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New York City Retirement Systems (Systems)

Board of Education Retirement System of the City of New York (BERS)
New York City Employees' Retirement System (NYCERS)
Teachers' Retirement System of the City of New York (TRS)

DRAFT: December 15 - 17, 2020

Investment and Fiduciary Analysis of Prudent Strategies for Divestment of Securities Issued by Fossil Fuel Reserve Owners

Phase 3: Options for Prudent Divestment from Fossil Fuel Reserve Owners

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I. Executive Summary

The 21st century will likely mark both rising physical climate risk and an accelerating global effort by regulators, governments, businesses, and investors, to address the drivers of climate change. In our opinion, these developments necessitate re-evaluations of risk and return, prudent investment strategies, and actions that may better manage long-term risk and return. Our analysis indicates that fossil fuel reserve owners face high potential risk for economic disruption from the transition to a low carbon global economy.

We find the Systems can prudently divest from fossil fuel reserve owners using a variety of approaches. Meketa's research indicates that the Systems may be best served by utilizing a data-driven approach to divestment to help insulate the Systems from the increasing risks faced by fossil fuel reserve owners while protecting return. This third and final report analyzes how different prudent divestment options might affect portfolio performance. The options are designed to meet the the following goals of the project:

- Provide a range of prudent divestment options that are sufficiently large to provide maximum protection from the risks facing fossil fuel reserve owners.
- Identify risk, return, and diversification characteristics of divestment options, specifying the reallocation approach with consideration of re-investment options based on portfolio optimization, sustainablity, or other approaches.
- Address ongoing monitoring requirements for divestment options, appropriate for the Systems' resources capacity.

This report discusses approaches to defining divestment options and presents analysis of three sample divestment strategies of relatively large sets of fossil fuel owners. The divestment examples include divesting from:

1) all fossil fuel reserve owners;
2) fossil fuel reserve owners that show at least one higher risk level in at least two of three risk categories: fossil fuel exposure, energy transition management quality, and financial health;
3) fossil fuel reserve owners with >10% extractives revenue OR >10% thermal coal revenues.

We first describe the rationale for each divestment option. The three divestment options are based on different combinations of securities and offer different approaches to addressing risk. Strategies may be refined based on company-specific climate and/or financial risk metrics criteria. Second, we analyze expected results for each divestment strategy including: back-test performance results using three different re-investment approaches; expected future returns in 1.5° and 3.0° climate scenarios; potential decarbonization of the Systems' portfolios; and company- and industry-specific considerations. Third, we decribe a variety of different approaches to the divestment process and potential costs of divestment. Finally, we outline for each divestment option the onging process that might be expected for the Systems to monitor fossil fuel divestments over time.

II. Divestment Options

We find the Systems can prudently divest from all or any range of fossil fuel reserve owners in the Systems' publicly listed portfolios using different reinvestment approaches. This is based on back-testing and forward-looking scenario analyses that show divestment from all or any range of fossil fuel reserve owners would likely generate higher returns and lower risk for the Systems' portfolios. Below we present three divestment options.

Option 1: Divest all fossil fuel reserve owners.

In our Phase 1 report, we found that among leading climate change global asset owners there was no consistent definition of fossil fuel owners used for divestment strategies. The Systems elected to examine all fossil fuel reserve owners. For Divest 1 option, we looked at the divestment of all fossil fuel reserve owners, as defined by ISS. We identified [redacted] fossil fuel reserve owners held by the Systems Combined as of June 30, 2020. The number of companies for BERS, NYCERS, and TRS were respectively [redacted], as of June 30, 2020 holdings.

Option 2: Divest fossil fuel owners with at least one higher (Tier 1) risk metric in at least two of three risk categories: fossil fuel exposure, energy transition management, and financial health.

For Option 2, we looked for a set of companies that exhibited Higher Risk for at least one risk metric in at least two of the three risk categories. For example, a company might have higher potential stranded capex risk (fossil fuel exposure category), medium or lower risk for every energy transition management risk metric, but higher risk for at least one of the two financial health risk metrics. We believe the combination of these risk metrics offer a compelling cross-section of data on climate risk and adaptation potential and offer a basis for the creation of a divestment threshold.

In our Phase 2 report, to provide a more granular assessment of the [redacted] companies considered for potential prudent divestment, we looked at 11 risk metrics representing four risk categories: (1) fossil fuel exposure, (2) energy transition management, (3) financial health, and (4) physical climate risk. We found there was no credible and broad set of data measuring company's management of physical climate risk, similar to measurements of energy transition management, and excluded that category of data from this analysis. Thus, Divest 2 combines risk metrics encompassing: 1) fossil fuel exposure, 2) energy transition management, and 3) financial health risk.

For each risk metric, we established risk thresholds to identify companies with Higher (Red), Medium (Yellow), and Lower (Blue) Risk (see Appendix A-1 for Risk Thresholds). We were able to identify sufficient and actionable data on the range of reserve owners, but no data provider as of yet offers a complete data set. We expect over time that the quality of climate data on companies will continue to improve; the coverage of companies will continue to expand, and climate metrics will be refined and newly developed that can potentially enhance our ability to analyze the climate change risks investors face.

A variety of divestment criteria using company risk metrics may be developed. For example, if we concentrate on higher risk levels for each metric, at an extreme, one might decide to target for divestment only companies that register as higher risk on every metric for which we had data for that company in every risk category. For this variation, we only included companies that had risk metric data in at least two categories. With these criteria, we identified [redacted] of the [redacted] companies. At another extreme, [redacted] of the [redacted] fossil fuel owners had at least one Higher Risk metric in at least one of the three risk categories.

For the Systems Combined, Option 2 criteria results in [redacted] of the [redacted] fossil fuel reserve owners identified for potential divestment. The number of companies for BERS, NYCERS, and TRS were [redacted], [redacted], and [redacted], respectively, as of June 30, 2020 holdings.

Option 3: Divest fossil fuel owners with >10% extractive revenue OR >10% thermal coal revenue.

For Option 3, we offer a definition more focused on companies that likely have some potential material exposure to reserves risk: fossil fuel owners with >10% extractive revenue OR >10% thermal coal revenue. This definition does not explicitly focus divestment on companies that are exclusively in the energy sector, as do the definitions of some large asset owners that divest fossil fuels. However, by focusing on extractive revenues and thermal coal revenues, the result is a tighter focus on energy sector companies than the broad, all-inclusive Option 1. Investors regularly use revenue thresholds in divestment decisions. Moreover, data vendors provide fairly consistent revenue data on extractive or thermal coal proceeds. Depending on the investor's view of materiality and the risks of the business activity, they may consider different revenue thresholds. For example, if the goal were to identify companies predominantly involved in fossil fuel business activity instead of some potential material exposure, Option 3 might be refined to >50% extractive revenue OR >10% thermal coal revenue. For the Systems Combined, Option 3 criteria results in [redacted] of the [redacted] fossil fuel reserve owners identified for potential divestment. The number of companies for BERS, NYCERS and TRS were [redacted], and [redacted], respectively, as of June 30, 2020 holdings. Figure 1 summarizes the fossil fuel owner exposure for the Systems Combined and for BERS, NYCERS and TRS under each of these three Divestment Options as of June 30, 2020.

Figure 1 – Divestment Options[1]

Divestment Options Comparison Total Public Equity and Fixed Income Fossil Fuel Reserve Owner Exposure (As of June 30, 2020)												
	Systems Combined			BERS			NYCERS			TRS		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
Total Plan AUM ($ mm)	[redacted]											
Total Public Listed AUM ($ mm)												
Total FF Exposure ($ mm)												
FF Percent of Total Systems Plan AUM (%)												
FF Percent of Total Public Listed AUM (%)												
Total Issues												
Total FF Companies Represented												

For the Systems Combined, Option 1 represented $[redacted] for the full set of [redacted] fossil fuel owners. Option 2 represented $[redacted] for [redacted] companies with at least one Higher Risk metric in at least two of the three risk categories for the Systems Combined. Option 3 represented $[redacted] for the [redacted] fossil fuel owners with >10% Extractives or >10% Thermal Coal revenues for the Systems Combined.

For each Option, Figure 2 shows the top 10 largest exposures for BERS, NYCERS, TRS and the Systems Combined as of June 30, 2020. The largest exposure was to a [redacted] is included in Option 1, but not in either Options 2 or 3. The Systems had large holdings in [redacted] are included in Option 1, Option 2, and Option 3.

[1] Source: BAM and ISS.

Figure 2 – Top 10 Largest Exposures by $AUM[1]

Top 10 Fossil Fuel Reserve Owners by Assets Under Management																
Issuer	Combined ($ mm)	GICS Sector	Integrated Oil Company	Systems Combined			BERS			NYCERS			TRS		
				Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
[redacted]															

Key	
Symbol	**Meaning**
✓	In Top 10 by AUM for respective pension plan and divestment option
✓	Not in Top 10, but is in respective plan and divestment option
✗	Not in respective plan and divestment option

[1] Source: BAM and ISS.

III. Analysis of Divestment Options

III.A Performance Back Tests

Performance back tests are a traditional method of providing some insight into how a portfolio might perform relative to a benchmark. Given the disruptive economic changes underway, particularly regarding fossil fuels, history may prove to be a less useful guide to future prospects than it might be during a time of less change. That said, the downward capital market trends over the last decade for fossil fuel are unlikely to significantly reverse course long term for fossil fuel owners that do not significantly transform their businesses to succeed during the transition away from fossil fuels.

This section presents back test results compared to leading global equity benchmarks for Options 1 and 3. Since Option 2 relies on company level climate and financial risk data, and historical climate risk metrics are not sufficiently available to define which companies would have met the criteria for Option 2 in past years, back tests on Option 2 were not conducted. However, since the number of companies in Option 2 is firmly between the ranges of Options 1 and 3, back tests for Option 2 would likely have generated results within the parameters of the Option 1 and Option 3 back tests.

Divested securities can be reinvested with different approaches. We present three examples — a pro-rata reweighting of a global market cap weighted index, a reweighting using an alternative, heuristic approach aimed at success during carbon transition years, and a reweighting using an alternative optimization approach that seeks to optimize diversification. **For all three reinvestment approaches, both Option 1 and Option 3 back tests generate higher returns, lower risk (as measured by standard deviations), and higher risk-adjusted returns (as measured by the Sharpe Ratio), than the parent index.** While the tracking error for these reinvestment approaches are greater than [redacted] the improvements in return, risk, and Sharpe Ratio represent a more risk efficient and higher return portfolio than the parent index.

The most straight-forward approach to reinvest is to pro-rata reweight the securities in an index once the list of divested securities are removed. For Options 1 and 3, we show the results for two broad market cap weighted indexes — the FTSE All-World Index and the MSCI All Country World Index ("MSCI ACWI").

The FTSE All-World ex-Fossil Fuel index uses a straightforward pro-rata reweighting of all the securities in the index after removing the fossil fuel companies from the FTSE All-World Index. As shown in Figure 3, the FTSE All-World ex-Fossil Fuel Index produced higher annualized returns and lower standard deviations, resulting in better Sharpe ratios than the parent FTSE All-World Index does for all trailing time periods. The standard deviation is a measure of the volatility in returns. A lower standard deviation means the returns were less volatile. The Sharpe ratio, a measure of risk-adjusted return, measures the excess return above a risk-free rate for the volatility of holding a riskier asset. A higher Sharpe Ratio indicates a more efficient portfolio.

We also measure the tracking error of each divestment approach compared to the parent index. The tracking error measures how much the returns of the portfolio differ from the returns of the benchmark (formally the standard deviation of the difference between the returns of the portfolio from the returns of the benchmark). For the FTSE All-World ex-Fossil Fuel approach, the tracking error to the FTSE All-World Index ranged between 0.6% and 0.9%. A tracking error of 0.0% would mean the return streams were identical to that of the parent index. As shown here, tracking error can mean that the portfolio produced better returns than the parent benchmark. However, the same tracking error could have been the result of the portfolio returns underperforming the parent index. Deviation from the benchmark or parent index does not necessarily mean the new portfolio is less risk efficient or more risk efficient. In this case, all results show that the divested options are generally more risk-efficient than the parent benchmark, and generate higher returns than the benchmark.

Figure 3 – FTSE TPI Trailing Performance Estimate[1]

Trailing Performance for Exclusion Options Reweight FTSE All World by FTSE All-World TPI Climate Transition ("FTSE All-World TPI") (Annualized ending October 31, 2020)	# of companies as of end date	1 Year	3 Year	5 Year	9 Year	Since Inception
Gross Return Annualized (%)						
FTSE All-World Index	**3,840**	**5.2**	**5.9**	**8.6**	**9.3**	**10.5**
FTSE All-World ex-FF Index	3,617	7.6	7.0	9.3	10.4	11.5
FTSE All-World TPI Index	1,339	3.8	6.0	8.6	9.5	10.6
FTSE All-World TPI ex FF Index	1,281	4.6	6.3	8.8	10.1	11.1
Option 1	[redacted]					
Option 3	[redacted]					
Standard Deviation (%)						
FTSE All-World Index	**3,840**	**23.1**	**16.9**	**14.1**	**13.0**	**13.4**
FTSE All-World ex-FF Index	3,617	22.6	16.7	14.0	12.8	13.1
FTSE All-World TPI Index	1,339	22.3	16.3	13.6	12.7	13.0
FTSE All-World TPI ex FF Index	1,281	22.1	16.2	13.6	12.6	13.0
Option 1	[redacted]					
Option 3	[redacted]					
Sharpe Ratio						
FTSE All-World Index	**3,840**	**0.30**	**0.33**	**0.58**	**0.70**	**0.77**
FTSE All-World ex-FF Index	3,617	0.40	0.40	0.62	0.79	0.85
FTSE All-World TPI Index	1,339	0.24	0.34	0.59	0.73	0.79
FTSE All-World TPI ex FF Index	1,281	0.27	0.36	0.61	0.77	0.83
Option 1	[redacted]					
Option 3	[redacted]					
Tracking Error (%)						
FTSE All-World Index	**3,840**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
FTSE All-World ex-FF Index	3,617	0.6	0.7	0.7	0.8	0.9
FTSE All-World TPI Index	1,339	1.5	1.4	1.2	1.1	1.1
FTSE All-World TPI ex FF Index	1,281	1.6	1.5	1.3	1.3	1.3
Option 1	[redacted]					
Option 3	[redacted]					

Green shading signifies that it outperformed All-World TPI index. Yellow shading signifies that it outperformed All-World TPI/underperformed All-World.

[1] Source: FTSE/Russell, BAM, and ISS.

In this time of tremendous long-term energy transition, alternatives to market cap weighted approaches may bring perspective more suited to capture the long-term benefits of a global economy undergoing an energy transition. There are many sound investment approaches. For illustration, we selected two distinct approaches that have been recently adopted by large global asset owners that are among the leaders on addressing climate change risks and opportunities.

First, we present the FTSE All-World Transition Pathway Initiative ("TPI") Climate Change Index ("FTSE All-World TPI Index"). The FTSE All-World TPI Index can be described as a heuristic investment model approach. The FTSE TPI index series is not a fossil fuel divestment index, although many fossil fuel companies have zero weight. For example, the index includes oil producers Royal Dutch Shell and Repsol, but not others such as BP, ExxonMobil, and Chevron. It is a transparent, rules-based method of alternatively weighting securities based on the climate transition methodology. It seeks to tilt away from a market cap weight approach to favor companies that are expected to thrive in a transition away from a carbon economy. The index uses the London School of Economics' Transition Pathway Initiative ("TPI") framework, which assesses companies' alignment with the Paris agreement's goal to keep global warming below 2°s Celsius. The FTSE TPI Index incorporates similar climate risk factors that Meketa uses to look at company specific climate risks in this report, including the TPI Energy Transition Management Quality Index, Exopsure to Fossil Fuel Reserves, Emission Intensity, and Green Revenue Share.

One example of a large pension fund that uses the FTSE TPI Index is the The Church of England. The FTSE TPI Index is now their benchmark for their passive equity, reflecting their perspective that they expect this alternative approach to fare better than a market cap weighted approach over the coming long term carbon transition. In February 2020, the Church of England (approximately $10 billion AUM) announced that its pension fund shifted 600 million pounds ($789 million, from the MSCI Developed Market index (standard market cap weighted) to the FTSE Developed Market ex-Korea TPI Index. The Church of England said that the shift represented its entire passive equity portfolio.

As shown in Figure 3, the FTSE All-World TPI Index, before additional fossil fuel reserve owner exclusions, generated higher returns, lower volatility and higher Sharpe Ratios than the FTSE All-World Index for the trailing 3-year, 5–year, 9-year, and since inception periods. For the trailing 1-year period ending October 31, 2020, the FTSE All-World TPI index generated lower returns that the FTSE All-World. In general, the FTSE All-World TPI Index has more exposure to low volatility securities than the FTSE All-World. This resulted in the TPI indexes performing relatively well during the COVID-19 drawdown period (March 2020), but lagging somewhat during the market bounce back period from April 2020 through present.

As shown in Figure 3, all three FTSE All-World TPI ex-fossil fuel portfolios produced higher returns, lower standard deviations, and higher Sharpe Ratios than the FTSE All-World Index during the trailing 3-year, 5-year, and 9-year and since inception periods. During the trailing 1-year period, each of the TPI ex-fossil fuel portfolios, trail FTSE All-World Index, but outperform the FTSE All-World TPI Index.

The tracking error for the FTSE All-World TPI and TPI ex-fossil fuel portfolios compared to the FTSE All-World Index ranged from 1.1% to 1.6%, as compared to the tracking error of the pro-rata reweighted FTSE All-World ex-Fossil Fuel Index, which was between 0.6% and 0.9%. We would expect the FTSE TPI Indexes to have a larger tracking error because it introduces changes throughout the index to reweight the portfolio to emphasize factors that are expected to produce better long-term results than a standard market cap weighted index.

Figure 4 presents the results for Option 1 and Option 3 using a simple pro-rata reweighting of the MSCI ACWI Index. As with the FTSE All-World ex-Fossil Fuel Index, using a simple pro-rata reweighting of a parent market cap weighted benchmark, both Options 1 and 3 produced better annualized returns, with lower standard deviations and higher Sharpe Ratios for all trailing periods, including the 1-year, 3-year, 5-year, and 15-year periods. The tracking error for these options ranged between [redacted]

Most leading passive investment managers have a core competency the ability to optimize custom portfolios to minimize the tracking error to a parent benchmark. Thus, additional implementation options exist, should an investor be interested in implementing an ex-Fossil Fuel portfolio with a lower (or higher) tracking error to the parent index as a key criteria. A lower tracking error means that the outperformance, or underperformance of the custom portfolio would be less than it would be when the tracking error is not constrained. In the ex-fossil fuel portfolio examples here, a lower tracking error would result in lower returns compared to the parent indexes.

Figure 4– Performance Back Test: MSCI ACWI Pro-Rata [1]

Trailing Performance for Divestment Options Reweight MSCI ACWI by Market Cap (Annualized Ending September 30, 2020)	# of Issuers	1 Year	3 Year	5 Year	15 Year
Gross Return Annualized (%)					
MSCI ACWI	2,995	11.0	7.7	10.9	7.7
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Standard Deviation (%)					
MSCI ACWI	2,995	27.6	18.4	15.9	17.0
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sharpe Ratio					
MSCI ACWI	2,995	0.40	0.42	0.69	0.45
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Tracking Error (%)					
MSCI ACWI	2,995	0.0	0.0	0.0	0.0
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Green shading signifies that it outperformed All-World TPI index.

[1] Source: TOBAM, BAM, and ISS.

In Figure 5, we present Divest Options 1 and 3 reweighting within TOBAM's Diversification optimization methodology. An example of a large pension fund that uses TOBAM's methodology in their fossil fuel divestment strategy is, AP1, the Swedish State's largest pension fund. In October 2020, the $39 billion AUM fund adopted TOBAM's Maximum Diversification® as one approach to help shift their Emerging Market Equity and High Yield Fixed Income portfolios to fossil free. This follows AP1's March 2020 announcement of their intent to divest from all fossil fuel companies as an efficient way for the fund to manage the financial risk associated with a transition in line with the Paris agreement. Further, they decided to develop a roadmap and measurable targets towards reaching a carbon neutral portfolio by 2050.

For AP1, TOBAM now applies a 100% fossil-fuel free approach to the Anti-Benchmark® Emerging Markets Equity and Global High Yield strategies funds. The approach excludes companies with significant involvement in the production, sales or extraction of fossil fuels (including coal, coal power generation, oil and gas) from the investment universes of both strategies. TOBAM's Maximum Diversification® approach focuses on building robust portfolios exposures rather than the result of the composition of individually selected securities. Research suggests that, when combined with adequate sustainability criteria, this approach can offer a unique way to invest in a sustainable way without giving up the benefits of diversification in terms of risk and return. AP1 did not switch their MSCI Emerging Market market cap weighted benchmark. For the EM market segment, TOBAM describes that AP1 felt comfortable with tracking errors of 8-12% to the MSCI EM Index because they want to have a diversifier in their portfolio and share TOBAM's conviction that market cap weighted indexes are not the best constructed for today's markets.

As shown in Figure 5, performance back tests show that for the trailing 1-, 3-, 5-, and 15-year periods, the TOBAM Diversified ACWI Benchmark generated higher returns, lower standard deviation, and higher Sharpe ratios than the MSCI ACWI market cap weighted index. These results are with a tracking error of between 1.3% and 1.4%.

When Option 1 and Option 3 are re-invested using the TOBAM Diversified Benchmark, both ex-fossil fuel options significantly outperform both the TOBAM Diversified ACWI and the MSCI ACWI with lower standard deviations and higher Sharpe Ratios for every trailing period. These very strong, long-term positive results for Option 1 and Option 3 came with a tracking error to the MSCI ACWI of [redacted] approximately [redacted] l tracking error than incurred by the TOBAM Diversified strategy.

Figure 5 – Performance Back Test: TOBAM Diversification[1]

Trailing Performance for Divestment Options Reweight MSCI ACWI by TOBAM Diversification (Annualized Ending September 30, 2020)	# of Issuers	1 Year	3 Year	5 Year	15 Year
Gross Return Annualized (%)					
MSCI ACWI	**2,995**	**11.0**	**7.7**	**10.9**	**7.7**
Diversified Benchmark ACWI	1,770	14.2	9.4	11.6	8.9
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Standard Deviation (%)					
MSCI ACWI	**2,995**	**27.6**	**18.4**	**15.9**	**17.0**
Diversified Benchmark ACWI	1,770	27.3	18.3	15.7	16.7
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sharpe Ratio					
MSCI ACWI	**2,995**	**0.40**	**0.42**	**0.69**	**0.45**
Diversified Benchmark ACWI	1,770	0.52	0.51	0.74	0.53
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Tracking Error (%)					
MSCI ACWI	**2,995**	**0.0**	**0.0**	**0.0**	**0.0**
Diversified Benchmark ACWI	1,770	1.4	1.3	1.3	1.4
Option 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Green shading signifies that it outperformed MSCI ACWI index.

The results above concentrate on equity portfolios. BERS, NYCERS and TRS predominant exposure to fossil fuel reserve owners was in equities. The predominant equity exposure was in passively managed accounts for each plan. BERS, NYCERS, and TRS Systems' corporate fixed income fossil fuel reserve owner exposure was predominantly in actively managed accounts. There are ever growing fixed income approaches to reducing or excluding fossil fuel companies from fixed income portfolios.

In sum, at this juncture in history, traditional back-tests indicate that the Systems may prudently divest from fossil fuel reserve owners as a whole or in a more focused fashion, using a range of different reinvestment approaches. We expect that adopting approaches that seek to position investments in a way that an asset owner believes should, over the long-term outperform a market weighted approach, will incur more tracking error than simple replication of a market cap weighted approach. In this situation, a deviation from tracking error is likely to result in outperformance relative to the current parent index.

[1] Source: TOBAM, BAM and ISS.

III.B Financial Impact in Climate Scenarios

Consistent with the discussion of climate scenario outcomes in Phase 2 of this report, Meketa employed its top-down, multi-factor scenario analysis framework to evaluate potential divestment Options 1, 2, and 3. We use both pro-rata and risk-optimized approaches to rebalancing. We specify broad, economically linked factors and project their future behaviors based on underlying historical relationships. The model generates a large number of "simulations" describing how different asset classes and macroeconomic factors could potentially behave over a particular forecast period given what we know about their past behavior.

In our opinion, scenario analysis can provide substantial forward-looking insight. We note several model inputs, conventions, and assumptions that may affect results:

Period of Analysis: Our analysis begins in June 2020, a period immediately after a sharp equity market recovery and continued fixed income market strength following a substantial downturn in equity markets and economic growth associated with the COVID-19 pandemic. Our modeling incorporates 1) extrapolation of recent trends and 2) reversion to mean expected long-term returns when generating simulations for analysis. If the analysis shifts the starting point, it is possible the relationship between the mean expected returns of the actual and divestment portfolios would differ.

In Figure 6, as a representative example, we display the results of re-analyzing the TRS actual portfolio and divestment portfolio Options 1, 2 and 3, as of December 31, 2019 to examine the impact of the period of analysis on expected returns and risk. In the December 2019 results, we observe relative to the June 2020 analysis that:

1) For the 30-year period beginning December 2019, expected returns for the actual portfolio and each divestment Option portfolio are higher under the 1.5° and 3.0° scenarios than for the comparable portfolios for the June 2020 period.
2) For December 2019 results the expected returns of Options 1, 2, and 3 portfolios are all higher in both the 1.5° and 3° scenarios than the actual portfolio, while they are all lower in the June 2020 results. The Option 1 portfolios outperform by approximately [redacted] in the December 2019 results, versus underperforming by approximately [redacted] in both scenarios in June 2020.
3) The standard deviation is more stable between the actual portfolio and Option 1, 2 and 3 portfolios in the December 2019 results than in the June 2020 results.
4) The Sharpe Ratios for the December 2019 results show every divestment Option with a slightly higher Sharpe ratio than the actual portfolio, except for Option 3, which matched the results of the actual portfolio. In contrast, the June 2020 results show all divestment Option portfolio Sharpe Ratios match or slightly underperform the actual portfolio.

Figure 6 – Climate Scenario Analysis: Actual and Ex-Fossil Fuel Portfolios[1]

Climate Scenario Analysis: Actual Portfolios TRS	1.5°		3.0°	
	Dec 31, 2019 (%)	Jun 30, 2020 (%)	Dec 31, 2019 (%)	Jun 30, 2020 (%)
30-Year Expected Return (annualized) (%)				
Actual Portfolio	7.14	6.52	6.53	6.12
Option 1 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Option 2 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Option 3 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Standard Deviation (%)				
Actual Portfolio	12.55	12.13	13.71	13.28
Option 1 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Option 2 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Option 3 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Sharpe Ratio				
Actual Portfolio	0.47	0.43	0.38	0.36
Option 1 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Option 2 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]
Option 3 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]

Green shading signifies that it outperformed Actual Portfolio.

Consequently, we believe the period of analysis did have a meaningful impact on results in this case. In our opinion, the broad trends evident in this sample of December 2019 analysis from TRS are generalizable to the BERS and NYCERS.

As a result, in our opinion, decisions about future positioning and policy, including the implementations, will need to take into account this timing effect. The December 2019 results represent a more "normal" market environment. The June 2020 results reflect markets that are grappling with a global pandemic and with dramatically lowered economic growth. Though market conditions have continued to improve as of the time of this report (December 2020), the path of economic and financial growth in the near-term is still highly uncertain.

[1] Source: BAM and ISS.

Analysis of Companies, Not Reserves or Emissions: When evaluating divestment of fossil fuel owners, we model the divestment of companies, not their underlying assets. Reviewing the broadest universe of fossil fuel reserve owners (i.e., the Option 1 portfolio), some companies appear to own fossil fuel reserves alongside significant other businesses (e.g., [redacted]). Although the risk and return characteristics of some fossil fuel reserve owners are likely strongly determined by the value of their reserves, others that have multiple lines of business may be relatively unaffected by changes in climate change policy, or even benefit from polices and behaviors intended to limit rises in global temperature. Further, we incorporate past trends of company performance relative to macroeconomic factors such as fossil fuel prices – including whether that sensitivity increases or decreases over time. Consequently, we generate simulations where even aggressive climate change mitigation measures may have little or even a positive impact on some fossil fuel reserve owners that have limited their reliance on fossil fuel reserves to drive their business results.

Point versus Range Estimates: While we present average 30-year expected returns as a starting point for discussion, it is important to recognize that these figures merely represent a range of potential outcomes. As shown in Figure 7 across portfolios, the middle 50% of return outcomes between both non-divested and divested approaches ranges from approximately [redacted] annually. Further, the realized returns need not have the same relationship as the average returns.

Rebalancing Approaches: An additional point of consideration is that the divestment from securities requires determining a method to reallocate market value from the divested securities to the remainder of the portfolio. We include two approaches to rebalancing the divested portfolios in our analysis: a pro-rata method and a risk-optimized method:

- **Pro-Rata**: The pro-rata method reinvests market value made available by divesting equity securities and fixed income securities proportionally in the remaining equity and fixed income portfolios. This approach maintains the actual portfolio's existing balance of equity and fixed income exposure while removing exposure to the divested companies.
- **Risk-Optimized**: Divested portfolios that experience a decrease in overall risk relative to the actual portfolio using a pro-rata reinvestment reweighting, are simultaneously likely to exhibit a decrease in long-term expected return. We recognize that reducing total portfolio risk and incurring a lower expected return may not be consistent actual asset allocation behavior where decision makers may be targeting fixed levels of either risk or expected return. The risk-optimized rebalancing method seeks to adjust rebalancing of assets to maintain a similar level of risk in divested portfolios relative to the actual portfolio by preferentially reinvesting market value made available by divesting fixed income securities into equities. The transfer of assets from fixed income to equity securities is capped by the amount of fixed income securities divested.

Results & Discussion – Pro-Rata Rebalancing

Consistent with the findings of Phase 2, various degrees of climate change had similar impacts across portfolios. The 3°C temperature rise scenario results in lower expected returns, higher volatility, and decreased risk efficiency as measured by Sharpe ratio relative to the 1.5°C temperature rise scenario across all portfolios.

Figure 7 – Climate Scenario Analysis: Actual and Ex-Fossil Fuel Portfolios[1]

Climate Scenario Analysis: Actual and ex-Fossil Fuel Portfolios (As of June 30, 2020)						
	BERS		NYCERS		TRS	
	1.5°	3.0°	1.5°	3.0°	1.5°	3.0°
30-Year Expected Return (annualized)(%)						
Actual Portfolio	6.72	6.31	6.58	6.18	6.52	6.12
Option 1 Portfolio	[redacted]					
Option 2 Portfolio	[redacted]					
Option 3 Portfolio	[redacted]					
Standard Deviation (%)						
Actual Portfolio	12.22	13.41	11.49	12.57	12.13	13.28
Option 1 Portfolio	[redacted]					
Option 2 Portfolio	[redacted]					
Option 3 Portfolio	[redacted]					
Sharpe Ratio						
Actual Portfolio	0.44	0.37	0.46	0.39	0.43	0.36
Option 1 Portfolio	[redacted]					
Option 2 Portfolio	[redacted]					
Option 3 Portfolio	[redacted]					

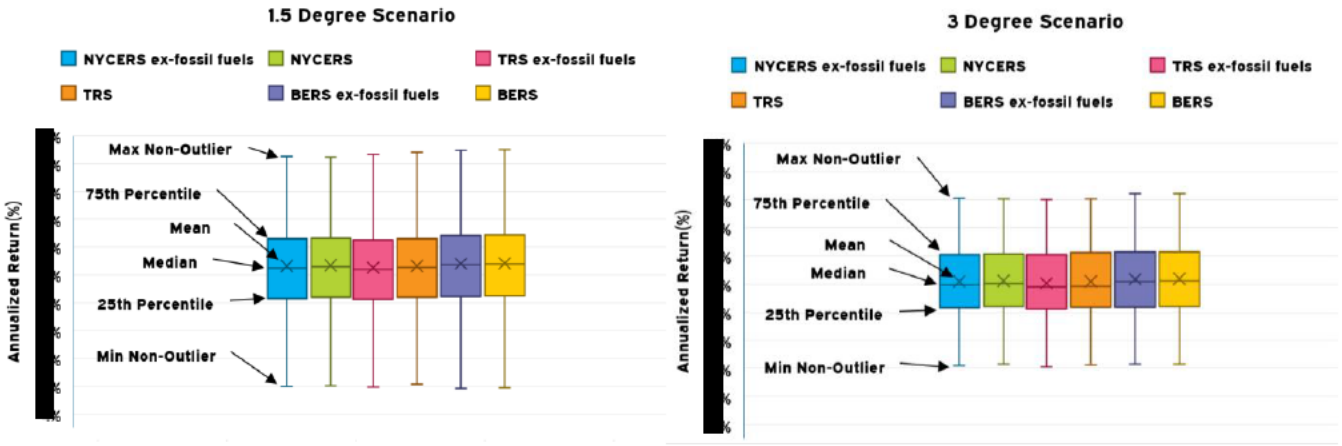
Green shading signifies that it outperformed Actual Portfolio.

The impact of divesting securities within each climate scenario varies across potential divestment options. In both the 1.5°C and 3°C temperature rise scenarios, the portfolios with the highest number of divested securities (i.e., Option 1) tend to reduce both expected return and risk the most relative to other divestment portfolio versus the actual portfolio. Other divestment options generally maintain expected return and risk levels near that of the actual portfolio. The resulting Sharpe Ratios for all Option 1 portfolios were [redacted] lower than the actual portfolios, while they generally matched that of the actual portfolios for Options 2 and 3.

[1] Source: BAM and ISS.

While it may appear counterintuitive that any exclusion of fossil fuel reserve owners could result in even slightly lower expected returns, particularly in a 1.5°C rise scenario (i.e., simulations which likely reflect substantial amounts of policy intervention to limit carbon emissions sufficiently to limit global temperature increases), we note that the June 2020 timing could potentially cause this outcome. Additionally, as demonstrated in Figure 8, there exists considerable uncertainty in the wide ranges around estimates of future returns for the portfolios.

Figure 8 – Climate Scenario Analysis: Actual and Ex-Fossil Fuel Portfolios[1]



Results & Discussion – Risk Optimized Rebalancing

Comparing the June 2020 1.5°C and 3°C temperature rise scenarios under risk optimized rebalancing displays similar patterns of returns to pro-rata rebalancing. The 3°C temperature rise scenario results in lower expected returns, higher volatility, and decreased risk efficiency as measured by the Sharpe ratio, relative to the 1.5°C temperature rise scenario. However, the expected levels of risk and return across divested portfolios are higher under the optimized rebalancing results than in the pro-rata reweighting, due to having greater weights to equities.

[1] Source: BAM and ISS.

Figure 9 – Climate Scenario Analysis: Optimized Actual and Ex-Fossil Fuel Portfolios[1]

Climate Scenario Analysis: Optimized Actual and ex-Fossil Fuel Portfolios (As of June 30, 2020)						
	BERS		NYCERS		TRS	
	1.5°	3.0°	1.5°	3.0°	1.5°	3.0°
30-Year Expected Return (annualized)(%)						
Actual Portfolio	6.72	6.31	6.58	6.18	6.52	6.12
Option 1 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 2 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Standard Deviation (%)						
Actual Portfolio	12.22	13.41	11.49	12.57	12.13	13.28
Option 1 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 2 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sharpe Ratio						
Actual Portfolio	0.44	0.37	0.46	0.39	0.43	0.36
Option 1 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 2 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3 Portfolio	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Green shading signifies that it outperformed Actual Portfolio.

Using optimized rebalancing for the June 2020 period, Option 2 and Option 3 divestment portfolios tend to produce expected returns in excess of the actual portfolio. The Option 3 divestment portfolio yielded expected returns greater than or equal to the actual portfolio across all plans in both climate rise scenarios. The Option 2 portfolio yielded expected returns greater than or equal to the actual portfolio across all plans in the 1.5°C climate rise scenario and in the 3°C climate rise scenario. The Option 3 portfolio provided the highest expected return to the BERS and NYCERS portfolios under both climate scenarios while the Option 2 portfolio provided the highest expected return to TRS.

Selecting a prudent portfolio is not the same exercise as simply picking the portfolio with the highest expected mean level of return. A prudent portfolio is one that can achieve the objectives of the investor while taking a minimal amount of risk. Our analysis demonstrates that the proposed divestment portfolios represent prudent options for the Systems. Even with the June 30 results, they generally have similar degrees of risk efficiency relative to the actual portfolio with a mix of slightly increased or reduced levels of expected return and reduced or constant risk. Our analysis demonstrates that if the Systems' overall levels of risk are kept relatively consistent with the actual portfolios, the divested portfolios can, in many cases, generate similar or higher levels of expected returns than the actual portfolio.

[1] Source: BAM and ISS.

We stress that there is still a high degree of uncertainty surrounding the impact of climate change on investment portfolios. In our opinion, while it is worthwhile to discuss the relative merits of various options, there is substantial scope for deviation from mean expected outcomes.

III.C Carbons Emissions—Decarbonization Impact

In a world that is moving to decarbonize, high exposure to greenhouse gas emissions — and carbon emissions specifically — can provide an indication of potential future risk. As shown in Figure 10, the total Scope 1 + 2 emissions, Carbon Footprint, and Weighted Average Emissions Intensity were highest for the most inclusive divestment option – Option 1, and lowest for Option 3, the most targeted to companies with material extractives or thermal coal revenues, most of which are energy sector companies.

Figure 10 – Carbon Exposure Public Equity Portfolio Actual and Fossil Fuel Reserve Owners ("FFRO") [1]

BERS, NYCERS and TRS Total Public Equity Portfolio Actual and Fossil Fuel Reserve Owners Carbon Exposure (As of June 30, 2020)									
Pension Plan	Number of Companies (#)	(% total)	Assets Under Management ($ mm)	(% total)	Total Scope 1 + Scope 2 Emissions (millions tons CO_{2e})	(% total)	Scope 1 + 2 Carbon Footprint (tons CO_{2e}/$ mm invested)	(% total)	Scope 1 + 2 WA Emissions Intensity (tons CO_{2e}/$ mm revenue)	(% total)
BERS Public Equity[2]	**6,073**		**3,537.4**		**0.5**		**128.1**		**160.0**	
BERS FFRO: Option 1	[redacted]				0.1	(22.8)	25.1	(19.6)	19.0	(11.9)
BERS FFRO: Option 2					0.1	(18.0)	20.3	(15.8)	14.7	(9.2)
BERS FFRO: Option 3					0.0	(8.9)	9.1	(7.1)	6.2	(3.9)
NYCERS Public Equity[3]	**9,274**		**33,431.5**		**4.9**		**147.2**		**175.3**	
NYCERS FFRO: Option 1	[redacted]				1.3	(27.0)	34.6	(23.5)	25.8	(14.7)
NYCERS FFRO: Option 2					1.2	(23.7)	30.9	(21.0)	23.0	(13.1)
NYCERS FFRO: Option 3					0.5	(9.9)	11.5	(7.8)	6.9	(4.0)
TRS Public Equity[4]	**9,949**		**39,284.6**		**5.5**		**138.8**		**184.4**	
TRS FFRO: Option 1	[redacted]				1.6	(29.4)	35.8	(25.8)	25.0	(13.6)
TRS FFRO: Option 2					1.5	(26.6)	33.0	(23.8)	22.4	(12.1)
TRS FFRO: Option 3					0.6	(11.3)	12.8	(9.2)	7.3	(4.0)

[1] Source: BAM and ISS.

[2] [redacted] of the total systems combined market value were unmapped by ISS.

[3] [redacted] of the total systems combined market value were unmapped by ISS.

[4] [redacted] of the total systems combined market value were unmapped by ISS.

Scope 3 emissions, which include the emissions made by users of a product after it is sold, are of much greater importance to fossil fuel producers (most of which are in the energy sector) than in some other sectors with fossil fuel reserve owners, such as utilities, where Scope 1 + 2 emissions are most relevant. If Scope 3 emissions were to be included, the Energy sector companies would likely have a much greater percentage reduction in emission measures than other key sectors with fossil fuel reserve owners, including [redacted]. As a result, with Scope 3 Emissions included, Option 3 would be expected to include a relatively larger percentage of Weighted Average Emissions, compared to Option 1 and 2 than it does when comparing Scope 1 + 2 emissions.

Divestment of fossil fuel reserve owners would reduce the Systems' carbon emission exposures somewhat. The approach to reinvestment of divested fossil fuel reserve owners can further reduce the overall portfolio's emission intensity, and improve other energy transition-related key performance indicators. For example, as shown in Figure 11, divesting from the FTSE All-World Index reduces the Emission Intensity by about 12%, from 281.04 to 246.37 metric tons/$mm revenue. However, shifting from the FTSE All-World to the FTSE All-World TPI Index reduces the total Emission Intensity by 47%. Adopting the FTSE All-World TPI ex-FF index reduces Emission Intensity by 52%. The custom ex-fossil fuel reserve Options 1 and 3, when reinvested using the FTSE All-World TPI index framework, further reduce Emission Intensity by 56%.

Figure 11 – Energy Transition Key Performance Indicators: FTSE All-World Indexes and Divestment Options

	Number of Securities	Reserve Per Equity (Metric Tons/$mm Equity)	Emission Intensity (Metric Tons/$mm Revenue)	Green Revenue (Proportion of total revenue %)	ESG Score	TPI-Aligned Score
FTSE All World Index	3,840	6,713.6	281.0	1.62	3.12	2.51
FTSE All-World ex Fossil Fuels Index	3,617	295.4	246.4	1.73	3.14	2.51
FTSE All-World TPI Index	1,339	1,497.1	148.0	2.26	3.45	3.27
FTSE All-World TPI ex FF Index	1,281	52.9	132.1	2.40	3.45	3.27
FTSE All-World TPI Option 1	[redacted]	95.1	123.2	2.45	3.47	3.27
FTSE All-World TPI Option 3	[redacted]	151.1	124.3	2.43	3.46	3.27

Similarly, the share of green revenue (defined as revenue that contributes to mitigating climate change) increases more in the TPI Index and TPI ex Fossil Fuel divestment options than in the FTSE All-World ex-Fossil Fuel Index, which stays with the market cap weighted framework and does not include the TPI approach. All six indexes represent broad, all-world equity indexes. Reflecting this, for all indexes shown, the share of green revenues reflects the relatively low green revenue share in the overall economy. As shown in Figure 11, The FTSE All-World Index shows the smallest percentage of green revenues of the indexes reviewed, at 1.62% of total revenues. The highest green revenue share, for the TPI Option 1 is 2.45% of total revenues, a 51% increase in green revenue share over the FTSE All-World Index. All of the TPI Indexes show similar increases in Green Revenue Share. In contrast, after removing fossil fuel owners, the FTSE All-World ex-Fossil Fuel index, which reinvests pro-rata within the market cap weighted framework in all of the FTSE All-World securities, increases the Green Revenue Share in the portfolio by just 7%.

III.D Company and Industry Specific Considerations

The performance back tests and forward-looking climate scenario analyses above indicate that divestment from fossil fuel reserve owners can be prudent, with reasonable expectations that investment returns and risks that ex-fossil fuel portfolios can meet or exceed actual, non-divested portfolios with potentially higher investment returns, lower volatility, and higher risk-adjusted returns. Divestment from fossil fuel reserve owners also reduces carbon emissions exposure, in addition to fossil fuel reserves risk. Climate change risks and opportunities are systemic and global. In this context, each option for divestment can carry different strengths and weaknesses to the Systems' overall long-term goals of financial success in an era of disruptive long-term energy transition and physical climate risk.

In this section, we look at some pros and cons of fossil fuel divestment options based on company and industry and climate data available today to consider alongside the overall aggregate risk and return expectations of different options.

Company Material Potential Stranded Asset Risk

While many companies that own fossil fuel reserves face significant and material stranded asset risks, the potential stranded asset risk appears to be immaterial for fossil fuel reserve owners with de minimis revenues from extractives and production. We found [redacted] of the [redacted] fossil fuel reserve owners in Option 1 and [redacted] companies in Option 2 generated $0 revenues from extractives and $0 revenues from thermal coal. Most of these companies were [redacted] companies, with only [redacted] companies. However, such companies may face other material climate change risks. For example, if they do not have revenue from fossil fuel extraction or production, they may rely materially on revenue from fossil fuel power generation, fossil fuel equipment and services, fossil fuel exploration, or other fossil fuel business activities related to their ownership of reserves. Moreover, those companies in Option 2 that have no revenues from extractives or thermal coal may still indicate higher risk across a range of climate and financial indicators.

If the objective is to specifically identify potential value of reserves as risk, then a direct measurement of reserves volume owned would be useful. If the objective encompasses broader concerns such as climate risks related to fossil fuel reserves and business, then using additional criteria such as those in Options 2 and 3 could be beneficial.

The divestment option criteria affect even the largest fossil fuel reserve owners in the Systems' investment portfolios. For example, the largest fossil fuel reserve $AUM holding for BERS, NYCERS, and TRS was [redacted]. Data shows that [redacted] generates 10% of its revenue from extractives and 10% from thermal coal. The [redacted] shows 0% of its revenues from extractives and from thermal coal because [redacted] dilutes its exposure to the [redacted]. [redacted] is included in Option 1 but likely has [redacted] risk. It is [redacted] the fossil fuel reserve owners in [redacted]

GICS Sectors (and Subsectors) Differ in Key Material Climate Risks

Using fossil fuel reserve ownership as the key risk criterion can be valuable because it identifies any fossil fuel owner, regardless of economic sector. It is most relevent in the Energy Sector, and particularly in energy subsectors involved in extraction and production of fossil fuels. However, in other economic sectors, focusing on fossil fuel reserve ownership risk will likely not identify many companies that are at higher risk with the energy transition, and may exclude companies that are not at high risk for their economic sector.

For example, the second largest number of fossil fuel reserve owners were found in the [redacted] for the Systems Combined, NYCERS and TRS, as shown in Figure 12.

Figure 12: Divestment Options: BERS, NYCERS, and TRS Investment Exposure[1]

Divestment Options Comparison Total Public Equity and Fixed Income Fossil Fuel Reserve Owner Exposure (As of June 30, 2020)													
	Systems Combined			BERS			NYCERS			TRS			
GICS Sector	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	
Total Plan AUM ($ mm)	[redacted]												
Total Public Listed AUM ($ mm)													
Total FF Exposure ($ mm)													
FF Percent of Total Plan AUM (%)													
FF Percent of Total Public Listed AUM (%)													
Total Issues													
Total FF Companies Represented													
Energy													
[redacted]													

[1] Sources: BAM and ISS...

Many utility companies purchase rather than own fossil fuel reserves. Therefore, greenhouse gas emissions intensity by utilities is probably a metric that can better identify power utilities climate risk, which is often regulatory risk. In the Systems' portfolios, [redacted] do not own fossil fuel reserves. The [redacted] that do own reserves generate less than 10% of revenues from extractives and production. A measure of emissons intensity, and/or measures of emissions alignment with the Paris Accord might more easily allow for a climate energy transition risk comparison among power utility companies than fossil fuel reserve ownership.

Energy Transition Potential for Fossil Fuel Owners

The 11 company risk metrics, revealed that a majority of the fossil fuel owners face financial risk, and exhibit fossil fuel exposure and/or transition management risk. The relatively broad divestment Options discussed here capture these companies that show some higher risk. They also include companies with strong indicators of ability to successfully manage the energy transition. The broadest Option, Option 1, includes the most number of companies with mixed risk levels.

For example, Option 3 includes fossil fuel reserve owners with >10% extractives or >10% thermal coal revenues. This relatively low threshold ensures that companies with some material exposure to extractives or thermal coal revenues are identified. However, the threshold also means that the Systems might target for divestment a company with up to 90% revenues from renewable energy or green revenues of some type. The vast majority of the fossil fuel reserve owners have at this juncture zero green revenue share. However, even among fossil fuel reserve owners, [redacted] companies generated >20% of their revenues from green sources. [redacted] were [redacted]. This included [redacted]. These [redacted] green revenues ranged from 26% to 40% of their revenues. [redacted] companies are included in Option 1 and Option 2, due respectively to their status as fossil fuel reserve owners and to their performance on other risk metrics relating to transition readiness and financial risk. [redacted] had sufficient revenues from extractives and thermal coal to be included in Option 3.

For Option 3, the >10% revenues from extractives ensures that the company is generating a material amount of revenues from fossil fuel extraction. We anticipate that as new climate policies and regulations are put in place, more and more companies, including fossil fuel reserve owners, could potentially increase their green revenue share. Like reserve ownership, green revenue share is only one metric. For utilities, it cannot fully indicate a company's relative competitiveness within their grid. In order to further recognize the materiality of green revenue, the minimum extractives revenue threshold could be raised from >10% to ensure a company does not have majority green revenues. For example, raising the threshold to 50% would result in decreasing the companies in Option 3 by [redacted] companies. However, a higher extractive revenue threshold may inadvertantly miss companies that face material risk from fossil fuel reserves. This is an example where perhaps two climate metric criteria may better identify companies progress in transitioning. For example, an extractives revenue threshold lower than >50% such as the >10% extractive revenue threshold might be further refined with an exception based on a minimum green revenue threshold as evidence of companies with mitigated risk. This is one example of potential considerations that may arise from adopting a broad fossil fuel reserve ownership definition for divestment in a complex market environment.

An illustration of the potential pros and cons of of Option 2 criteria can be found among the [redacted] Integrated Oil Companies. As shown in Figure 13, each of these companies demonstrated higher or moderate risk in the vast majority of the risk categories of fossil fuel exposure, energy transition management, and financial risk. Option 2 identifies companies based on a diversity of key risk categories, metrics in key areas, and recognizes those that are higher risk in at least one metric in a majority of those categories – two of three categories. However, among these [redacted] oil and gas integrated companies, [redacted] ranked a 4 or 4* by TPI on TPI Management Quality: [redacted] had green revenue share above $0. These types of company level metrics are behind forward-looking transition climate indexes, such as the FTSE TPI Climate Transition Index inclusion of some oil majors, while excluding others. These forward-looking metrics indicate certain companies are relatively stronger than others in transition potential. For this example as of today's data, those companies that show higher transition potential with better metrics in energy transition management, like peers with worse management quality metrics, show relatively high risk on economic and potential stranded capex exposure.

Figure 13 – [redacted] Integrated Oil Companies Climate and Financial Risk Indicators[1]

[redacted] Integrated Oil Companies Climate and Financial Risk Indicators																
			Fossil Fuel Reserve Exposure Risk				Energy Transition Management Risk				Financial Risk		Physical Climate Risk	Included in Divestment Option	
Issuer	Combined ($ mm)	GICS Sector	O&G Potential Stranded CapEx in SDS (%)	O&G Potential Stranded CapEx in B2DS (%)	Power & Utilities Coal B2DS Relative Alignment Index (%)	Power & Utilities Gas B2DS Relative Alignment Index (%)	TPI Mgmt Quality Score (or No Reporting)	Green Revenue Share (%)	Emissions Intensity (tons CO_2e/$m revenue)	2-Yr % Change in Emissions Intensity (2016-2018) (%)	Altman Z-Score	EVA/ Sales (%)	427 Company Physical Risk Score	Option 2	Option 3
[redacted]															

[1] Source: BAM and ISS.

We anticipate that with changing markets and policies, and new technologies, there will be likely escalating growth in renewable and green business opportunities, even for oil and gas extractives companies. For example, today, solar and wind energy are cost competitive in many markets, even with storage, which technological innovations are making increasingly efficient. Technologies that draw on the core skill sets and technologies of the oil and gas sector are coming to market. They range from green hydrogen, which is growing rapidly, to newer technologies, such as that from Canadian Company, Eavor, which uses innovations in oil and gas drilling to offer a new drilling technology to use the heat from the earth's core to generate renewable energy. Such technologies may pose a further threat to existing oil and gas companies or a potential transition opportunity that leverages their significant skill set and technologies to transition to renewable energy.

Corporate Governance Considerations

The Systems' active leadership on proxy voting and engagement on climate issues, and collaboration with institutional investor organizations such as Climate Action 100+ to encourage change would necessarily change with broad fossil fuel reserve owner divestment from its equity portfolio. Each Option includes some companies targeted for global institutional investor engagement by Climate Action 100+. These are typically larger companies. As shown in Figure 14, Option 1 includes [redacted] Climate Action 100+ companies that, combined account for [redacted] of the Systems' Public $AUM. All [redacted] fossil fuel owners accounted for [redacted] of Public Listed $AUM. Similar Option 1 exposures to Climate Action 100+ companies are evident for BERS, NYCERS and TRS. For Option 3, the Climate Action 100+ companies is reduced to [redacted] of the Systems' $AUM, representing [redacted] of the [redacted] fossil fuel companies.

Figure 14 – Systems Combined Top 10 Fossil Fuel Reserve Owners by Assets Under Management[1]

Divestment Options Comparison Total Public Equity and Fixed Income Fossil Fuel Reserve Owner Exposure (As of June 30, 2020)												
	Systems Combined			BERS			NYCERS			TRS		
GICS Sector	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
Total Plan AUM ($ mm)	[redacted]											
Total Public Listed AUM ($ mm)												
Total FF Exposure ($ mm)												
FF Percent of Total Plan AUM (%)												
FF Percent of Total Public Listed AUM (%)												
Total Issues												
Total FF Companies Represented												
Climate Action 100+ Companies												
Climate Action 100+ as % of Public AUM												

As evident in new institutional investor organizations such as the Net Zero Asset Owners Alliance, which aims to achieve net zero by 2050 and commits to setting interim targets to achieve such goals, many institutional investors view coordinated institutional investor proxy voting and engagement as a powerful tool for transitioning companies.

We expect the broadest fossil fuel divestment option to most materially weaken the Systems' engagement opportunities with suppliers of fossil fuels. Because the energy transition and climate change are systemic, divestment of suppliers could be compatible with a shift of the Systems' proxy voting and engagement efforts to focus on companies that are responsible for the demand for energy and for financial firms involved in financing fossil fuels.

[1] Source: BAM and ISS.

Climate Data

We find that data vendors today have similar, but not fully consistent, lists of fossil fuel reserve owners in a market that has yet to adopt consistent definitions and disclosure standards. These differences can reflect differences in definition, differences in information on specific companies, differences in timing of updating company climate data as mergers, acquisitions, sales of units, and bankruptcies shift the carbon profiles of companies, and simply differences in breadth of coverage. Thus, divestment options defined by climate metrics may be more or less comprehensive depending on the definitions used by any given vendor, and the coverage.

After reviewing the leading ESG data vendors, Meketa selected ISS as our ESG and Climate data vendor due to our finding that the ISS data typically covered a broader range of companies with quality metrics for climate, social, and governance areas. We found an additional benefit in ISS's ESG data independence from the three major index providers, where we find index providers offer quality climate and ESG data, but may prioritize coverage of companies in their indexes. We were able to leverage the ISS ESG and climate data with ISS' considerable proxy voting database. For this year, as evident in the metrics Meketa used for this report, we elected to complement the ISS climate metrics with data on potential stranded capex from Carbon Tracker, physical climate risk data from 427, energy transition management quality scores from TPI, and financial Altman-Z scores from Bloomberg.

Changing Metrics

We find improvements in climate data are emerging rapidly. As an example, we note two developments even during the few months since we first defined the company climate and financial risk metrics during Phase 2 that, in our opinion, could further enhance the assessment of climate risk for fossil fuel reserve owners and, more broadly, for companies throughout the economy.

First, we find that forward-looking measures of carbon emissions, similar to the TPI Carbon Performance metric are being developed and released for wide sets of companies, rather than being limited to the relatively few companies in the TPI coverage. In our opinion, such metrics may be a useful substitute, or complement, to using the percentage change in emissions intensity as an indicator of the direction of change in emissions by companies. For example, in ISS' December 2020 release of its climate data updates, we found that a measure of Paris and SDS alignment will be available that is tailored to each industry specifics, similar to the TPI approach. For example, Scope 3 emissions will apply to the Energy Sector, as compared to Scope 2 emissions for the utilities sector.

Second, during our research, we found what we believe is an excellent database on physical climate risks from 427. However, we could not find a vendor that provided any database on how companies manage their physical climate risks. Most, like TPI, have so far focused on management of energy transition risks. For this reason, while we include physical climate risk data in this report there was no physical climate risk management data to assess. In our opinion, there was not sufficient information to include physical climate risk in our decision-making criteria for fossil fuel reserve potential divestments. The ISS December 2020 release also noted that management of physical climate risk will become an additional element of their climate database. We anticipate that physical climate management data and other climate data points will continue to improve over time and become more widely available to the investment industry.

Summary

We find that every divestment option relies on the utilization of different data and different analytical approaches, and that each have positive and negative attributes. We find that Divest Option 1 offers an opportunity to exit a sector associated with intrinsic risk but does not sensitively account for material differences between securities. Divest Option 2 utilizes a series of metrics to create a composite picture of each security's exposure to reserve ownership, financial risk, and transition risk indicators, but is based on evolving data and can potentially include companies that may show higher risk in two metrics, while also showing lower risk in multiple other key climate and financial metrics. Divest Option 3 hones in on a smaller subset of companies that are generating significant revenue from the extraction of fossil fuels, but it does not offer insight into transition potential. Regardless of the strengths and weaknesses of each particular methodology, we find that each option can serve as a prudent framework for divestment.

IV. Divestment Process, Transaction Costs

Once the Systems select a divestment option and a reinvestment plan, the divestment process can further influence implementation costs. Because the Systems manage their passive investments in separate accounts, rather than co-mingled vehicles, we anticipate that there would be relatively minimal costs to divestment, and, in our opinion, transaction costs would not likely be an overriding determinant in divestment decision.

Adopting Option 1, 2, or 3, might be implemented by:

- Divesting all passive and active accounts;
- Divesting passive and directing active managers to exclude or explain why they prefer not to divest;
- Divesting very high risk fossil fuel reserve owners, putting others on a watch/engagement list prior to divestment, and other on a monitoring list; or
- Keeping all existing positions and hedging the Systems' portfolios to bring the portfolios to a neutral exposure to the divestment list.

As shown in Figure 15, generally the majority of the Systems' fossil fuel reserve owner exposures for Option 1, 2, or 3 are passive equities. We expect divesting all passive and active accounts entail greater direct transaction costs to the Systems than divesting from targeted securities. The transaction costs to the Systems of divestment for actively managed accounts would depend on the individual contracts with the Systems' active managers.

Figure 15 – BERS, NYCERS, and TRS Passive/Active Fossil Fuel Exposure[1]

BERS, NYCERS and TRS Exposure to Fossil Fuels (As of June 30, 2020)								
	Plan	Option 1			Option 2		Option 3	
	$AUM ($ mm)	$AUM ($ mm)	# of Firms	# of Issues	$AUM ($ mm)	# of Firms	$AUM ($ mm)	# of Firms
BERS								
Total Equity & FI (Public)	**5,842.1**							
Total Equity & FI (Public) % of AUM	**100.0**							
Total Equity	**3,550.9**							
Passive	2,065.2							
Active	1,485.7							
Total Fixed Income (Public)	**2,291.2**							
Passive	535.6							
Active	1,755.6							
NYCERS								
Total Equity & FI (Public)	**57,184.9**							
Total Equity & FI (Public) of AUM	**100.0**							
Total Equity	**33,431.5**							
Passive	20,082.4							
Active	13,349.1							
Total Fixed Income (Public)	**23,753.4**							
Passive	4,053.6							
Active	19,699.8							
TRS								
Total Equity & FI (Public)	**69,433.1**							
Total Equity & FI (Public) of AUM	**100.0**							
Total Equity	**39,284.1**							
Passive	25,462.0							
Active	13,822.1							
Total Fixed Income (Public)	**30,149.0**							
Passive	9,300.7							
Active	20,848.3							

In general, we expect higher transaction costs for lower liquidity sectors, such as emerging markets equity. Figure 16 provides general guidance for potential transaction costs, based on pro-rata reinvestment of any divested securities. As shown, we find a general estimate of $[redacted] to transition out of the full $[redacted] in fossil fuel reserve owners for Option 1, as compared to $[redacted] to divest from the $[redacted] in fossil fuel owners for Option 3.

The potential periods for divestment can vary depending on the divestment process the Systems pursue. Implementing divestment in full upfront aims to address all levels of potential risk immediately. Alternatively, divestment may be paced based on the standards and thresholds of risk applied to the companies.

[1] Source: Meketa, BAM and ISS ESG.

Figure 16 – Estimated Transaction Cost[1]

Estimated Transaction Cost	Option 1 ($ mm)	Option 2 ($ mm)	Option 3 ($ mm)
BERS			
Total Equity			
Total Fixed Income (Public)			
Total Equity & FI (Public)			
NYCERS			
Total Equity			
Total Fixed Income (Public)			
Total Equity & FI (Public)			
TRS			
Total Equity			
Total Fixed Income (Public)			
Total Equity & FI (Public)			
Total Assets Moved			
Total Cost			

We estimated these transaction costs based on proposals for prior Meketa transitions for similar asset classes using the median cost estimate provided by the transition manager. We assume equities are two-thirds large cap and one-third small cap. We assume fixed income buckets are core fixed income. Transaction costs can be [redacted] or more, due to market conditions on the transaction date. There would likely be potential for lower transition costs given scale of transaction, and the accompanying advantage in negotiations. These estimates are for directional guidance only. To develop a more concrete estimate of costs we recommend that, once the Systems have decided on a divestment option and implementation approach, that they might enlist a qualified transition manager.

Depending on reinvestment option, direct transaction costs may vary. For example, reinvesting using an alternative model to better reflect sustainability risks, or overall diversification risks, rather than reweighting within a standard market cap weighted index would entail the transition of a greater number of securities from the original market cap weighted benchmark. There may be additional investment management fees to transition a part or all of the Systems' passive investments to an alternative investment approach, such as TOBAM diversification or FTSE TPI Climate Transition.

[1] Source: Meketa.

V. Monitoring Divestments

The process entailed for the ongoing monitoring of a fossil fuel divestment depends on the divestment option. Meketa proposes annual monitoring and review for all options. Below, we briefly summarize the process that would likely be required to monitor Options 1, 2, and 3 discussed in this report.

Option 1 would be the most simple to monitor on an ongoing basis—all fossil fuel reserve owners, as shown in Figure 17. Option 1 would require an annual review of the list of fossil fuel reserve owners to add any new reserve owners, and remove any companies that no longer own fossil fuel reserves.

Figure 17– Monitoring Fossil Fuel Divestment Lists[1]

Monitoring Fossil Fuel Exclusion Lists			
	Option 1	Option 2	Option 3
Divestment Option	All FF Reserve Owners	Apply Company Risk Factors: 1 Red in at least 2 of 3 Risk Categories	>10 Extractives and Production OR >10 Thermal Coal Revenues
Review Periods	Annual	Annual	Annual
June 30, 2020 Number of Issuers			
Systems Combined	[redacted]		
BERS			
NYCERS			
TRS			
Step 1	Use ISS definition of fossil fuel reserve (coal, oil, gas) owners to adjust list of companies to exclude.	Use ISS definition of fossil fuel reserve (coal, oil, gas) owners to adjust total universe.	Use ISS fossil fuel reserve (coal, oil, gas) owner database to identify all with extractives or thermal coal revenues.
Step 2		Review and potentially adjust company risk factors for any new or potentially improved factors.	Assess market for potential adjustment of revenue thresholds for exclusion.
Step 3		Review and potentially adjust risk thresholds for each factor.	Use ISS Climate data to adjust list of companies to exclude.
Step 4		Use company risk factors to determine if companies have improved or deteriorated to adjust list of companies to exclude.	

[1] Source: BAM and ISS.

Option 2 (Higher Risk Fossil Fuel Owners based on company climate and financial risk factors) requires more attention, time and resources than either Option 1 or Option 3. Option 2 resources could be more efficiently used if the Systems also used the company risk metrics for portfolio analysis tools in addition to divestment, such as monitoring and engagement with managers and companies.

Option 3 (Fossil Fuel owners with >10% extractives or >10% thermal coal revenues) would likely require slightly more time and resources to monitor than Option 1. For this option, once the Systems identify an updated list of fossil fuel owners with extractives or thermal coal revenue, the second step would be to assess the economy and market to determine whether to revise the revenue thresholds. The third and final step would be to adjust the list of companies to add any new companies that meet the criteria, and remove any existing companies that no longer meet the revenue thresholds.

Overall, we find that the ongoing resources required to monitor Options 1, 2, or 3, or variations on these options, could be reasonably pursued by the Systems.

VI. Summary and Conclusions

We find that the rapid global developments around climate change indicate the need for re-assessments of risk and return and what is prudent, and actions that may better manage long-term risk and return. Our analysis indicates that fossil fuel reserve owners face high potential risk for economic disruption from the transition to a low carbon global economy. The performance back tests, and financial impact analysis in forward looking climate scenario analysis we performed, show that the divestment options we provide in this report generally result in higher returns, lower risk and greater risk efficiency compared to current portfolios. These results indicate that the divestment options can likely protect the Systems from increased risk and volatility deriving from fossil fuel reserve owners and fundamental climate-related transformations in the markets.

We find the Systems can prudently divest from fossil fuel reserve owners using a variety of approaches, including all of the Options provided in this report, and find the ongoing resources to monitor divestment Option 1, 2, or 3 – or variations on these options – could be reasonably pursued by the Systems. **Meketa's research indicates that the Systems may be best served by using a more focused approach to divestment such as Options 2 and 3** to help insulate the Systems from the increasing risks face by fossil fuel reserve owners while protecting return.

Overall, given the high levels of uncertainty and change expected in the coming years, there will likely be many climate risks and opportunities throughout the economy, and specifically in fossil fuel related businesses. In this context, we find that the broader the divestment option using fossil fuel reserve ownership as a fundamental divestment factor, the greater the likelihood of divestment from companies that will likely successfully transition to a low carbon economy.

A broad divestment approach such as Option 1 is likely simplest to implement and least expensive to monitor, but is the most likely to include divestment from companies that are lower risk, and may be successfully transitioning –companies that may provide opportunities to lower long-term risk through coordinated engagement rather than divestment.

A more focused divestment approach such as Option 2, which relies on company risk criteria, or Option 3, which focuses on companies with likely material exposure to extractive revenues or thermal coal revenues, may better serve the Systems' long-term objectives. A more focused approach may increase the divestment focus on higher risk fossil fuel reserve owners and lower the divestment of companies that seem to be successfully transitioning; while maintaining the potential portfolio wide investment return and risk benefits seen in a broad divestment of fossil fuel reserve owners.

If a forward-looking approach to climate transition risks is uses, alternatives to market cap weighted approaches to reinvestment of divested fossil fuel reserve owners can improve the portfolio's overall risk and return expectations and significantly increase the overall portfolio's total decarbonization, and other energy transition related performance indicators, such as the share of green revenues.

We expect a broad fossil fuel divestment option, focused on all suppliers of fossil fuels to most weaken the Systems' engagement opportunities with suppliers of fossil fuels. Because the energy transition and climate change are systemic, divestment of suppliers could be compatible with a shift of the Systems' proxy voting and engagement efforts to focus on companies that are responsible for the demand for energy and for financial firms involved in financing fossil fuels.

VII. Appendices

A. Divestment Options – Description

1. Risk Thresholds for High, Medium, and Low Risk
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B. Divestment Options – Analysis

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A. Divestment Options – Description

Appendix A-1:
Risk Thresholds for High, Medium, and Low Risk[1]

Systems Combined Company Climate and Financial Risk Metrics Thresholds for Tier 1 (Higher), Tier 2 (Medium) and Tier 3 (Lower) Risk (2020)					
Risk Variable	Systems (No. of Firms)	Systems Market Value ($ mm)	Tier 1 Risk	Tier 2 Risk	Tier 3 Risk
Total Fossil Fuel Reserve Owners	[redacted]				
Fossil Fuel Reserve Exposure Risk					
O&G Potential Stranded CapEx in SDS			≥ 50%	50% > *x* > 0%	0%
O&G Potential Stranded CapEx in B2DS			≥ 50%	50% > *x* > 0%	0%
Power & Utilities Coal B2DS Relative Alignment Index			1st & 2nd Quartiles	3rd Quartile	4th Quartile
Power & Utilities Gas B2DS Relative Alignment Index			1st & 2nd Quartiles	3rd Quartile	4th Quartile
Energy Transition Management Risk					
TPI or (for companies with no TPI score: if ISS found No Reporting = Tier 1 Risk; unrated if ISS found Reporting)			TPI 0-2 (if no TPI score, then if ISS found NO carbon reporting)	TPI 3	TPI 4-4*
Emissions Intensity (tons CO2e/$M revenue)			4th Quartile (top 25%) using TRS Portfolio Emissions Intensity Quartiles by GICS Sector.	3rd & 2nd Quartiles (middle 50%) using TRS Portfolio Emissions Intensity Quartiles by GICS Sector.	1st Quartile (bottom 25%) using TRS Portfolio Emissions Intensity Quartiles by GICS Sector.
2-Yr Percentage Change in Emissions Intensity (2016-2018)			4th Quartile (top 25%) using TRS Portfolio Emissions Intensity Change Quartiles by GICS Sector.	3rd & 2nd Quartiles (middle 50%) using TRS Portfolio Emissions Intensity Change Quartiles by GICS Sector.	1st Quartile (bottom 25%) using TRS Portfolio Emissions Intensity Change Quartiles by GICS Sector.
Green Revenue Share			0%	0%-20%	≥20%
Physical Climate Risk					
427 Company Physical Risk Score			≥75	75-25	≤25
Financial Risk					
Altman Z Score			≤1.8	1.8-3.0	≥3.0
Economic Value Added/Sales			≤0% for current margin. If any of last 3 years >0%, then yellow.	0.0%-6.7%	≥6.7%

[1] Source Meketa Investment Group.

Appendix A-2:
Systems Combined Fossil Fuel Exposure[1]

Systems Combined Total Public Equity and Fixed Income Fossil Fuel Reserve Owner Exposure (As of June 30, 2020)									
		Exposure, Management, and Financial Risk Categories							
GICS Sector	All FF Companies	Tier 1 for All Risk Metrics That Have Values	3 Tier 1 Risks: Tier 1 for At Least 1 metric	3 Tier 1 Risks: Tier 1 for At Least 1 metric w/ >50% Extractive as 5th Exposure Risk Metric	2 Tier 1 Risks: Tier 1 for At Least 1 Climate Risk and 1 in Financial Risk Metric	2 Tier 1 Risks: Tier 1 for At Least 1 Risk Metric in At Least 2 of 3 Risk Categories	>10% Extractive Revenue	>50% Extractive Revenue	>10% Thermal Coal Revenue No Oil or Gas Reserves
Total Systems Plan AUM ($ mm)	[redacted]								
Total Systems Public Listed AUM ($ mm)									
Total FF Exposure ($ mm)									
FF Percent of Total Systems Plan AUM (%)									
FF Percent of Total Public Listed AUM (%)									
Total Issues									
Total FF Companies Represented									
Energy									
[redacted]									
Climate Action 100+									
Climate Action 100+ as %AUM									

[1] Source: BAM and ISS.

B. Divestment Options — Analysis

Appendix B-1:
FTSE/Russell TPI Climate Transition Index Methodology

Overview

For an overview of the FTSE TPI Climate Transition Index, please refer to:
https://www.ftserussell.com/files/support-document/ftse-tpi-climate-transition-index-series-overview

For additional information on the FTSE TPI Climate Transition Index, please refer to:
https://www.ftserussell.com/index/spotlight/ftse-tpi-climate-transition-index

As a summary introduction to the FTSE TPI Climate Transition Index, we drew the following paragraphs from the FTSE TPI Climate Transition Index Overview link above.

Integrating climate change into index-based portfolios has to date focused largely on lowering exposure to carbon (i.e. fossil fuel reserves and/or carbon emissions). However, demand for more sophisticated implementation options for capturing the risks and opportunities arising from the climate transition (i.e. the shift to a low carbon economy) is growing.

The FTSE TPI Climate Transition Index Series fills this gap by providing investors with the next generation of climate indexes. It combines FTSE Russell's expertise in climate data and sustainable investment index design with the Transition Pathway Initiative's ("TPI") analysis of how the world's largest and most carbon exposed / intensive public companies are managing the climate transition.

Index constituent weights are adjusted using five transparent criteria: company exposure to specific climate related risks (carbon emissions; fossil fuel reserves) and opportunities (green revenues) as well as the extent of climate governance activities (management quality) and commitments to 2 degree aligned emissions pathways (carbon performance). Meaningful adjustments based on the TPI's forward-looking analysis ensure that leading and lagging company behavior is clearly reflected in the index.

Benefits

- Provides a clear picture of company alignment with the climate transition based on five climate parameters.
- Combines market-leading insights and data from FTSE Russell and the Transition Pathway Initiative.
- Delivers significant improvements across all climate parameters – carbon, green revenues and 'Paris alignment' – whilst managing tracking error vs the benchmark.
- Transparent index construction – using FTSE Russell's tilt-based multi-factor methodology – Supports investor stewardship and corporate engagement activities.

Appendix B-2:
TOBAM Maximum Diversification® Methodology

Overview

For an introduction to TOBAM please see: About TOBAM: https://www.tobam.fr/about-us/

For additional information on TOBAM's approach, please see: TOBAM Maximum Diversification® approach: https://www.tobam.fr/maximum-diversification/

This brief introduction to TOBAM's diversification approach is drawn from the link above. The TOBAM methodology may be implemented at varying degrees of diversification. For the sample divestment portfolios presented in this report, TOBAM employed its lowest level of diversification approach, which is founded on the maximizing diversification methodology.

TOBAM's investment philosophy is based on maximizing diversification in order to capture the risk premium of an asset class. While many managers focus upon 'alpha' to contribute to performance, less attention may be dedicated to improving 'beta' which often provides the major contribution to performance and risk. The most common way for investors to obtain 'beta' exposure is through a market cap-weighted strategy; however, academic and practitioner research shows that other strategies for gaining 'beta' exposure regularly outperform the market cap weighted strategies, leading to inefficiencies in the allocation. **TOBAM believes that these inefficiencies arise from insufficient diversification in the market cap-weighted strategy.**

Decades of academic studies since Harry Markowitz (1959) and William Sharpe (1964) have explained why diversification should play a key role in portfolios's asset allocation.

Yves Choueifaty after years of academic research introduced a measure of diversification: the Diversification Ratio®. The details of this were initially published in 2006 in the United States Patent and Trademark Office (Choueifaty, "*Methods and Systems for Providing an Anti-Benchmark Portfolio*, May 2006) and later in 2008 in the Journal of Portfolio Management [Choueifaty & Al, "*Toward Maximum Diversification*" Fall 2008].

TOBAM's Anti-Benchmark® strategy is based on the Maximum Diversification® approach, designed to maximize the degree of diversification when selecting the weighting of assets in the portfolio allocation process. The Diversification Ratio® is maximized to produce a portfolio designed to access risk premium evenly from all the effective independent sources of risk available in the market at any given time. TOBAM's approach is fully quantitative and does not use any predictions of expected return, neither for the assets nor for any underlying risk factors.

Appendix B-3:
Top 10 Fossil Fuel Owners by BERS AUM[1]

Top 10 Fossil Fuel Reserve Owners by Assets Under Management BERS																
			Fossil Fuel Reserve Exposure Risk				Energy Transition Management Risk				Financial Risk		Physical Climate Risk	Included in Divestment Option	
Issuer	Combined ($ mm)	GICS Sector	O&G Potential Stranded CapEx in SDS (%)	O&G Potential Stranded CapEx in B2DS (%)	Power & Utilities Coal B2DS Relative Alignment Index (%)	Power & Utilities Gas B2DS Relative Alignment Index (%)	TPI Mgmt Quality Score (or No Reporting)	Green Revenue Share (%)	Emissions Intensity (tons CO_{2e}/$m revenue)	2-Yr % Change in Emissions Intensity (2016-2018) (%)	Altman Z-Score	EVA/ Sales (%)	427 Company Physical Risk Score	Option 2	Option 3
[redacted]															

[1] Sources: BAM and ISS.

Appendix B-4:
Top 10 Fossil Fuel Owners by NYCERS AUM[1]

Top 10 Fossil Fuel Reserve Owners by Assets Under Management NYCERS															
			Fossil Fuel Reserve Exposure Risk				Energy Transition Management Risk				Financial Risk		Physical Climate Risk	Included in Divestment Option	
Issuer	Combined ($ mm)	GICS Sector	O&G Potential Stranded CapEx in SDS (%)	O&G Potential Stranded CapEx in B2DS (%)	Power & Utilities Coal B2DS Relative Alignment Index (%)	Power & Utilities Gas B2DS Relative Alignment Index (%)	TPI Mgmt Quality Score (or No Reporting)	Green Revenue Share (%)	Emissions Intensity (tons CO_{2e}/$m revenue)	2-Yr % Change in Emissions Intensity (2016-2018) (%)	Altman Z-Score	EVA/ Sales (%)	427 Company Physical Risk Score	Option 2	Option 3
[redacted]															

[1] Sources: BAM and ISS.

Appendix B-5:
Top 10 Fossil Fuel Owners by TRS AUM[1]

Top 10 Fossil Fuel Reserve Owners by Assets Under Management TRS																
			Fossil Fuel Reserve Exposure Risk				Energy Transition Management Risk				Financial Risk		Physical Climate Risk	Included in Divestment Option	
Issuer	Combined ($ mm)	GICS Sector	O&G Potential Stranded CapEx in SDS (%)	O&G Potential Stranded CapEx in B2DS (%)	Power & Utilities Coal B2DS Relative Alignment Index (%)	Power & Utilities Gas B2DS Relative Alignment Index (%)	TPI Mgmt Quality Score (or No Reporting)	Green Revenue Share (%)	Emissions Intensity (tons CO_{2e}/$m revenue)	2-Yr % Change in Emissions Intensity (2016-2018) (%)	Altman Z-Score	EVA/ Sales (%)	427 Company Physical Risk Score	Option 2	Option 3
[redacted]															

[1] Sources: BAM and ISS.

C. Divestment Process

Appendix C-1:
BERS Sub-asset Class Fossil Fuel Exposures[1]

BERS Exposure to Fossil Fuels (As of June 30, 2020)	Plan	Option 1		Option 2		Option 3	
	$MV ($ mm)	$MV ($ mm)	# of Firms	$MV ($ mm)	# of Firms	$MV ($ mm)	# of Firms
Total Equity & FI (Public)	**5,842.08**						
Total Equity	**3,550.85**						
Passive	2,065.17						
Active	1,485.68						
Domestic Equity	**2,208.60**						
Passive	1,934.38						
Active	274.22						
International Equity	**1,215.17**						
Passive	130.79						
Active	1,084.38						
Global Equity	**127.07**						
Passive	--						
Active	127.07						
Total Fixed Income (Public)	**2,291.23**						
Passive	535.61						
Active	1,755.62						
Structured	**1,359.63**						
Passive	248.59						
Active	1,111.04						
TIPS	**287.02**						
Passive	287.02						
Active	--						
High Yield	**401.05**						
Passive	--						
Active	401.05						
Bank Loans	**120.38**						
Passive	--						
Active	120.38						
ST/Cash Equivalents	**123.15**						
Passive	--						
Active	123.15						

[1] Source: Meketa, BAM, ISS ESG.

Appendix C-2:
NYCERS Sub-asset Class Fossil Fuel Exposures[1]

NYCERS Exposure to Fossil Fuels (As of June 30, 2020)							
	Plan	Option 1		Option 2		Option 3	
	$MV ($ mm)	$MV ($ mm)	# of Firms	$MV ($ mm)	# of Firms	$MV ($ mm)	# of Firms
Total Equity & FI (Public)	**57,184.9**	[redacted]					
Total Equity	**33,431.5**						
Passive	20,082.4						
Active Separate Account	13,349.1						
Active Comingled	--						
Domestic Equity	**20,553.1**						
Passive	16,090.0						
Active	4,463.2						
International Equity	**12,584.1**						
Passive	3,992.5						
Active	8,591.7						
Global Equity	**294.3**						
Passive	--						
Active	294.3						
Total Fixed Income (Public)	**23,753.4**						
Passive	4,053.6						
Active	19,699.8						
Core - FI EM	**52.2**						
Structured	**15,861.5**						
TIPS	**2,729.1**						
Passive	1,930.6						
Active	798.5						
High Yield	**2,960.6**						
Bank Loans	**1,066.4**						
Opportunistic Fixed Income	**--**						
Convertible Bonds	**1,083.5**						
Targeted	**--**						

[1] Source: Meketa, BAM, ISS ESG.

Appendix C-3:
TRS Sub-asset Class Fossil Fuel Exposures[1]

TRS Exposure to Fossil Fuels (As of June 30, 2020)							
	Plan		Option 1		Option 2		Option 3
	$MV ($ mm)	$MV ($ mm)	# of Firms	$MV ($ mm)	# of Firms	$MV ($ mm)	# of Firms
Total Equity & FI (Public)	**69,433.1**	**2,557.7**					
Total Equity	**39,284.1**	**1,914.5**					
Passive	25,462.0	1,014.8					
Active Separate Account	13,822.1	899.7					
Active Comingled	--	--					
Domestic Equity	**22,597.2**	**755.9**					
Passive	21,465.5	751.3					
Active	1,131.7	4.6					
International Equity	**16,392.3**	**1,158.5**					
Passive	3,996.6	263.4					
Active	12,395.8	895.1					
Global Equity	**294.6**	**--**					
Passive	--	--					
Active	294.6	--					
Total Fixed Income (Public)	**30,149.0**	**643.2**					
Passive	9,300.7	--					
Active	20,848.3	643.2					
Core - FI EM	**61.7**	**1.2**					
Structured	**21,227.9**	**375.3**					
TIPS	**3,159.6**	**--**					
Passive	2,274.1	--					
Active	885.5	--					
High Yield	**4,048.3**	**265.4**					
Bank Loans	**1,651.0**	**1.4**					
Opportunistic Fixed Income	**--**	**--**					
Convertible Bonds	**0.3**	**--**					
Targeted	**--**	**--**					

[1] Source: Meketa, BAM, ISS ESG.