Common Investment Meeting (BERS)

Schedule	Wednesday, October 18, 2017, 09:00 AM — 02:00 PM EDT
Venue	Office of the New York City Comptroller, 1 Centre Street, 10th Floor (Room 1005) - Northside, New York, NY 10007
Organizer	Kim Boston

Agenda

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9:00 AM	Welcome and Opening	
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PUBLIC SESSION

Trucost

Carbon Footprinting NYC Retirement Systems Public Equity – BERS Report

As of 6/30/17

S&P Dow Jones Indices
ESG Analysis

October 2017

CREDITS

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INTRODUCTION

Carbon Footprint analysis measures the carbon risks and opportunities not captured by standard portfolio analysis and presents a systematic assessment of carbon impacts relative to your benchmark.

Carbon footprint analysis quantifies greenhouse gas emissions (GHG) embedded within the portfolio, presenting these as metric tonnes of carbon dioxide equivalents (tCO2e). This is achieved by carrying out a carbon footprint for each individual company encapsulating both scope 1 and scope 2 impacts.

Scope 1 emissions are direct emissions from sources owned or controlled by a company, such as:

- Stationary Combustion: From the burning and use of fossil fuels, (e.g. natural gas, fuel oil, propane, etc.) for comfort heating or other industrial applications.
- Mobile Combustion: From the burning and use of fossil fuels (e.g. gasoline, diesel) used to operate vehicles or other forms of mobile transportation.
- Process Emissions: Emissions released during the manufacturing process in specific industry sectors (e.g. cement, iron and steel, ammonia)
- Fugitive Emissions: Unintentional release of emissions from sources including refrigerant systems and natural gas distribution.

Scope 2 emissions are indirect emissions from the consumption of purchased electricity, heat, steam, or other sources of energy (e.g. chilled water) supplied to the company.

This report presents the results of the carbon footprint analysis of the New York City Board of Education Retirement System (BERS) fund, part of the New York City Retirement Systems.

Portfolio	New York City Board of Education Retirement System (BERS)
Benchmark	BERS Composite Benchmark
Date of Holdings	June 30, 2017
Date of Analysis	September 14, 2017

METHODOLOGY

Each company's contribution to the carbon footprint of the portfolio is calculated on an equity ownership basis using the market cap[1] of each company – thus, owning 1% of a company's shares means also owning 1% of that company's emissions. Company emissions and revenues are therefore apportioned to the portfolio in the following way:

$$\text{Apportioned Carbon Emissions: } \frac{Value\ of\ investment\ held}{Company\ market\ capitalization}\ x\ Company\ GHG\ emissions$$

$$\text{Apportioned Revenues: } \frac{Value\ of\ investment\ held}{Company\ market\ capitalization}\ x\ Company\ revenue$$

In addition to the total portfolio carbon emissions (sum of all apportioned carbon emissions), the carbon footprint of the fund is presented, in detail, using the portfolio carbon intensity metric (described below), which normalizes emissions relative to companies' revenues/sales.

- **Portfolio carbon intensity (emissions relative to companies' revenues/sales):** Calculated by dividing the portfolio's total apportioned carbon emissions by the portfolio's total apportioned revenue, to give carbon emissions per USD 1 million revenue generated.

$$\frac{Portfolio\ total\ apportioned\ carbon\ emissions}{Portfolio\ total\ apportioned\ revenue}$$

  The higher this number, the less carbon efficient the portfolio, and accordingly, the lower the number, the more carbon efficient the portfolio. The portfolio carbon intensity (relative to revenues) indicates how operationally efficient the portfolio companies are in terms of carbon emitted per unit of "output" and can be used to identify which companies have improved their efficiency over time. Comparing the total GHG emissions of each company relative to annual revenue, gives a measure of carbon intensity that enables comparison between companies, irrespective of size or geography. However, this measure is sensitive to market dynamics, commodity production yields, and currency exchange rates. This carbon footprinting approach indicates a level of 'carbon risk' by assessing the extent of a

[1] For an equity portfolio, market cap is the most appropriate apportioning metric when calculating an investor's "ownership" of emissions. However, when it comes to a fixed income portfolio, a balanced fund, or even an aggregated footprint across asset classes, enterprise value, net debt, gross debt, or total invested capital might all be considered.

portfolio's correlation of revenues with carbon emissions. The more carbon intensive a portfolio, the more likely its revenues could be at risk if companies start to internalize the negative impacts of their emissions.

Two additional carbon footprint metrics were examined in addition to the portfolio carbon intensity. A more detailed description and the results of these metrics can be found in the Appendix.

- **Portfolio carbon emissions per million USD of investment**: Calculated by dividing the portfolio's total apportioned carbon emissions by the total value of the portfolio's holdings to give carbon emissions per USD 1 million invested.
- **Weighted average carbon intensity to measure exposure to carbon intensive companies:** Calculated by summing the carbon intensity of each company (regardless of ownership) multiplied by its weight in the portfolio.

KEY METRICS

Table 1 displays the results of BERS funds under the three different footprint metrics.

TABLE 1: SUMMARY OF CARBON FOOTPRINT ANALYSIS

	Number of Companies	Value of Holdings ($mn)	Total Portfolio Carbon Emissions (tCO2e)	Portfolio Carbon Intensity (tCO2e/$mn revenue)
Portfolio	1798	$1,636.06	220,726.63	250.94
Benchmark	1806	$1,636.06	220,793.50	251.35
Relative Efficiency (%)				0.16%

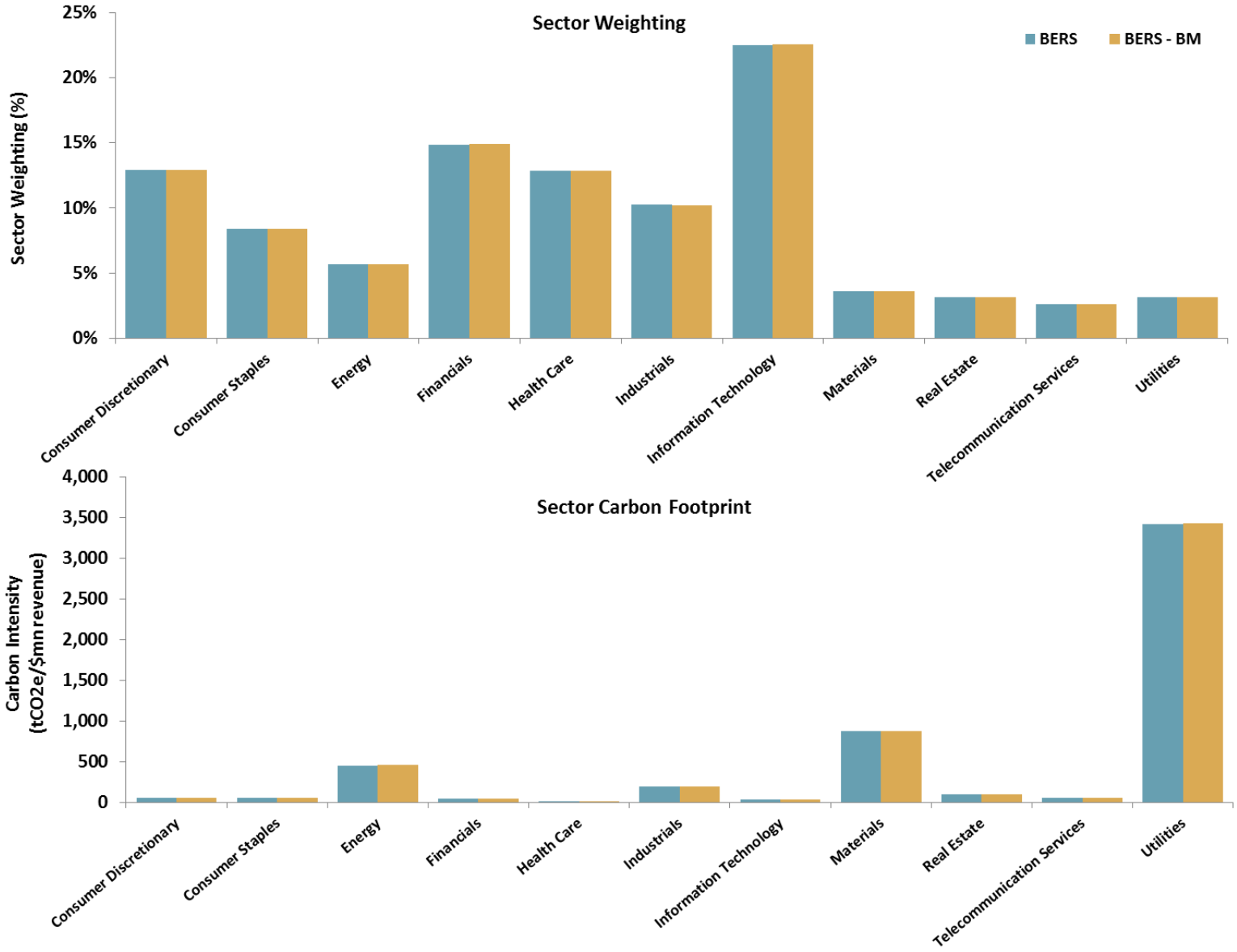
The portfolio is 0.16% more carbon efficient than the benchmark

The carbon footprint of the portfolio is 250.94 tCO2e/$mn revenue. The carbon footprint of BERS's benchmark is 251.35 tCO2e/$mn revenue making the portfolio 0.16% more carbon efficient than the benchmark. The portfolio is responsible for 220,726.63 metric tonnes of total carbon emissions while the benchmark is responsible for 220,793.50 metric tonnes of total carbon emissions.

SECTOR ANALYSIS

Figure 1 below shows how the sector weighting, by value invested, in the portfolio differs from that in the benchmark and the effect on the carbon footprint of the portfolio. The BERS portfolio and the benchmark share similar relative weighting schemes and carbon intensities across all sectors. While Information Technology, Financials, and Consumer Discretionary are the top three weighted sectors accounting for 50.34% of the total value invested, they all have relatively low carbon intensities and thus only contribute 7.35% of the total portfolio carbon emissions. Utilities, Materials, and Energy, on the other hand, account for a relatively low percentage of the value (12.46%), but have the highest carbon intensities in the portfolio at 3,416.79 tCO2e/$mn revenue for Utilities, 881.35 tCO2e/$mn revenue for Materials, and 455.14 tCO2e/$mn revenue for Energy. These sectors are also the top contributors to the total portfolio emission accounting for 40.11%, 15.71%, and 23.02% of total emissions respectively.

FIGURE 1: SECTOR WEIGHTING OF PORTFOLIO AND BENCHMARK AND CARBON FOOTPRINT OF PORTFOLIO AND BENCHMARCH BY SECTOR



ATTRIBUTION ANALYSIS

The attribution analysis identifies drivers of portfolio carbon efficiency relative to a benchmark. The two principal reasons why the carbon exposure of the portfolio may differ from the benchmark are due to sector allocation decisions and stock allocation decisions. The sum of the stock and sector allocation effects results in either a positive or negative overall portfolio carbon efficiency relative to a benchmark.

The 0.16% relative carbon efficiency of the portfolio is due to a combination of 0.03% positive sector allocation effects and 0.14% positive stock selection effects

Sector allocation effects are based on the amount of the portfolio's apportioned revenue generated in a sector relative to the benchmark's apportioned revenue generated in that sector combined with that sector's carbon intensity. If the portfolio generates more revenue than the benchmark in a sector, it is "overweight" in that sector. If the portfolio generates less revenue than the benchmark in a sector, it is "underweight" in that sector. If the portfolio is overweight in carbon intensive sectors then the portfolio is likely to be more carbon intensive than the benchmark, creating a negative sector allocation effect.[2] A scenario resulting in a positive sector allocation effect would be the portfolio being overweight in carbon efficient sectors (when compared to the benchmark's average).[3]

Stock selection effects are based on the average carbon intensity of the companies held in the portfolio within a certain sector compared to the same sector's average carbon intensity in the benchmark. If the average intensity of a sector in the portfolio is lower than in the benchmark, then the portfolio contains more carbon efficient companies than the benchmark does in the same sector.[4] Stock selection effects indicate the potential to reduce the carbon intensity of the portfolio without adjusting sector weightings. For example, if the stocks within a carbon intensive sector are the most carbon efficient companies, then it is possible that the portfolio may still have a lower carbon footprint than the benchmark.

In summary, the 0.16% relative carbon efficiency of the portfolio compared to the benchmark is due to a combination of 0.03% positive sector allocation effects and 0.14% positive stock selection effects. Table 2 below breaks down how each sector contributes to the overall effect. Sectors have been defined using the Global Industry Classification Standard (GICS) system at the industry groups level.

[2] A negative sector allocation effect would also result from the portfolio being underweight, compared to the benchmark, in carbon efficient sectors.
[3] A positive sector allocation effect would also result from the portfolio being underweight, compared to the benchmark, in carbon intensive sectors.
[4] If the average intensity of a sector in the portfolio is greater than in the benchmark, then the portfolio contains more carbon intensive companies than the benchmark does in the same sector.

TABLE 2: SUMMARY OF STOCK AND SECTOR ALLOCATION EFFECTS

	Sector Revenue Percentage		Carbon Intensity (tCO2e/$mn revenue)		Carbon Apportioned		Footprint Attribution		
Sector	**Portfolio**	**Benchmark**	**Portfolio**	**Benchmark**	**Tonnes**	**%**	**Sector Allocation**	**Stock Selection**	**Total Effect**
Consumer Discretionary	15.40%	15.38%	54.24	54.31	7,348.13	3.33%	0.02%	0.00%	0.02%
Consumer Staples	11.63%	11.60%	61.02	60.80	6,240.40	2.83%	0.02%	-0.01%	0.01%
Energy	12.69%	12.71%	455.14	456.15	50,814.15	23.02%	0.02%	0.05%	0.07%
Financials	12.40%	12.44%	48.18	48.10	5,254.30	2.38%	-0.03%	0.00%	-0.04%
Health Care	12.24%	12.28%	15.71	15.73	1,691.15	0.77%	-0.04%	0.00%	-0.04%
Industrials	11.86%	11.81%	192.46	192.83	20,085.47	9.10%	0.01%	0.02%	0.03%
Information Technology	12.18%	12.20%	33.81	33.75	3,621.49	1.64%	-0.02%	0.00%	-0.02%
Materials	4.47%	4.45%	881.35	874.27	34,668.23	15.71%	-0.05%	-0.13%	-0.18%
Real Estate	1.01%	1.02%	95.87	94.99	853.04	0.39%	-0.01%	0.00%	-0.01%
Telecommunication Services	3.18%	3.15%	58.15	57.76	1,625.67	0.74%	0.02%	0.00%	0.02%
Utilities	2.95%	2.95%	3,416.79	3,435.34	88,524.61	40.11%	0.09%	0.22%	0.31%
Total	**100.00%**	**100.00%**	**250.94**	**251.35**	**220,726.63**	**100.00%**	**0.03%**	**0.14%**	**0.16%**

The attribution analysis reveals whether sectors contribute positively or negatively to the relative carbon efficency of the portfolio, regardless of the percentage of total emissions that sector accounts for. For example, Utilities, Materials, and Energy are the largest contributors to BERS's

total carbon emissions due to their high carbon intensities, but play different roles when it comes to the impact on the relative carbon efficiency of the portfolio compared to the benchmark.

Materials sector carries the largest negative effect on the relative portfolio carbon efficiency while Utilities carries the largest positive effect.

Materials has the greatest negative effect on the portfolio's carbon efficiency at -0.18%. This is due to negative sector allocation (-0.05%), from the portfolio being overweight in this carbon intensive sector, and negative stock selection effect (-0.13%) from the portfolio holding more carbon intensive stocks in this sector than the benchmark. This is followed by the Financials and Health Care sectors, each with -0.04% effect. The negative effects of these sectors are both due to negative sector allocation in which the portfolio is underweight in these relatively carbon efficient sectors.

The Utilities sector has by far the largest positive effect on the relative performance of the portfolio followed distantly by Energy (0.31% and 0.07% respectively). Both sectors have positive sector allocation effects in that the portfolio is underweight in these carbon intensive sectors and positive stock selection, indicating the portfolio holds more carbon efficient stocks in these sectors compared to the benchmark.

TOP CONTRIBUTORS

The ten companies that contribute the most to the portfolio's carbon intensity are shown in Table 3 below. Note that a company may appear due to the proportion owned, rather than because it is the most carbon intensive stock held. The rank in benchmark sector column is useful in assessing the carbon intensity of the top ten contributors relative to sector peers.

While the top 10 companies represent 2.10% of the total value of holdings, they are responsible for 24.54% of the total carbon emissions of the portfolio. The top 10 contributors are mostly all Utilities sector companies, the most intensive sector of the portfolio. Two companies are in the Energy sector, the third most intensive sector of the portfolio.

If American Electric Power Co., Inc., the largest carbon footprint contributor, were removed from the portfolio, the carbon intensity of the fund would decrease by 3.25%

The top 10 companies represent 2.10% of the total value of holdings but are responsible for 24.54% of the total apportioned carbon.

Table 3: Largest Contributors to Portfolio's Carbon Footprint

Company Name	Sector	Holding ($mn)	Carbon Apportioned (metric tonnes)	Percentage of Total Portfolio Carbon Emissions (%)	Company Carbon Intensity (tCO2e/$mn revenue)	Effect on Portfolio Carbon Intensity (%)*	Carbon Intensity Rank in Benchmark Sector**	Data Source (Scope 1)***
American Electric Power Co., Inc.	Utilities	$2.20	7,436.55	3.37%	7,031.68	-3.25%	88/100	CDP
The Southern Co.	Utilities	$3.06	6,861.09	3.11%	5,365.86	-2.97%	79/100	PRE
Duke Energy Corp.	Utilities	$3.76	6,293.40	2.85%	4,307.80	-2.69%	68/100	ENV
Dynegy, Inc.	Utilities	$0.08	4,572.69	2.07%	14,917.09	-2.04%	95/100	AR
Peabody Energy Corp.	Energy	$0.10	5,587.25	2.53%	991.57	-1.90%	101/128	PRE
The AES Corp.	Utilities	$0.47	4,435.64	2.01%	4,611.52	-1.90%	74/100	CDP
Exxon Mobil Corp.	Energy	$21.98	8,095.37	3.67%	485.53	-1.81%	80/128	CDP
NRG Energy, Inc.	Utilities	$0.34	4,079.29	1.85%	5,365.29	-1.76%	78/100	ENV
Xcel Energy, Inc.	Utilities	$1.50	3,384.61	1.53%	4,779.97	-1.45%	75/100	OTH
FirstEnergy Corp.	Utilities	$0.83	3,418.71	1.55%	3,667.84	-1.44%	63/100	PRE
Total		**$34.30**	**54,164.61**	**24.54%**		**-21.22%**		

* The Effect on Portfolio Carbon Intensity is the percentage decrease in the carbon intensity of the portfolio without the company compared to the current portfolio carbon intensity. This measures the amount a specific company reduces the carbon efficiency of the portfolio.

** Footprint Rank in Benchmark Sector - A ranking of one indicates that the stock has the lowest carbon footprint among the stocks in the benchmark sector. An entry of N/A indicates that the stock is not a member of the benchmark.

*** See Table 4 below for definitions of Data Source.

TABLE 4: DATA SOURCE EXPLANATION

Code	Explanation
AR	Exact Value from Annual Report/10K/Financial Accounts Disclosure
AR*	Value derived from data provided in Annual Report/Financial Accounts Disclosure
CDP	Exact Value from CDP
CDP*	Value derived from data provided in CDP
ENV	Exact Value from Environmental/CSR
ENV*	Value derived from data provided in Environmental/CSR
OTH	Exact Value from personal communication
OTH*	Value derived from personal communication
PDD	Estimate scaled according to company-specific data
PRE	Derived from previous year
TC	Data Calculated by Trucost
TC*	Estimate derived from production data

COMPANY REPORTING ASSESSMENT

Trucost will provide to the New York City Comptroller's Office the underlying data of the BERS portfolio to identify companies for engagement, including non-reporting companies and carbon intensive companies relative to sector peers.

APPENDIX

Portfolio carbon emissions per million USD of investment: Calculated by dividing the portfolio's total apportioned carbon emissions by the total value of the portfolio's holdings to give carbon emissions per USD 1 million invested.

$$\frac{Portfolio\ total\ apportioned\ carbon\ emissions}{Portfolio\ total\ value\ of\ investment\ held}$$

The portfolio carbon emissions per million USD of investment measures the carbon emissions directly associated with the amount invested. This metric can be viewed as a 'carbon responsibility' metric in that it describes the associated carbon impact per million invested, allowing for comparisons across portfolio of different sizes. This metric is sensitive to swings in market cap making it difficult to compare year-over-year results and gives no indication of operation efficiency.

	Number of Companies	Value of Holdings ($mn)	Total Portfolio Carbon Emissions (tCO2e)	Portfolio Carbon Emissions per Investment (tCO2e/$mn invested)
Portfolio	1798	$1,636.06	220,726.63	134.91
Benchmark	1806	$1,636.06	220,793.50	134.95
Relative Efficiency (%)				0.03%

The portfolio carbon emissions per million USD of investment is 134.19 metric tonnes of CO2e which is 0.03% more carbon efficient than the benchmark which has emissions of 134.95 tCO2e/$mn invested.

Weighted average carbon intensity to measure exposure to carbon intensive companies: Calculated by summing the carbon intensity of each company (regardless of ownership) multiplied its weight in the portfolio.

$$\sum Company\ carbon\ intensity\ x\ Company\ weighting\ in\ portfolio$$

The weighted average carbon intensity measures the portfolio's exposure to carbon-intensive companies based on the relative weights of companies in the holdings. This metric can be applied across asset classes and does not use investors' proportional share of total equity and, therefore, is not sensitive to share price movements. However, this metric does not apportion emissions to the investor and therefore attributes no "ownership" to the emissions. As such, a comparison of absolute performance cannot be done under the weighted average approach.

	Number of Companies	Value of Holdings ($mn)	Total Portfolio Carbon Emissions (tCO2e)	Weighted Average Carbon Intensity (tCO2e/$mn revenue)
Portfolio	1798	$1,636.06	220,726.63	213.73
Benchmark	1806	$1,636.06	220,793.50	213.60
Relative Efficiency (%)				-0.06%

The weighted average carbon intensity of the portfolio 213.73 tCO2e/$mn revenue which is 0.06% less carbon efficient than the benchmark which has a weighted average intensity of 213.60 tCO2e/$mn revenue.

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