Differences in potential financial risks and opportunities are widespread within each sector and sub-sector and are not uniform geographically.

Energy Sector

Figure 3 identifies the energy subsectors embedded in the SBI's passive domestic equity index, the Russell 3000.

Figure 3: Russell 3000 – Energy Sub-Sector Descriptions

Sector	Subsector	Industry
Energy	**Energy Equipment & Services**	Energy Equipment
		Oil Well Equipment & Services
	Non-Renewable Energy	Coal
		Oil: Refining & Marketing
		Offshore Drilling & Other Services
		Oil: Crude Producers
		Oil: Integrated
		Gas Pipeline
	Alternative Energy	Alternative Energy

Renewables growth surprised on the upside for most of the past decade. For example, in multiple years, the International Energy Agency ("IEA") revised upward its solar and wind capacity forecasts. The IEA's update in 2019 concludes that "solar PV is well on track to reach the Sustainable Development Scenario (SDS) level by 2030, which will require electricity generation from solar PV to increase 16% annually, from 570 TWh in 2018 to almost 3 300 TWh in 2030. Renewable energy double digit growth is projected to continue for multiple decades, through at least 2050.

The coal subsector, with its relatively more expensive cost structure, and status as the highest emitting fossil fuel, is experiencing the greatest declines in demand and market value. New bankruptcies are announced regularly in the U.S. Coal producing companies tend to be highly dependent on a single product - coal. Continued declines in demand for coal are expected to continue in developed countries. In developing countries with abundant coal supplies, undeveloped energy infrastructure, and rapidly growing populations improving their livelihoods, such as India and South Africa, coal may remain, and possibly increase in use for many decades.

The oil and gas sectors comprise companies with a wide range of resources and capability to thrive as the low carbon economy transition escalates. For example, oil well equipment and services companies, although they typically own no fossil fuel reserves, may be at high risk if they do not develop alternative sources of revenue. Stand-alone exploration and development companies may face financial challenges. In contrast, large integrated oil companies currently have much greater resources to adapt than smaller energy sector companies. Integrated oil companies often have stronger balance sheets, significant financial resources, and extensive knowledge of energy markets.

For example, Goldman Sachs (July 2019) contends that while integrated oil and gas businesses become more profitable on the back of reduced competition and higher barriers to entry, they can successfully transform into big energy, leveraging strong balance sheets and risk-taking capabilities, to play a leading role on the higher risk spectrum of power supply, biofuels, electric mobility, carbon capture and coal substitution. The report states that European Oils already spend approximately 50% of their capital expenditures in low carbon activities. Goldman Sachs' measure of low carbon capex includes capex for total gas (for power & retail), petrochemicals, biofuels, renewables and natural sinks (reforestation, carbon capture and storage). Integrated oil companies are investing multiple billions in clean energy. This still represents a small part of their overall capex. They are simultaneously shifting focus to become power companies to take advantage of the energy market transformations.

Over the long term gas is expected to become increasingly non-competitive, with continued falling costs of renewables, coupled with enhanced storage and other efficiency technologies. Even with strong renewables growth, current expectations indicate that oil is likely to remain important through 2050. For example, Barclay's May 2019 report: "Oil in 3D: the demand outlook to 2050" concludes that oil consumption is likely to peak between 2030-2035, and the peak could come earlier if controlling emissions is given a primary focus. Petrochemical demand is expected to increase, and oil is expected to remain a large part of the energy mix, even under the low emissions scenario through 2050.

There are a wide range of expectations on the timing of the energy transition. For example, Carbon Tracker's September 2018 report: "2020 vision: why you should see peak fossil fuels coming" argues that we should expect global peaking in the demand for fossil fuel energy in the 2020s, when the challenging technologies of solar PV and wind are expected to be around 6% of total energy supply and 14% of electricity supply. The Carbon Tracker analysis focuses on the peak in demand growth, rather than on the total share of renewables in the energy mix. The report applies the theory of diffusion of innovation to the energy transition. They discuss the four main phases in the global energy transition, which is moving at different paces in different geographies and sectors: innovation (up to around 2% penetration for new technology); peaking (at 5-10% penetration); rapid change (at 10-50% penetration); and the endgame (after 50% penetration). Carbon Tracker argues that the peaking phase - the point at which demand for the old energy source peaks - is the most important tipping point for financial markets and investors.

Assessments of company management and strategy can offer additional forward-looking indicators. Data is now being collected that includes more systematic assessments of management/governance of greenhouse gas emissions and the risks and opportunities arising from the energy transition, alongside carbon emissions reduction performance. For example, as shown in Figure 4, the Transition Pathway Initiative ("TPI"), established in January 2018, recently published "Management Quality and Carbon Performance of Energy Companies: September 2019", a report that analyzed 135 energy companies involved in coal mining, electricity, and oil and gas production. This TPI report found that: "Only four energy companies are…unaware of, or not acknowledging climate change as a business

issue. Close to 60% of energy companies are on Level 3 – integrating climate change into operational decision-making or Level 4 – strategic assessment of climate change."

Figure 4: Management Quality Level

		Total Companies		Oil & Gas Companies	Coal Mining Companies	Electricity Utilities
Level	Level Description	Percent	Number	Number	Number	Number
Level 0	Unaware	3%	4	1	3	0
Level 1	Awareness	19%	25	5	11	9
Level 2	Building Capacity	21%	28	18	1	9
Level 3	Integrating into operational decision-making	27%	36	14	2	20
Level 4	Strategic Assessment	31%	42	12	6	24

Source: TPI, September, 2019 Report.

Utilities

Utilities (electric and natural gas) in the U.S. and globally have been and will continue to transition to low(er) carbon energy at varying rates, often in concert with local/regional regulatory mandates. Figure 5 illustrates the top 15 'dirtiest' and top 15 'cleanest' U.S. utilities, as calculated by Tortoise Advisors utilities research, as of 2017. The table reveals a wide range of carbon emissions/megawatt hours. The information shows that the dirtiest U.S. utilities, as of the 2017 data, used the highest amounts of coal to generate power.

Figure 5: The Cleanest and Dirtiest U.S. Power Generation Companies

The 2017 Top 15 "cleanest" and "dirtiest" US power generation companies (excluding pure renewable companies) Source: Tortoise Advisors					
	Ton of CO2 / MWh		Generation Source (Fossil fuel)		
Company Name	Company	Grid*	Coal (%)	Natrl Gas (%)	Oil & Deriv. (%)
Dirtiest US Power Generation Companies					
Ppl Corp	0.87	0.46	85	14	0
Mge Energy Inc	0.82	0.46	79	17	0
Black Hills Corp	0.80	0.46	80	9	0
Nisource Inc	0.78	0.46	70	29	0
Otter	0.78	0.46	81	1	1
WEC	0.75	0.46	68	26	0
Cms	0.72	0.46	63	32	0
Ameren Corporation	0.72	0.46	75	1	0
Alliant Energy Corp	0.72	0.46	63	27	0
Oge Energy Corp	0.66	0.46	54	39	0
American Electric Power	0.65	0.46	64	11	0
VISTRA ENERGY CORP	0.65	0.46	59	21	0
Dte Energy Company	0.63	0.46	63	5	0
Allete Inc	0.61	0.46	63	0	0
Hawaiian Electric	0.58	0.46	0	17	72
Cleanest US Power Generation Companies					
Atlantic Power Corp	0.34	0.39	7	73	0
Entergy Corp	0.30	0.46	11	53	0
Dominion Resources Inc Va	0.28	0.46	15	37	0
Idacorp Inc	0.27	0.46	24	11	0
Nrg Yield	0.24	0.46	0	64	1
AVISTA CORP	0.24	0.46	13	31	0
El Paso Electric Co	0.21	0.46	0	58	0
Public Service Enterprise Gp	0.21	0.46	10	26	1
Consolidated Edison Inc	0.20	0.46	0	0	28
Nextera Energy Inc	0.20	0.45	2	46	0
Sempra	0.19	0.42	0	53	0
Edison International	0.10	0.46	0	28	0
Avangrid Inc	0.09	0.46	0	24	0
P G & E Corp	0.06	0.46	0	16	0
Exelon	0.04	0.46	0	12	0

* As some companies have non-US operations, their grid average emission numbers are different than a pure U.S. operating company

Individual U.S. utility companies are beginning to adopt more explicit energy transition targets. Xcel Energy Inc., a utility holding company based in Minneapolis, Minnesota, serves more than 3.3 million electric customers and 1.7 million natural gas customers in eight Western States. In December 2018, Xcel became the first major U.S. utility to set a goal of 100% carbon-free electricity by 2050, with an 80% reduction goal (from 2005 levels) by 2035. Xcel is actively closing coal plants and looking to invest in renewables. Duke Energy, headquartered in Charlotte, North Carolina, and serving multiple primarily Southeastern states, offers energy services to approximately 7.4 million customers, and retail natural gas services to over 1.5 million customers. Duke Energy's 2018 Sustainability Report indicated electricity generation came from: 34% natural gas/fuel oil, 33% nuclear, 31% coal, and 2% hydro and solar. In September of 2019, Duke Energy announced a long-term commitment to reach net zero carbon emissions by 2050.

From both an investment and carbon emissions perspective, each utility's mix of energy generation and carbon footprint will be less meaningful if compared to a global average rather than to the grid in which it participates. As 2017 research by Ecofin and CarbonAnalytics articulates, the main reason is that the impact of various types of energy generation is quite different depending on the type of power it displaces. For example, a new gas-fired power station in predominantly renewables-fueled New Zealand would have a negative impact on the carbon footprint of the grid, whereas the same asset in predominantly coal-fueled China could have a positive impact.

In the utilities sector, a primary focus in the global financial markets has been on the energy transition. Utilities can be significantly affected by physical climate risk issues. For example, Investors that focused only on the Pacific Gas & Electric Corporation's (PG&E) relative standing in the energy transition, would have found that it ranks as one of the leading, cleanest electricity utilities in the U.S. (Figure 5). However, this ranking does not assess physical climate risks. The escalation in wildfires in California, and related lawsuits filed against PG&E, resulted in PG&E filing for bankruptcy in January 2019. Increasing wildfire danger and damages spurred California utilities to invest in fire prevention efforts, such as the San Diego Gas and Electric's multi-front efforts, from replacing wooden poles with stronger metal poles to withstand high winds, improving electric wire insulation, to dramatic improvements in their climate monitoring technology.

The energy and utilities industries illustrate some of the energy transition and physical climate risks and opportunities that are unfolding globally.

Climate Change Investment Opportunities

Climate change investment opportunities are growing in nearly every asset class, in concert with the expansion of the 'green' economy. The 2019 academic article, "Estimating the scale of the U.S. green economy within the global context" (Georgeson, Lucien & Maslin, Mark, Palgrave Communications, 2019, 5:121) concludes that the U.S. low carbon and environmental goods and services sector is estimated to represent $1.3 trillion in annual sales revenue, and to employ nearly 9.5 million workers, or 4% of the U.S. working age population. This section offers some indications of this evolution in public equity and bond markets.

Public Equity

In public equity markets, climate related index choices continue to grow, and evolve. Today, the three major index providers – FTSE/Russell, MSCI and S&PDJI combined offer 21 distinct environmental indexes, and another 15 ESG indexes that incorporate environmental themes, as shown in Figure 6.

Figure 6: ESG Equity Indexes From Major Index Providers[1] (June 30, 2019)

Type of Index	ESG	E
FTSE/Russell	2	6
MSCI	9	12
S&PDJI	4	3
Total	15	21

Early environmental indexes primarily focused on excluding fossil fuel reserves owners from parent indexes. These were followed by low carbon indexes, which seek to reduce rather than eliminate carbon emissions and/or fossil fuel reserves exposure, while relatively closely tracking the performance of the parent index. Green revenue public equity indexes then came to market. For example, FTSE/Russell's green revenues index overweights companies throughout the economy whose green products and services represent 20% or more of that company's revenues. Specialized indexes, such as S&PDJI's REITS green index focus on energy efficiency in buildings. Today indexes are available that address both energy transition risks and opportunities, while tracking the parent index. We anticipate that, as financial markets and climate change dynamics evolve, additional environmental indexes will come to market that incorporate material physical climate risks and opportunities alongside material energy transition risks and opportunities.

[1] Source: FTSE/Russell, MSCI, and S&PDJI .

Green bond issuance surpassed the $100 billion mark in June 2019 as shown in Figure 7. The concern of 'green-washing'—issuing green bonds that do not contribute environmentally—continues to surround the unregulated green bond market.

Figure 7: Green Bond Issuance USD 100 Billion Milestones 2017-19[1]

Year	$100bn Mark in Issuance	Annual Green Issuance: (Initial Figure) – Adjusted Current Figure
2017	November	(USD 154.886) **USD162.7bn**
2018	September	(USD 163.665) **USD169.6bn**
2019	June	Forecast: USD **180-250bn**

One recent study found a documented increase in environmental performance associated with green bonds. However, the conclusions were only significant for green bonds that were certified by independent third parties (The May 2019 NBER report by Caroline Flammer, Boston University: Green Bonds: Effectiveness and Implications for Public Policy). To scale up sustainable finance, The European Union Technical Expert Group ("EU TEG") has been working on recommendations for the development of an EU Green Bond Standard, with a view to increasing transparency and comparability of the green bond market, and to provide clarity to issuers on the steps to follow for an issuance. The organization - Climate Bonds - expects that the impact of the EU TEG process will help open the 2020s path towards the first trillion in annual green finance investment.

PEER PENSION PLAN APPROACHES TO CLIMATE CHANGE ISSUES

Approaches to climate change investment risks and opportunities vary widely among U.S. public pension plans. In Meketa's opinion, there is no one right approach to these issues. Climate change, and more broadly, overall ESG implementations may encompass any or all the following aspects of a plan's investment strategy: investment beliefs, investment policy, asset allocation, investment manager selection and monitoring, investment portfolio monitoring, portfolio climate risk report, proxy voting policy and procedures, and engagement with regulatory bodies, investment managers, and companies. Figure 8 outlines a range of approaches.

[1] Source: Climate Bonds Initiative.

Figure 8: Approaches to Addressing Climate Risk and Opportunity for Institutional Investors

Approach	Short-Term Financial Risk	Long-Term Investment Thesis	Costs
Monitor funds	None	Alert managers	Minimal
Monitor Portfolio	None	Improve understanding over climate risk exposures	Can be significant to conduct full climate risk report
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
Engage Managers	None	Improve underlying fundamentals of specific investment mandates	Increased staff or delegated engagement services time
Engage 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
Engage on Regulatory Issues	None	Improve regulatory fundamentals	Requires minimal to high staff and board time
Invest in Low Carbon, Green Tilted, or Paris Aligned 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
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
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

Climate Change Due Diligence in Investment Fund Searches and Monitoring

Climate change due diligence questions for investment fund searches and fund monitoring continue to evolve from early questions of whether the fund manager is a signatory to PRI, to questions designed to gather more granular information regarding funds approach to, and results from addressing climate risks and opportunities. Questions include climate risk and opportunity approach, identifying material risks, reporting on key performance metrics, staffing, investment policy and guidelines, investment results, and proxy voting and engagement on climate change issues.

Climate change questions are designed specifically for distinct asset classes. For example, the institutional Limited Partners Association ("ILPA") includes ESG guidelines in ILPA Principles 3.0: Fostering Transparency, Governance and Alignment of Interests for General and Limited Partners. The guidelines state that GPs should consider maintaining and periodically updating an ESG policy, provided to all LPs or to potential LPs on request. The policy should include sufficient information to enable an LP to assess the degree to which the GP's investment strategy and operations are aligned with an individual LP institution's ESG policies, including how ESG is factored into due diligence as well as incident disclosures and performance reporting. The policy should identify procedures and protocols that can be verified and/or documented, rather than a vague commitment of behavior.

PRI and the Institutional Investors Group on Climate Change (IIGCC) both publish reporting guides on climate change impacts for private equity investments. The IIGCC guide comprises two sections, including: i) a summary of the rationale for incorporating climate change concerns in private equity investments and ii) a due diligence framework that LPs and GPs can use when engaging with their fund and portfolio company investments.

Climate Change Portfolio Monitoring

Climate risk and opportunity investment portfolio monitoring is evolving in two general ways. First, ESG, and climate risk metrics are beginning to be used alongside a pension plan's traditional performance reporting. Second, climate risk scenario analysis has emerged.

Metrics for Portfolio Monitoring

Climate change metrics include but are not limited to carbon footprint analysis, green revenues exposure, carbon reserves, climate policy approach indications and physical climate risk exposure. Some institutional investors use such metrics to assess the impact of the carbon exposure of portfolios and individual companies. Metrics targeting fossil fuel reserves companies, might include:

- **Fossil fuel reserve mix.** Measure of stranded assets, and, or projected capital expenditures expected to be stranded under different climate scenarios.

- **Operational efficiency**, including carbon emissions intensity (CO^2 emissions-scope 1 + 2/$mm revenue), carbon emissions (scope 1 + 2 trend), carbon emissions (scope 1 + 2)/ per barrel of oil equivalent trend.[1]
- **Green revenues metrics.** The percent of green revenues, and the trend in the percent of green revenues, capital expenditures and projected capital expenditures on renewable energy products.
- **Climate policy approach.** These efforts are traditionally more qualitative. More and more quantitative measures are being developed, such as Carbon Disclosure Project ("CDP") Participation. Another example comes from the UK based non-profit, InfluenceMap which compiles data to produce an influence score. The influence score includes an organizational score that ranks each corporation against a set of climate change policy and legislation related queries (e.g. position on a carbon tax, energy efficiency standards). This is combined with a relationship score, which reflects the links external influencing agents have with the corporation. Large ESG data providers offer metrics to capture a company's climate policy and regulatory approach.
- **Physical climate risk exposure.** For example, the company 427 (majority owned by Morningstar as of July 2019) produces an overall physical climate risk score associated with individual companies. Their analysis uses facility-level corporate data. With that data, 427 assesses physical climate risk exposures, including sea level rise, water stress, extreme weather events such as heat, drought, floods, and hurricanes for an entire company. They conduct similar analyses of individual securities and for aggregated equity, debt, or real estate portfolios.

We anticipate that as climate change data reporting quality and availability improve, and as climate changes and global responses evolve, new metrics will become available to address investor climate risks and opportunities.

Portfolio Climate Risk Analysis

Some large state pension plans and their global peers are developing their own unique approaches to climate risk monitoring and reporting. Generally, state plans including CalPERS, CalSTRS and NYSCRF intend to report within the TCFD framework. The TCFD provides suggested voluntary guidelines for asset owners to report climate risks. The TCFD guidelines were first released in June 2017, and include climate scenario analysis as an element of reporting on Strategy.

[1] The GHG Protocol Corporate Standard classifies a company's GHG emissions into three 'scopes'. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 includes all other indirect emissions that occur in a company's value chain, through to use by the final consumer of the product or service.

The TCFD guidelines encompass:

- Governance – board oversight of climate risks
- Governance – management's responsibilities on climate issues
- Strategy – climate related risks and opportunities over the short, medium and long-term
- Strategy – impact on plan, strategy and financial planning
- Strategy – resilient strategy and scenario analysis
- Risk Management – processes for identifying and assessing risk
- Risk Management – processes for managing risks
- Risk Management – integration into overall risk management
- Metrics and Targets – metrics
- Metrics and Targets – scopes 1, 2 and 3 emissions related risks
- Metrics and targets – targets

PRI supports the TCFD guidelines and made them mandatory for PRI signatories as of 2020. As a member of PRI, we anticipate that the SBI will want to begin developing its approach to reporting in accordance with the TCFD guidelines.

Coordinated Institutional Investor Proxy Voting and Engagement

During the past 15 years, institutional investor organizations dedicated to coordinated efforts to improve ESG, and specifically to address climate change grew significantly. The SBI actively participates in many of the most influential investor organizations and efforts. Figure 9 illustrates U.S. public pension plan involvement, and the SBI's current participation in a number of these efforts.

Figure 9: U.S. Public Pension Plan Participants in Institutional Investor Climate Risk Efforts

Organization	CII	CERES	PRI	SASB	Climate Action 100+	TCFD	Global Statement to Governments on Climate Change	Net Zero Asset Owner Alliance
Year Launched	1985	1989	2006	2011	2017	2017	2018	2019
Total U.S. Public Fund Members/Signers	56	20	15	5	16 (9/7)[1]	7	13	1
SBI Member/Signer	Yes	Yes	Yes	-	Yes	Yes*	Yes	-

[1] 16 Total (9 Participants/7 Supporters). *The SBI will be applying TCFD guidelines through its PRI reporting by 2021.

The Council of Institutional Investors ("CII"), founded in 1985, was comprised of 56 U.S. public pension plan members as of June 2019. CII is a non-profit, nonpartisan association of U.S. asset owners, primarily pension funds, state and local entities charged with investing public assets and endowments and foundations. CII is a leading voice for effective corporate governance, strong shareowner rights and vibrant, transparent and fair capital markets. CII promotes policies that enhance long-term value for U.S. institutional asset owners and their beneficiaries.

Ceres, founded 30 years ago, in 1989, today includes 20 U.S. public pension plan members. Ceres is a sustainability non-profit organization working with the influential investors and companies to build leadership and drive solutions throughout the economy. Ceres aims to address the world's biggest sustainability challenges, including climate change, water scarcity and pollution, and inequitable workplaces, through networks and advocacy.

As of 2019, 15 U.S. public plans are signatories to the Principals for Responsible Investing ("PRI"), a global organization founded in 2006. The Sustainable Accounting Standards Board ("SASB"), founded in 2011, is dedicated to developing ESG accounting standards that are likely to be materially relevant in 79 distinct industries. Currently five U.S. public plans, or their State Treasurers, are members of SASB (CalPERS, CalSTRS, Maryland State Retirement and Pension, Oregon State Treasurer, and Vermont State Treasurers Office).

Recent climate specific actions include, for example, the Climate Action 100+ effort, which focuses on engagements with the 100+ largest global CO^2 emitters. Climate Action 100+ includes 16 U.S. public funds (9 participants/7 supporters), of which the SBI is a participant. Separately, seven U.S. public pension plans list their organizations as supporters of TCFD recommendations. In 2018, global investors sent a statement to governments urging action on climate change. As of June 2019, globally 792 organizations signed the letter, including 13 U.S. public pension plans. In September 2019, the U.N. backed Net Zero Asset Owner Alliance launched with 12 large global asset owners, including CalPERS. The stated goals are to reach Net Zero by 2050.

U.S. Public Pension Plan Climate Investment and/or Divestment

To date, institutional investor concern has typically concentrated on energy transition risk, outside of the real estate market where physical climate risk is prominent. Trends indicate that early investment approaches, in addition to increased attention to proxy voting and engagement, focused on divestment of fossil fuel energy producers. This evolved to a greater concentration on the low carbon emissions across the economy. Recently, as investors seek to understand both energy transition and physical climate risks and opportunities as systemic issues, attention is shifting to resilience – trying to look at the entire investment portfolio to build in more resilience in the face of climate change trends and their long-term investment risk and return implications.

These trends are also evident in the metrics used to assess portfolio climate change exposures. Such metrics are rapidly shifting from primary attention to fossil fuel reserves and potential stranded assets, to also look at:

- Carbon emissions economy wide
- Measures of climate opportunity, such as green revenue shares
- Physical climate risk exposure
- Seeking more forward looking understanding with
  - Climate scenario analysis
  - Management's governance and strategy for climate change

Today, we find there are public pension plans across the spectrum, from those trying to grapple with climate change resiliency to those who have not yet integrated climate change risk/opportunity into their investment portfolio analysis. Currently, U.S. public pension plans often choose to engage with the companies which they hold publicly listed equities, seeing divestment, or exclusion, as a final resort. Some seek to invest in carbon-constrained and renewable energy strategies in public and private markets. For example, CalPERS, CalSTRS, NYSCRF, NYC Retirement Systems and SFERS have each generally focused on engagement. They have also allocated capital to carbon-constrained and/or renewables investments, and. Some plans, such as CalPERS and CalSTRS exclude companies with majority revenues from thermal coal, (for CalPERS and CalSTRS as per state legislation).

Increasingly, public plans that consider divestment of fossil fuels companies, analyze the potential for financially stranded companies, taking into account potential financial risk and climate risk metrics, rather than just the potential for stranded fossil fuel reserves assets. In March 2019, the largest public pension plan in the world, the Norway Government Pension Fund Global ("GPFG"), announced that it would divest from 31 fossil fuel exploration and development companies in its portfolio. The GPFG elected to continue its investments in the large integrated oil companies, as the GPFG saw those companies as having the financial resources and capability to play a meaningful role in moving toward a lower carbon economy.

SBI CURRENT APPROACH TO CLIMATE CHANGE ISSUES

We find that the SBI has taken multiple initial steps to analyze and address climate change risks across its investment portfolio (Figure 10), including: adopted investment beliefs that include a belief regarding engagement on 'Environmental, Social and Governance ("ESG") issues; incorporated ESG into their standard public market investment guidelines, developed proxy voting guidelines and practices that encourage corporate reporting on climate change factors; conducted climate risk surveys of its private equity funds, engaged on climate change risk issues through active participation in key institutional investor organizations that support and foster coordinated efforts regarding addressing climate change investment risks, including CII, PRI, CERES, Climate Action 100+and ILPA, and by becoming a signatory to letters urging action to address climate change risks.

Figure 10: SBI Climate Risk Developments

ESG Investment Policy/Procedure	SBI Implementation
Investment beliefs	Yes
Investment policy	Yes
Asset allocation	-
Investment manager selection	Yes
Monitor investment managers	Work in progress
Monitor investment portfolio	Work in progress
Proxy voting policy	Yes
Engagement	Yes

The SBI staff includes in all public market actively managed fund guidelines for equities and fixed income a clause stating that: "The manager is expected to incorporate environmental, social and governance ("ESG") broadly into its portfolio or process." The SBI staff's approach to ESG/climate risk diligence in evaluating private markets funds includes the following steps:

- Review the diligence materials/questionnaires that funds provide.
- Staff preference is for funds to generally follow the ILPA DDQ template, which has a section on ESG considerations.
- Ask funds to provide to us their ESG policy (if they have one). SBI staff encourages funds to create a policy but does not give feedback to funds on what they consider to be a "good" or "bad" policy.
- For investments that are very clearly related to the energy industry (oil and gas extraction, transportation and storage of fossil fuels, power generation and renewable energy), or would clearly be subject to climate risk (example: real estate funds buying beachfront property in Miami), staff spends a significant amount of time during due diligence asking questions about how the fund manager is assessing and mitigating climate risk in their investments. The nature and extent of ESG diligence may vary among investment opportunities, based upon the how climate change impacts each specific opportunity.

Engagement on the Governance of Fossil Fuel Companies

The SBI, in concert with coordinated efforts of institutional investors in the U.S. and abroad, participates in regulatory engagements on climate change, such as its active membership in CII, Climate Action 100+, Ceres and PRI, and adding the SBI's name to the Global Statement to Governments on Climate Change.

SBI EXPOSURE TO FOSSIL FUELS, THERMAL COAL AND RENEWABLE ENERGY INVESTMENTS

The SBI's current efforts to address climate change risks and opportunities address the SBI's investments throughout the economy. For this report, we concentrate on energy transition investment risk, in particular for the fossil fuel companies, and the coal subsector, and renewable energy investment opportunities.

Public market equities comprise the largest asset class of the SBI's investment portfolio. These markets currently have the most readily available benchmark data on the share and performance of fossil fuels, including oil, gas and coal, and renewable energy investments. Meketa sought to gain insight into the SBI's exposure to non-renewable and renewable energy in two ways. First, we looked at the SBI's benchmarks for Domestic and International Equity (the Russell 3000 and the MSCI ACWI ex-US) compared to non-renewables, and renewables. Second, we conducted a climate risk survey of all SBI investment funds.

The SBI Public Markets Equity Benchmarks and Energy Sub-sectors

FTSE/Russell has under construction Russell 3000 ex-coal and ex-fossil fuel indexes. In lieu of comparing the Russell 3000 to ex-fossil fuel energy variants, Figure 11 presents information on the non-renewable and renewable energy sub-sector average weights and one-, three-, and five-year annualized trailing performance information compared to the Russell 3000.

Figure 11: Russell 3000 and Energy Sector Annualized Returns

(Periods Ending 12/31/2018)

	Number of Securities	1 Year		3 Year		5 Year	
Index	12/31/2018	Avg Weight	Return (%)	Avg Weight	Return (%)	Avg Weight	Return (%)
Russell 3000	**3,000**	**1.00**	**-5.2**	**1.00**	**9.0**	**1.00**	**7.9**
Russell 3000 Non-Renewable Energy	119	0.049	-16.0	0.0508	2.5	0.0565	-5.5
Russell 3000 Coal	9	0.0002	-18.3	0.0002	27.7	0.0004	-23.8
Russell 3000 Oil: Crude Producers	78	0.0151	-27.8	-0.4012	-3.2	0.0169	-12.7
Russell 3000 Oil: Integrated	7	0.0249	-11.1	-0.2898	4.1	0.0298	-2.8
Russell 3000 Alternative Energy	9	0.00011	8.4	0.00014	-5.4	0.00015	-15.6

For the trailing one-, three- and five-year periods ending December 31, 2018, the non-renewable energy sector trailed the overall Russell 3000 index annualized returns. Each non-renewables subsector also trailed the parent index, barring the three-year trailing for coal, which outperformed the parent index. The alternative energy subsector also materially underperformed the Russell 3000 for the trailing three- and five-year periods, and outperformed for the trailing one-year period.

The market share, and number of companies, for each subsector provides additional insight. In particular, the Russell 3000 coal sector is currently comprised of nine companies, which in aggregate accounted for two hundredths of one percent of the Russell 3000. The largest subsector by market share of the Russell 3000 is the seven integrated oil companies, with 2.49% of the Russell 3000 on average in the trailing 1-year period ending December 31, 2018. Alternative Energy is still a very small part of this investable index. Alternative energy accounted for the smallest subsector, with one one-hundredth of one percent of the Russell 3000.

MSCI publishes an MSCI ACWI ex-US ex-fossil fuels and an ex-coal index. As shown in Figure 12, for the trailing one- and three-year periods, both the ex-fossil fuels and the ex-coal indexes underperformed the MSCI ACWI ex-US. Both indexes outperformed the parent index for the trailing five-year period.

Figure 12: MSCI ACWI ex U.S. and ex-Fossil Fuel and ex-Coal

Annualized Returns
(Periods Ending 12/31/2018)

Index	1 Year (%)	3 Year (%)	5 Year (%)
MSCI ACWI ex-US	**-14.20**	**4.48**	**0.68**
MSCI ACWI ex-US ex Fossil Fuels	-14.94	3.60	0.92
MSCI ACWI ex-US ex Coal	-14.35	4.14	0.72

Climate Change Survey of SBI Investment Funds

Meketa conducted a survey of the SBI's investment funds to gain general insight into the SBI's current exposure to fossil fuels and to renewable energy investments. The survey asked fund managers questions regarding their exposure to fossil fuels and renewables, and their approach to managing potential material climate risks and opportunities. As shown in Figure 13, the managers of all 45 SBI public markets funds responded to the survey. Managers of 90% of the SBI's private markets funds (218 of 241 funds) responded. This high response rate resulted in the survey covering 96% of the SBI's total assets under management ("AUM") as of December 31, 2018, including 100% of the SBI's public markets assets, and funds representing 83% of the SBI's private market assets. Please note that the some investment manager firms manage more than one fund for the SBI. Thus, some managers responded for more than one fund's investment strategy that they manage for the SBI.

Figure 13: 2019 Climate Risk Survey of SBI Investment Funds

	Number of Investment Funds		Total Assets Under Management (12/31/2018) ($ Billions)	
Index	**Total**	**Total that Responded**	**Total**	**Total of Managers that Responded**
Total Portfolio	**289**	**266**	**$72.59**	**$69.61**
Public Markets	45	45	54.62	54.62
Private Markets	241	218	17.97	14.99

The SBI Public Markets Funds Climate Risk Survey Responses

The survey results indicate that over two thirds (31 of 45) of the SBI's public market funds report some exposure to investment in companies involved in the exploration and extraction of fossil fuels, as shown in Figure 14. These investments accounted for just 3% of the SBI's public markets AUM, including 2% of domestic equity AUM, 9% of international equity AUM, and 1% of fixed income assets. The total 3% share of the SBI's public market investments in companies involved in the exploration and extraction of fossil fuels reflects the SBI's dominant share of public markets assets invested in domestic equity relative to other asset classes.

Figure 14: 2019 Climate Survey Results from the SBI Public Markets Funds

	Funds that Responded						
				Investments in companies with			
				Exploration and extraction of fossil fuels		Renewable energy	
Asset Class	Total Number of SBI Funds	Number of Funds	Total SBI Assets under Management ($ Millions)	Number of funds	Total % share of AUM (%)	Number of funds	Total % share of AUM (%)
Total Public Markets	**45**	**45**	**$54,620**	**31**	**3%**	**27**	**2%**
Domestic Equity	**19**	**19**	**26,989**	**15**	**2**	**10**	**1**
Active	16	16	6,319	12	5	7	1
Passive	3	3	20,670	3	1	3	1
International Equity	**16**	**16**	**11,889**	**11**	**9**	**12**	**7**
Active	14	14	4,450	9	7	10	2
Passive	2	2	7,439	2	10	2	5
Fixed Income	**10**	**10**	**15,742**	**5**	1	**5**	1

Domestic equity active funds reported 5%, and passive domestic equity funds reported 1% of assets in fossil fuel exploration and extraction. International equity active funds reported 7% of AUM invested in fossil fuel exploration and extraction, compared to 10% of international equity passively managed funds.

The survey asked funds four questions aimed at gaining a general understanding of how the SBI's investment funds approach climate risk and opportunity in the funds in which the SBI is invested. The answers to these questions were qualitative, not quantitative. To summarize the responses, we categorized answers as Yes, No, Conditionally, or Not Applicable. Some funds provided detailed in-depth responses, while others provided minimal explanation.

Figure 15: 2019 Climate Survey Results from the SBI Public Markets Actively Managed Funds that Responded

				Actively Managed Funds that responded YES to:							
				Account for climate change material risks?		Account for low carbon economy opportunities		Calculate and disclose portfolio company carbon footprints?		Engage with companies not reporting and managing GHG emissions?	
Asset Class	Total Number of SBI Funds	No of Funds	Total SBI AUM of responses ($ millions)	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds
Total Public Markets	**40**	**40**	**$26,511**	**88%**	**36**	**83%**	**33**	**39%**	**17**	**73%**	**22**
Domestic Equity	**16**	**16**	**6,319**	**91**	**15**	**71**	**12**	**48**	**5**	**56**	**8**
Active	16	16	6,319	91	15	71	12	48	5	56	8
International Equity	**14**	**14**	**4,450**	**87**	**12**	**87**	**12**	**70**	**9**	**49**	**6**
Active	14	14	4,450	87	12	87	12	70	9	49	6
Fixed Income	**10**	**10**	**15,742**	**87**	**9**	**87**	**9**	**26**	**3**	**86**	**8**

As shown in Figure 15, the responses from the SBI's actively managed public markets funds indicate that 88% of the SBI's public markets actively managed assets are currently managed with some degree of accounting for climate change risks, and for low carbon economy investment opportunities (83%).

Figure 16: 2019 Climate Survey Results from all SBI Public Markets Funds that Responded

All Funds that Responded											
				Funds that responded YES to:							
				Account for climate change material risks?		Account for low carbon economy opportunities?		Calculate and disclose portfolio company carbon footprints?		Engage with companies not reporting and managing GHG emissions?	
Asset Class	Total Number of SBI Funds	No of Funds	Total SBI AUM of responses ($ millions)	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds
Total Public Markets	**45**	**45**	**$54,620**	**44%**	**36**	**42%**	**33**	**28%**	**17**	**83%**	**27**
Domestic Equity	**19**	**19**	**26,989**	**29**	**15**	**28**	**12**	**11**	**5**	**85**	**11**
Active	16	16	6,319	91	15	71	12	48	5	56	8
Passive	3	3	20,670	0	0	0	0	0	0	100	3
International Equity	**16**	**16**	**11,889**	**87**	**12**	**87**	**12**	**70**	**9**	**90**	**8**
Active	14	14	4,450	87	12	87	12	70	9	49	6
Passive	2	2	7,439	0	0	0	0	0	0	100	2
Fixed Income	**10**	**10**	**15,742**	**87**	**9**	**87**	**9**	**26**	**3**	**86**	**8**

We also surveyed the SBI passively managed public market funds. These funds are mandated to invest based solely on market capitalization, with no other tilts or exclusions.

As shown in Figure 16, the responses from the SBI's public markets funds, even including passively managed funds, indicate that close to half (44%) of the SBI's public markets assets are currently managed with some degree of accounting for climate change risks, and for low carbon economy investment opportunities (42%). As noted, this total includes passive public equity funds, and it includes the SBI's entire fixed income portfolio, which includes less than one-third corporate bonds, with the bulk of securities being in government bonds. For example, the Barclays Aggregate's top five sectors are: treasuries (43%), mortgage-backed securities (27%), corporate industrials (15%), corporate financials (8%), non-corporates (5%).

Funds responsible for approximately one-fourth (28%) of the SBI's public markets assets under management calculate and disclose portfolio company carbon footprints. This includes bond markets and passive equity products.

The passive domestic equity asset category reported the lowest share of its AUM responding yes to the questions regarding integrating material climate risks (0%), low carbon opportunities (0%), and disclosing carbon emissions (0%).

The actively managed funds predominantly responded yes to these generic climate risk and opportunities questions. Common explanations for those who answered yes, state that their company analysts integrate ESG considerations into their research and provide qualitative overview of the significant ESG risks and opportunities that could have a potential impact on company earnings and cash flow prospects. Funds often provided the disclaimer that their duty as a fiduciary is to add value with a client's agreed risk parameters, so that a company with ESG concerns could still be viewed as an attractive investment.

International equity actively managed funds reported the highest share of AUM in the SBI's public markets (70%) that report and disclose carbon emissions.

Regarding engagement, most passive domestic and international equity, and fixed income investment funds responded yes to the question: If a portfolio company is not currently reporting and managing its greenhouse case emissions, do you encourage management to do so? One SBI fixed income fund stated that they work with bond issuers to bolster their Paris Agreement alignment and help them improve their management of the underlying credit risks. Those funds that responded that they do not encourage management to report or manage greenhouse gas emissions typically stated that they did not due to time constraints when meeting with senior management, or that they used industry peers as estimates.

The SBI Private Markets Funds Climate Risk Survey Responses

Among the SBI's private markets funds, the survey results indicate that 68 (31%) of the 218 private market funds that responded report some exposure to investment in companies involved in the exploration and extraction of fossil fuels, as shown in Figure 17. These investments accounted for 8% of the SBI's private markets AUM, including 18% of private equity AUM, 27% of real assets AUM, 17% distressed private markets AUM, and, 0% of private credit and real estate AUM. The 8% total share of the SBI's private market investments in companies involved in fossil fuel exploration and extraction reflects the SBI's dominant share of private markets assets invested in private equity relative to other private markets asset classes.

Figure 17: 2019 Climate Survey Results from the SBI Private Markets Funds

		Funds that Responded					
				Investments in Companies Involved in			
				Exploration and Extraction of Fossil Fuels		Renewable Energy	
Asset Class	Total Number of SBI Funds	Number of Funds	Total SBI AUM ($Millions)	Number of funds	Share of AUM (%)	Number of funds	Share of AUM (%)
Total Private Markets	**241**	**218**	**$14,989**	**68**	**8%**	**45**	**6%**
Private Equity	127	124	8,278	37	18	28	8
Private Credit	25	16	833	0	0	2	1
Real Assets	37	31	2,679	15	27	6	2
Real Estate	23	18	878	1	0	0	0
Distressed	29	29	2,321	15	17	9	3

The SBI's reported private markets exposure to renewable energy was 6% of the SBI's total private market assets. Twenty-one percent (45) of the 218 SBI private markets funds that responded to the survey reported exposure to renewable energy. The highest share was reported for private equity, with 8% of the SBI's private equity AUM invested in companies involved in renewable energy.

Figure 18 presents an overview of the qualitative responses from the SBI's private markets funds. In general, the responses reflect differences in segments of the economy, with some funds focused on investments in areas such as real estate or services that have very different climate risk exposures than, for example, energy sector investors. For each question we categorized the responses as: Yes, No, Conditional, and Not Applicable ("NA"). Below we summarize the responses to each question.

Figure 18: 2019 Climate Survey Results from the SBI Private Markets Funds

		Funds that Responded									
				Funds that Responded YES to:							
				Account for climate change material risks?		Account for low carbon economy opportunities?		Calculate and disclose portfolio company carbon footprints?		Engage with companies not reporting and managing GHG emissions?	
Asset Class	Total Number of SBI Funds	No of Funds	Total SBI AUM of responses ($ millions)	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds	Percent of Total AUM (%)	No of Funds
Total Private Markets	**241**	**218**	**$14,989**	**63%**	**141**	**25%**	**69**	**7%**	**14**	**34%**	**54**
Private Equity	127	124	8,278	52	66	20	33	0	1	40	35
Private Credit	25	16	833	97	14	67	10	0	0	0	0
Real Assets	37	31	2,679	82	27	28	8	28	8	45	10
Real Estate	23	18	878	83	14	60	10	30	4	37	5
Distressed	29	29	2,321	59	20	18	8	0	1	8	4

Climate Risk: *Do you take into account how climate change risk, including physical, litigation and regulatory risks, and the energy transition to a low carbon economy risk might present material risks for existing and new investments?*

When asked if they address potential material climate risks in their investment processes, 65% (141) of the 218 private markets funds, representing 63% of the total SBI Private Markets AUM responded Yes. Managers of 17 funds responded No, 39 funds responded Conditionally, and 22 funds responded Not Applicable. Most of the funds who responded Yes stated that they utilize a detailed ESG due diligence framework or checklist to analyze and assess the environmental risks and exposure specific to each company before committing to an investment. Funds mentioned that they are taking steps to understand the potential physical effects of climate change, while working on being well-positioned with respect to the opportunities that are to be expected with a low carbon economy. Roughly 70% of funds who said No to this question did not provide a reason. One real estate fund who responded No, said they did not believe global climate change would adversely impact their business.

Low Carbon Economy Opportunities: *Do you take into account the revenue and/or growth opportunities a low carbon economy might present for existing and new investments?*

The survey found that 69 of the SBI's 218 private markets funds, representing 25% of the SBI's total private market assets, assess potential low carbon economy investment opportunities. The remaining funds included 68 funds that responded No, 31 funds that said Conditionally, and 65 funds said that the question was Not Applicable to their investment strategy. Funds that responded Yes generally described their belief that managing ESG risks can result in tangible value creation and indicated that they use due diligence processes or financial projection models to assess the potential value creation. Explanations as to why some funds do not take low carbon economy potential opportunities into account included funds saying they only invest in service sectors of the economy and stay away from industries traditionally associated with the carbon economy.

Carbon Footprint Measurement: *Do you calculate and disclose the carbon footprint of your portfolio companies? If so, please identify how carbon footprint is measured.*

Managers of 14 funds (6%) of the SBI's 218 private markets funds, representing 7% of the SBI's private markets assets stated that they calculate and disclose the carbon footprint of their portfolio companies, 66% of the fund respondents said No, 2% said Conditionally (if requested to calculate) and 25% said it was not applicable to them due to the nature of their business or because their fund had been fully liquidated. The primary asset classes that reported calculating carbon footprints were real estate and real assets.

Engagement: *If a portfolio company is not currently reporting and managing its greenhouse gas emissions, do you encourage management to do so?*

Managers of 54 of the SBI's 218 private markets funds, representing 34% of the SBI's Private markets AUM, indicated that they would encourage management to report and manage greenhouse gas emissions. Managers of 65 funds responded that they would not; 17 funds responded Conditionally and 63 funds said it was not applicable to their investment strategy. Private funds who said Yes, stated that they encourage portfolio companies to focus on ESG factors by measuring Key Performance Indicators (KPIs) such as greenhouse gas emissions, carbon footprint, total energy consumption, and water consumption, which all relate to climate change. Funds that said No or Not Applicable gave varying reasons including: they are not explicitly ESG funds so they are not focused on reporting ESG factors by portfolio companies; they are currently working on enhancing social impact disclosures and not asking for greenhouse gas disclosure, or they are secondary funds which do not sit on boards or actively manager companies and therefore are not in the position to control company management reporting. Funds who responded Conditionally explained that they encourage management if it was material and aligned with shareholder interest in the long-term.

MEASURES THAT COULD ADDRESS POTENTIAL RISKS TO THE RETIREMENT FUNDS OF CONTINUED INVESTMENT IN COMPANIES HOLDING A LARGE CARBON FOOTPRINT

Based upon our review of academic, manager, scientific, institutional investor organization, and market literature, and the activities of other U.S. public pension plans, that are active on climate change issues, we recommend that the SBI consider:

Investment Fund Due Diligence and Portfolio Monitoring

- Continue to regularly update investment fund due diligence specific to each asset class to ensure that material physical and energy transition climate risks and opportunities are vetted.
- Consider incorporating key indicators on climate risk exposure into annual performance reports.
- Consider periodically generating a climate risk report, including climate scenario analysis, consistent with the Task Force on Climate Related Financial Disclosures ("TCFD") recommendations.

Proxy Voting and Engagement

- Continue annual review of the SBI's proxy voting guidelines for climate issues.
- Continue participation in coordinated institutional investor efforts.
- Consider improving the consistency of proxy voting in the SBI's international equity portfolio. This might be accomplished by retaining a proxy service provider to vote all international proxies on the SBI's behalf.
- Consider deepening the SBI's engagement on climate risk with its investment managers, companies and public policy regulators, when feasible, such as the SBI's recent joining of the Climate Action 100+.

Investment Allocations

- Be Proactive: Consider shifting a portion of the SBI assets to investment strategies that are expected to benefit from long-term shifts to a low carbon economy (e.g. carbon capture technology), in keeping with the applicable fiduciary duty.

In our opinion, divestment of fossil fuels: does not impact the demand for non-renewable energy and, therefore, does not directly impact carbon emissions; gives up the SBI's shareowner voting rights and transfers those rights to parties that do not share the SBI's investment beliefs and proxy voting policies; and risks divestment from firms that may be actively transitioning to renewable energy as they continue to own non-renewable assets.

SBI RESOURCES NEEDED TO CONTINUE ACQUIRING KNOWLEDGE ON CLIMATE CHANGE

The resources required to adjust the SBI's investment fund due diligence to incorporate material climate issues, and to evolve its proxy voting policy can be relatively minimal. Taking additional steps to increase the SBI's engagement activities, develop portfolio reporting in line with TCFD recommendations, and possibly proactively allocate some investments to low carbon/green alternatives, could require significant resources. Depending on the scope, they could require an additional dedicated ESG/climate staff person, and additional resources for analysis, engagement, and investment execution. At the low end, we estimate a minimum of $250,000 – 400,000. A deep and ongoing shift could add $1 million to $2 million in costs.

CONCLUSION

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 divestment approaches. We believe the SBI should continue its effort to address and manage climate and other material ESG risks and opportunities. In our opinion, the SBI should continue to stay abreast of, and consider, the ongoing changes in assessments of climate risks, and approaches to managing these risks.

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