



FOSSILFREE SOMERVILLE

Presentation to the Somerville Retirement Board Investment Committee
February 27, 2014

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We respectfully request the Somerville Retirement Board divest the city's pension fund from the top 200 publicly traded fossil fuel companies (as defined by carbontracker.org) within a five-year period.

Fossil Fuel Companies are a Rogue Industry

- Burning of fossil fuels is the primary cause of CO2 pollution and global warming
- Upper limit of CO2 for sustained life on earth is 350 ppm; last summer we reached 400 ppm
- Extreme weather events underline the urgency of the issue
- Companies have declared oil, gas, and coal reserves five times the amount considered safe to burn

Divestment is a Moral Issue with Broad Public Support in Somerville

- Fossil fuel divestment is a national grassroots movement
- Over 400 residents have signed a petition urging divestment
- Mayor Curtatone strongly supports divestment
- S. 1225 will divest state funds from fossil fuels

Fossil Fuel Investment Risky; Divestment Presents Insignificant Risk

- 60-80% of reserves could be declared unburnable (carbon bubble)
- Aperio Group found divestment increases risk by statically insignificant 0.01%
- Five year time horizon allows for strategic sales

"As a mother, a citizen of Somerville, and a scientist, I couldn't support this initiative more strongly. Our investments offer an opportunity to create the future we want, not one that borrows from our children. It will take many tools to create a sustainable, healthier, and greener future - I'm grateful to live in a city that is ready to move towards that better future."

Juliette Rooney-Varga, Somerville Resident (response to Jan 16, 2014 Somerville Times Op-Ed by Mayor Curtatone)



WHY DIVEST FROM FOSSIL FUELS?

THE BURNING OF FOSSIL FUELS IS DESTROYING THE CLIMATE.

The concentration of carbon dioxide in Earth's atmosphere reached 400 parts per million (ppm), the highest level in human history, on May 10, 2013. Most species on our planet depend on atmospheric carbon levels to be below 350ppm to ensure long term survival. Anthropogenic climate change is accelerating faster than previously expected and this unfortunate milestone was caused in large part by the burning of fossil fuels. Fossil fuel corporations have five times more oil, coal and gas in known reserves than climate scientists think is safe to burn.

EXTREME WEATHER EVENTS UNDERLINE THE URGENCY OF THE ISSUE.

In just the last year, the U.S. has struggled to contend with extreme weather events like Hurricane Sandy, the Midwest drought and the Colorado wildfires. These events are serious reminders of the need to take bold action to curb climate change now. In Massachusetts alone, a study has shown that by 2050 a sea level rise of 26 inches in Boston, from carbon pollution and unmitigated global warming, could damage assets worth an estimated \$463 billion (Lenton et al., 2009).

DIVESTMENT FROM FOSSIL FUELS IS A MORAL ISSUE.

Just like in the movements to divest from the tobacco industry or to end Apartheid in South Africa, climate change is a deeply moral issue. Nationwide, colleges, religious organizations, cities and states are campaigning for divestment from fossil fuels on moral grounds: If it is wrong to wreck the planet, then it is also wrong to profit from that wreckage.

INVESTMENT IN FOSSIL FUELS PRESENTS RISK.

A report released by the [Carbon Tracker Initiative](#) and the [London School of Economics](#) shows that 60 to 80 percent of coal, oil and gas reserves held by the top 200 oil, gas and mining companies listed on the world's stock exchanges could be considered unburnable and therefore far less valuable than thought. This is because these reserves consist of five times the amount of carbon possible to emit without effectuating a two degree Celsius rise in the Earth's average temperature, causing climate change to tip out of control. The value of fossil fuel investments is predicted to implode, bursting the "carbon bubble," once investors are wary of this fact. News of the Carbon Bubble has begun to make headlines in media sources worldwide including The Guardian, Financial Times, The New York Times, and The Boston Globe.

DIVESTMENT PRESENTS INSIGNIFICANT RISK.

Recent studies have shown that divestment does not risk returns. One analysis by the Aperio Group, a group of investment advisors, shows that screening the top 200 fossil fuel companies only increased portfolio risk by an insignificant 0.01%. As Patrick Geddes, the former CFO for MorningStar and lead author of the report, told reporters, "Statistically, that's just noise." Another study conducted by investment management firm Phillips, Hager & North compares the performance of Domini, one of the top socially and environmentally screened funds in the world, to that of the traditional S&P 500 stock index. The report concludes: "the chief finding of this research is that socially responsible investing does not result in lower investment returns."

INVESTMENT IN FOSSIL FUELS STUNTS MASSACHUSETTS' OTHER GREEN EFFORTS.

By investing in clean energy and energy efficiency, Massachusetts has shown the nation that we can reduce our impact on the climate while creating jobs. Massachusetts is number one in the nation on energy efficiency. Investment in fossil fuels stunts those efforts. Big oil spends \$167,000 *daily* lobbying the U.S. Congress, frequently to block clean energy solutions. On the other hand, divestment from fossil fuels is a logical extension of the Commonwealth's consistently green leadership. It's time to invest in our future.

THE DIVESTMENT ASK PRESENTS A REASONABLE TIMESCALE.

The resolution that Alderwoman Rebekah L. Gewirtz has committed to introducing does not mandate immediate divestment, but urges the Retirement Board to freeze new investments in 200 top fossil fuel companies and then gradually phase out all holdings over the next five years. This five-year time period is adequate time for the Retirement Board and its investment advisors to pursue divestment in a financially responsible manner. The towns of Truro and Provincetown have divested, Cambridge City Council passed a resolution in favor of divestment in July 2013, and Northampton City Council did the same in September 2013. There is a bill in the Massachusetts State House (S.1225) requesting the state pension fund divest from fossil fuels. As more cities join the divestment movement we anticipate that even more advice and options will become available to financial advisors to complete this task.

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RESOLUTION urging the Retirement Board of Somerville to divest its pension funds from publicly-traded fossil fuel companies.

WHEREAS the climate crisis is a serious threat to current and future generations here in Somerville and around the world;

WHEREAS, The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report found that global warming is already causing costly disruption of human and natural systems throughout the world; and

WHEREAS, Almost every government in the world has agreed through the 2009 Copenhagen Accord that any warming above a 2°C (3.6°F) rise would be unsafe, and that humans can only pour about 565 more gigatons of carbon dioxide into the atmosphere to maintain this limit; and

WHEREAS, In its “Unburnable Carbon” report, the Carbon Tracker Initiative found that up to 80% of fossil fuel reserves must remain unburned to avoid a change in average global temperature of 2°C, making fossil fuel assets inflated and risky investments in the long term; and,

WHEREAS the mission of the City of Somerville is “to promote a thriving economy, healthy community, safe environment and quality lifestyle;” and,

WHEREAS the City of Somerville, issued in 2012 a “Climate Emergency Resolution to create a Somerville Climate Summit to determine the City’s responses to climate change “on a scale proportionate to the emergency and consistent with the city's own climate goals;” and,

WHEREAS the Climate Emergency Facilitation Support document from the aforementioned Summit states that “The City of Somerville acknowledges the eminent threat of climate change and its potential to critically disrupt economic, social, natural, and cultural systems locally, regionally, and worldwide;” and that the city is “integrating the City’s climate goals into municipal department planning and decision-making;” and,

WHEREAS the City of Somerville has made it a priority to to pursue a sustainable future marked by strong environmental leadership, as mentioned in the Mayor’s 2013 midterm address, and has taken steps to fulfill this goal, including the establishment of the Mayor’s Office of Sustainability & Environment, making a commitment to reducing the City’s carbon footprint by at least 10% by 2010, and increasing "green cover" in the City by increasing its tree inventory by 20%; and,

WHEREAS the City of Somerville believes that its investments should support a future where all citizens can live healthy lives without the negative impacts of a warming environment; and,

WHEREAS, students at more than two hundred colleges and universities in the United States, including Tufts University in Somerville have launched campaigns to have their institutions divest from fossil fuel companies; and,

WHEREAS, A recent report by the Aperio Group suggested that over the past ten years a carbon divested fund would have yielded higher returns than a non-divested portfolio; now,

THEREFORE, BE IT RESOLVED, That the Board of Aldermen of the City and County of Somerville urges the Retirement Board of the Somerville to review the Somerville investment portfolio to identify any holdings that include direct or indirect investments in fossil fuel companies; and, be it

FURTHER RESOLVED, That the Board of Aldermen urges the Retirement Board to immediately cease any new investments in fossil fuel companies or in commingled assets that include holdings in fossil fuel companies; and, be it

FURTHER RESOLVED, That, for any Somerville investments in commingled funds that are found to include fossil fuel companies, the Board of Aldermen urges the Retirement Board to contact the fund managers and request that the fossil fuel companies be removed from the funds; and, be it

FURTHER RESOLVED, That the Board of Aldermen urges the Retirement Board to ensure that none of its directly held or commingled assets include holdings in fossil fuel public equities and corporate bonds within 5 years as determined by the Carbon Tracker list; and

LET IT BE FURTHER RESOLVED that the Board of Aldermen urges the Retirement Board to prepare a report and options for investing the pension fund in a way that further maximizes the positive impact of the fund by seeking out investments that limit the effects of burning fossil fuels or help to mitigate its effects, such as clean technology & renewable energy, sustainable companies or projects, and sustainable communities. We request that the findings of said report be responded to in a manner consistent with the Retirement Board's fiduciary duty.

FURTHER RESOLVED, That the Board of Alderman urges the Retirement Board to release quarterly updates, available to the public, detailing progress made towards full divestment.

LET IT BE FURTHER RESOLVED that the Board of Aldermen urges the Massachusetts Senate and House of Representatives to pass bill S.1225, requiring the Massachusetts Pension Reserves Investment Trust (PRIT) to freeze any new investments in fossil fuel companies, and to divest from direct holdings in fossil fuel companies within 5 years. This would divest approximately \$1.4 billion in state investments in fossil fuel companies.

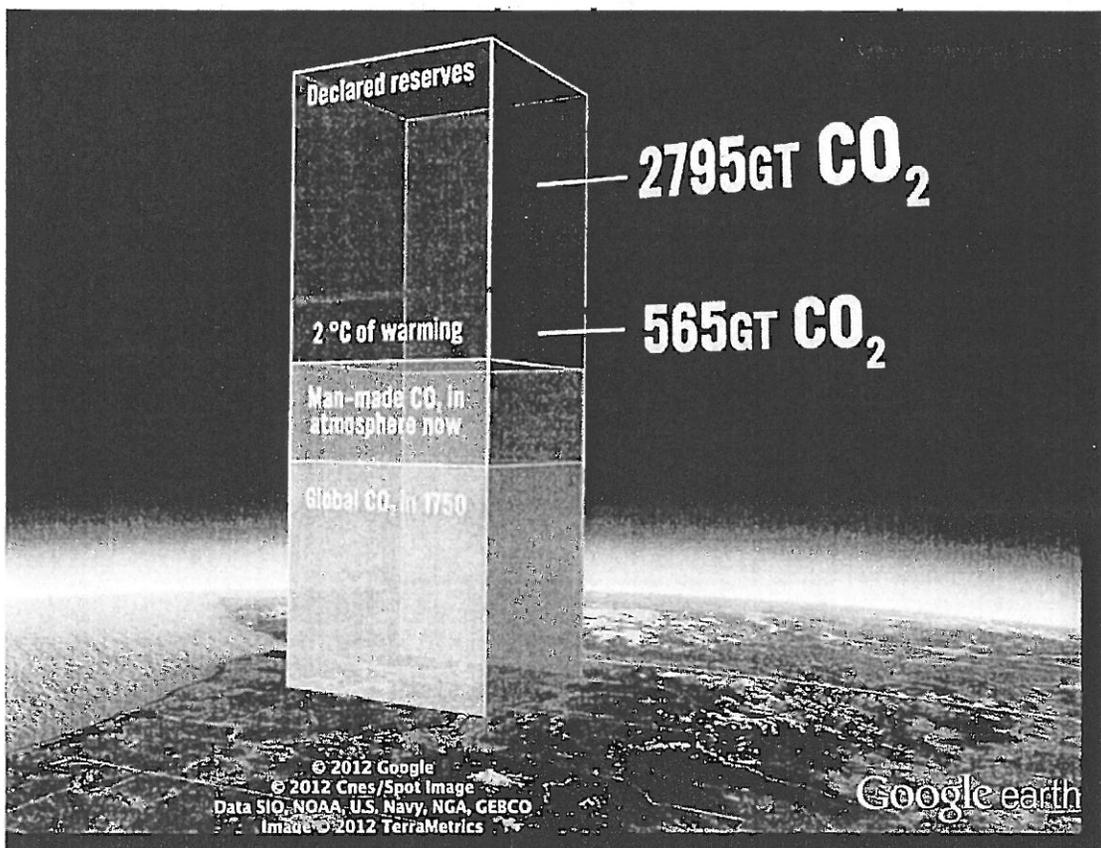
Cities that have made a commitment toward divestment from fossil fuels:

Seattle, WA
San Francisco, CA
Portland, OR
Eugene, OR
Berkeley, CA
Richmond, CA
Santa Monica, CA
Boulder, CO
Santa Fe, NM
Madison, WI
Bayfield, WI
State College, PA
Ithaca, NY
Truro, MA
Provincetown, MA
Providence, RI
Cambridge, MA
Northampton, MA
Ann Arbor, MI
Boxtel, NJ
New London, CT
Amherst, MA

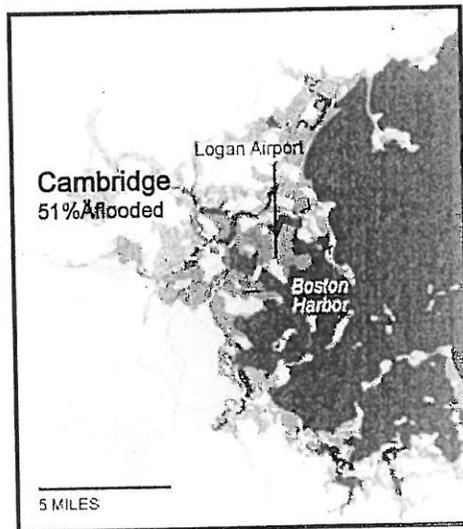
From <http://gofossilfree.org/commitments/>, accessed November 17, 2013

Q: What Will It Take?

A: Leave 80% of known carbon



Potential sea level changes within the next 100
years
'if nations make only moderate pollution cuts'



Sources: U.S. Geological Survey; National Oceanic and Atmospheric Administration; U.S. Fish and Wildlife Service



The Somerville Ti

Divest from fossil fuel investments

On January 16, 2014, in *Latest News*, by The News Staff



By Joseph A. Curtatone

(The opinions and views expressed in the commentaries of The Somerville Times belong solely to the authors of those commentaries and do not reflect the views or opinions of The Somerville Times, its staff or publishers)

In my inaugural address, I called upon our community to set a citywide goal to reduce our net carbon emissions to zero by 2050. That's an ambitious goal, but by setting the bar high, we will not be content to nip and tuck around the edges, but will fervently take on the challenge of climate change. Our children and their children deserve no less from us, and Somerville can make a difference. Cities are collectively responsible for over 70 percent of greenhouse gas emissions across the planet, according to the United Nations. We must do our part and do it the same way we approach every issue facing our city. We will study the facts and make prudent, patient investments today with an eye on tomorrow.

However, some of our investments today are part of the problem. We are funding the problem through our pension fund's holdings in fossil fuel companies. So in my inaugural address, I also publicly supported the goal of the Somerville Retirement Board divesting from fossil fuel companies.

The city's retirement board's chief responsibility is to secure the highest rate or return possible for investments in our pension fund. In the case of fossil fuels, the moral imperative is so clear and unambiguous to warrant divestment, but this is not only a moral imperative. It's sound financial policy, too.

There is a looming \$20 trillion carbon bubble, according to a report by London School of Economics' Grantham Research Institute on Climate Change and the Environment, in collaboration with nonprofit organization Carbon Tracker. That's because fossil fuel reserves are overvalued, and at least two-thirds of the reserves must remain untapped underground to prevent

climate change from increasing the global temperature by more than 2 degrees Celsius, a target agreed to by the United States and 113 other countries.

This means that these reserves are essentially unburnable and subsequently worthless, which will lead to incredible market losses by fossil fuel companies. Yet instead of taking this into account, the top 200 fossil fuel companies spent \$647 billion in 2012 to find more fossil fuels. That's equivalent to 1 percent of the global gross domestic product, a figure that if spent annually on climate change mitigation would stabilize greenhouse gases by 2050, according to a report by London School of Economics professor Sir Nicholas Stern. Spending billions on finding more fossil fuels when currently held reserves are likely to lose their value is a financial waste that increases the risk for investors such as the Somerville Retirement Board.

The red flag raised about the carbon bubble is supported by other financial institutions, including Standard and Poor's, HSBC Holdings and Citi. A coalition of investors, politicians and scientists has gone so far as to warn the Bank of England that fossil fuel reserves held by companies invested in by the City of London are "subprime" assets. We remember what happened in 2008 with subprime mortgages. These fossil fuel companies are poised for a great fall, and our legal obligation to fully fund our pension system does not need to fall with them. Divesting from fossil fuels is not only the moral choice, it's the financially responsible choice.

We are not alone in this fight. Seattle, San Francisco, Portland, Madison and Providence have already agreed to divest from fossil fuels. These cities' investments in their pension funds are at less risk today because they've divested. And they have sent a message that they will not take ownership in the corporations who seek higher profits at the expense of our planet's future.

Our community has already led the way on taking responsibility for our environment, from increasing recycling and installing solar panels on our schools, to green building incentives in the rezoning of Union Square and Boynton Yards, to energy-efficient LED lights for our streetlights, to making sure that the Green Line Extension and Assembly Square Orange Line station become a reality. We will continue to lead the way in 2014 through citywide Climate Change Mapping Sessions, detailing everything in our city that affects greenhouse gas emissions and identifying what we need to do to reduce these emissions and reach our net-zero goal by 2050.

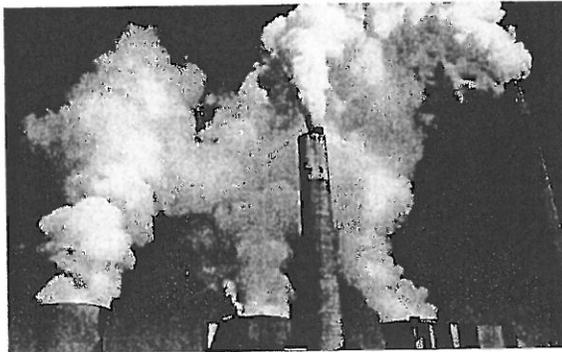
Even with all that, we must start with what we're doing right now to contribute to the problem. We are currently investing in the destruction of the planet. We need to divest from fossil fuel companies now.

Divestment Will Prevent Losses When Carbon Bubble Bursts

Carbon bubble will plunge the world into another financial crisis – report

Trillions of dollars at risk as stock markets inflate value of fossil fuels that may have to remain buried forever, experts warn

The Guardian, Thursday 18 April 2013
Damian Carrington



Global stock markets are betting on countries failing to adhere to legally binding carbon emission targets. Photograph: Robert Nickelsberg/Getty Images

The world could be heading for a major economic crisis as stock markets inflate an investment bubble in fossil fuels to the tune of trillions of dollars, according to leading economists.

The so-called "carbon bubble" is the result of an over-valuation of oil, coal and gas reserves held by fossil fuel companies. According to a report published on Friday, at least two-thirds of these reserves will have to remain underground if the world is to meet existing internationally agreed targets to avoid the threshold for "dangerous" climate change. If the agreements hold, these reserves will be in effect unburnable and so worthless – leading to massive market losses. But the stock markets are betting on countries' inaction on climate change.

The stark report is by Stern and the thinktank Carbon Tracker. Their warning is supported by organisations including HSBC, Citi, Standard and Poor's and the International Energy Agency.

Source: The Guardian; Carbon Tracker (attachments C and D)



TRILLIUM ASSET MANAGEMENT®

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**Stephanie R. Leighton, CFA,
Testimony on Massachusetts Senate Bill 1225
September 10, 2013**

Senator Brownsberger, Representative Michlewitz and members of the committee:
Good afternoon and thank you for giving me the opportunity to address the Committee today.

My name is Stephanie Leighton. I am a Senior Vice President and portfolio manager at Trillium Asset Management, the oldest independent investment advisor devoted exclusively to sustainable and responsible investing. Trillium is based in here Boston. I am a Chartered Financial Analyst charter holder and earned my MBA from Northeastern University. I am a member of the Boston Security Analysts Society and the CFA Institute. I have 31 years of investment experience.

I am here to testify in support of Senate Bill 1225: *An Act relative to public investment in fossil fuels.*

Our employee-owned firm has managed socially and environmentally screened investment portfolios for individuals and institutions since 1982. We have seen growing interest in our Fossil fuel free investment portfolios, which currently represent approximately 20% of our firm's \$1.2 billion of assets under management.

Trillium acts as sub-advisor for Green Century Balanced Fund, an environmental mutual fund with a fossil fuel free mandate.

The frequency and severity of extreme weather systems continues to impact the lives of people around the globe and increasingly in our own communities. Many investors are becoming acutely aware of the presence of fossil fuel companies in their own portfolios. It seems clear that climate change is no longer solely a threat to future generations. The damage to the environment, economy, homes, and lives is happening today.

In our experience, fossil fuel free investing has been a credible investment approach. I want to share my perspective as an investment manager who fully understands the demands of building portfolios that seek to maximize returns while managing risk.

Some have argued that divestment from fossil fuels could potentially increase risk and lower return because you are narrowing your investment universe.

Recent independent studies have shown that investors can go fossil fuel free without major negative impacts on portfolio performance.

Investment firm, Aperio Group, estimated that excluding all fossil fuel companies would have an annual standard deviation from its benchmark of just over half a percent but which has virtually no riskier in terms of volatility¹. They also report that over a 10 year period, a carbon-free portfolio outperformed its benchmark 73% of the time.

MSCI, a leading provider of investment decision support tools, looked at the impact of excluding companies owning carbon reserves from one of its index funds, the MSCI All Country World Index (MSCI ACWI). It determined that over a five year period the active return differential was 1.2% better for the same index without fossil fuel investments²

At Trillium, we utilize portfolio optimization software to help us manage the exclusion of fossil fuel stocks from a portfolio. It helps us to find other stocks that closely correlate with these stocks in terms of beta, or volatility of a stock in relationship to the market, and the size of the companies we invest in.

Investors can also seek to identify substitutes that most closely correlate with fossil fuel companies to minimize risk and tracking error or variation from benchmark. Many clean technology and industrial companies provide energy efficiency products such as LED lighting, power management, commercial building energy/efficiency controls.

Also within the industrial or technology sectors, we can find energy storage investments such as hybrid car batteries, electric grid distribution and transmission companies – some that are plays on bringing renewable energy to the power grid. Water and geothermal utilities can be evaluated as potential substitutes.

We mitigate risk and also improve the sustainability of portfolios by investing in green power generation – solar, wind, biofuels, geothermal – through finding bigger companies that have parts of their business in green/renewable sources of energy.

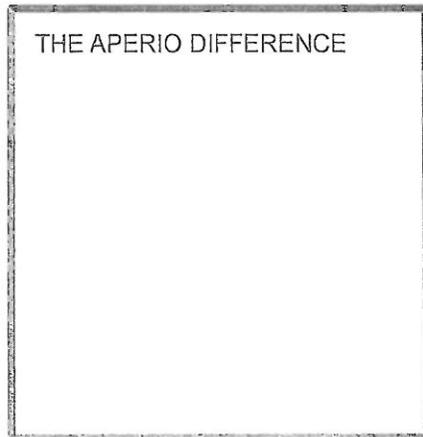
I believe that an investment portfolio can provide competitive returns over the market cycle — while managing a conscious choice to avoid fossil fuel investment exposure — and I am pleased to know that this committee is exploring that option.

Thank you.

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¹http://www.aperiogroup.com/system/files/documents/building_a_carbon_free_portfolio.pdf

² The MSCI ACWI ex-carbon vs. the MSCI ACWI for the time period February 2008-March 2013



Do the Investment Math: Building a Carbon-Free Portfolio

As university endowments face pressure to divest stocks of companies contributing the most to climate change, much of the public discussion has focused on the looming math of the environmental impact of a carbon-based economy. As endowments decide whether or not to divest or implement screens, another kind of math is needed as part of the process: the math of portfolio analysis. (Note: this version updates an earlier paper from December 2012.)

Author

Patrick Geddes, Chief Investment Officer

Do the Investment Math

In the past few months, a groundswell of public support has been pushing universities to divest their endowments of holdings in large fossil fuel companies. Writer and environmental advocate Bill McKibben has coined the phrase “Do the Math,” referring to the dangers of rising levels of carbon dioxide in the atmosphere. This focus on the math of climate change has been catalyzed by the publication of his influential article in *Rolling Stone* magazine this past July, “Global Warming’s Terrifying New Math.” This has been followed up by a 21-city college campus tour encouraging carbon divestment by large endowments and pension funds.

While some endowments like that of Hampshire college have announced plans to change their investment approach, many fiduciaries sitting on endowment boards dismiss with skepticism the idea of a portfolio helping to serve environmental goals. These skeptics often claim that incorporating environmental screening, however well intentioned, simply imposes a tax on investment return. While their wariness reflects a genuine and valid desire to protect the returns earned by the endowments, outright dismissal of any screening ignores another kind of math, the kind that measures the risk to a portfolio rather than the effects of carbon dioxide on our planet.

When the idea of fossil fuel screening gets floated, the first thing an endowment committee would want to know is the impact on return, especially whether screening imposes any penalty. The research data on a wide range of social and environmental screening show no such penalty (nor any benefit either), although the results are mixed.¹ Given the lack of evidence of a return penalty, the focus then shifts to the impact of screening on a portfolio’s risk, which is more predictable and easier to forecast than return. Skeptics are right when they claim that constraining a portfolio can only increase risk, but they frequently ignore the magnitude of the change in risk, which can be so minor as to be virtually irrelevant.

How can this risk impact best be estimated? For analysis, we’ll use a computer program called a multi-factor model, in this case the Aegis model from the company Barra. Aegis uses both industry and fundamental factors like price-earnings ratios to measure stock risk. The model generates a forecast for tracking error, which is the statistical measurement of deviation from a target benchmark like the S&P 500 or Russell 3000 for domestic stocks or the MSCI All Country World index for global stocks. Tracking error is analogous to the concept of darts thrown at a dartboard, where the bull’s-eye is the benchmark return and the measurement of the dispersion of dart throws around the bull’s-eye is the tracking error over a particular time frame, e.g. monthly returns over the past three years. A small or tight tracking error means the darts (each representing one monthly return) are clustered around the bull’s-eye, and a large or loose tracking error means the darts are all over the board.



As an example of the impact of screening on tracking error, we'll analyze the extra risk of excluding a small sample of companies that the climate change advocates have identified as particularly harmful, the so-called "Filthy Fifteen," U.S. companies judged by As You Sow and the Responsible Endowment Coalition as the most harmful based on the amount of coal mined and coal burned as well as other metrics. To measure the impact of excluding these companies, we'll start with a broad-market U.S. benchmark, the Russell 3000, then exclude the thirteen publicly traded stocks of the Filthy Fifteen² and finally use the multi-factor model to create an optimized portfolio as close to the Russell 3000 as possible. Investors who want a portfolio free of the Filthy Fifteen can get a tracking error versus the Russell 3000 of only 0.14%, a very minor difference from the benchmark.

What Does Additional Tracking Error Cost the Investor?

If investors are to decide whether a tracking error of 0.14% to exclude the Filthy Fifteen seems reasonable or excessive, they need some context for what that number implies. First, tracking error has an expected value of zero, meaning that in a passive management framework a portfolio's return is just as likely to be above the benchmark as below. Second, the average expected tracking error for institutional active management is 5.0% according to a survey of large U.S. pension funds,³ which means that investors already bear comparatively significant tracking error with their active managers. Third, in the language of statistics, tracking error is an estimate of standard deviation of returns versus a benchmark, which is in turn the square-root of variance. That means that tracking error cannot be simply added to overall portfolio risk (see Table 1). In other words, if the total market's risk is 17.67% (the Barra Aegis forecast standard deviation for the Russell 3000 as of December 31, 2012), the portfolio risk does not rise by another 0.14% to 17.81%. Instead, the impact of screening on absolute portfolio risk must be calculated using variance terms.

Table 1: Impact of Tracking Error for Exclusion of Filthy Fifteen

	Standard Deviation	Variance = (Std. Dev.) ²	Theoretical Return Penalty
Market Risk (Russell 3000)	17.6657%	3.1208%	
Tracking Error vs. R3000	0.1400%	0.0002%	
Screened Portfolio	17.6662%	3.1210%	
Incremental Risk	0.0006%		0.0002%

Source: Barra Aegis and Aperio Group

As Table 1 shows, adding 0.1400% of tracking error increases absolute portfolio risk by only 0.0006%, or about a half of one one-thousandth of a percent. In other words, the portfolio does become riskier, but by such a trivial amount that the impact is statistically irrelevant. In other words, excluding the Filthy Fifteen has no real impact on risk.

Skeptics could accurately point out that even for such a trivial amount, investors are technically bearing additional risk for which they are not compensated. Modern portfolio

theory holds that any increase in risk should earn an investor a corresponding increase in return. That theoretical loss of return in this case can be measured by using historical data for the “market premium,” i.e. the amount of extra return stock market investors have been paid historically for bearing extra risk. As shown in Table 1, the foregone return is 0.0002%, or two one hundredths of a basis point. Please see Appendix I for details on the calculation of the return penalty.

Having seen that excluding the Filthy Fifteen incurs virtually no risk penalty, we’ll now turn to a stricter set of screens for those endowments who may want to divest a more comprehensive list of companies from an entire industry, Oil, Gas & Consumable Fuels.⁴ Table 2 shows the naturally higher tracking error resulting from stricter screens.

Table 2: Impact of Tracking Error for Industry Exclusion

	Standard Deviation	Variance = (Std. Dev.) ²	Theoretical Return Penalty
Market Risk (Russell 3000)	17.6657%	3.1208%	
Tracking Error vs. R3000	0.5978%	0.0036%	
Screened Portfolio	17.6758%	3.1243%	
Incremental Risk	0.0101%		0.0034%

Source: Barra Aegis and Aperio Group. Numbers may not sum exactly due to rounding.

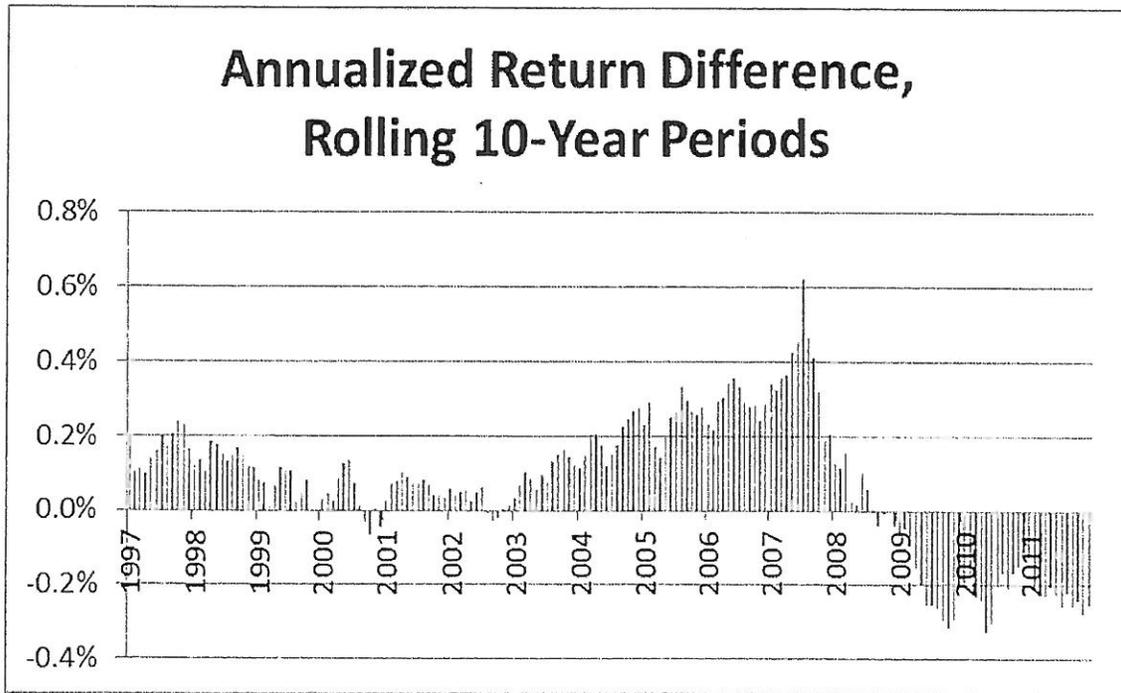
As Table 2 shows, adding 0.5978% of tracking error increases absolute portfolio risk by 0.0101%, with a theoretical return penalty of 0.0034%, or less than half a basis point. While that tracking error remains very low compared to active stock picking, the industry emphasis still means that if this industry outperforms the overall stock market, a portfolio with these exclusions will perform worse, while of course if those industries perform poorly relative to the market a screened portfolio would perform better.

The approach shown here of using a multi-factor model to manage risk in screened portfolios has been validated in a number of articles in academic finance journals that prove and explain this math in greater detail.⁵ Furthermore, while this analysis shows the effects for U.S. stocks, the math looks very similar for non-U.S. and global portfolios as well. Excluding more industries increases the tracking error slightly, as presented in an earlier version of this paper, more details of which can be found in Appendix II.

Historical Back Test

The risk data discussed so far reflect estimates of future incremental impact on a portfolio’s volatility. Another approach involves back testing hypothetical portfolios to see how they would have performed over different historical periods, i.e. looking backwards instead of forwards. Although such back testing should be taken with a healthy grain of salt, it can still provide at least some sense of how a screened portfolio would have performed. Using the same multi-factor Barra model used to create the portfolio shown in Table 2, the performance has been analyzed using historical return data. This screened portfolio has been optimized to track the Russell 3000 benchmark

but with no stocks from Oil, Gas & Consumable Fuels. Shown below is a graph of rolling ten-year return periods from the end of 1987 through the end of 2012 for the screened portfolio, called Full Carbon Divestment. The blue bars above the 0.0% line indicate that the screened portfolio earned a higher average annual return over the trailing ten-year period, while those below the line indicate the periods for which the portfolio performed worse than the benchmark.



Return numbers show annualized return difference between Full Carbon Divestment portfolio and Russell 3000 for periods from Jan 1988 to Dec 2012.

Average Annualized 10-year Return Difference	+0.08%
Percentage of Periods Higher than R3000	73%
Percentage of Periods Lower than R3000	27%
Tracking error, current forecast	0.60%
Tracking error, historical simulation	0.78%

As the chart and table show, the average return for a 10-year rolling period over the past 25 years was slightly positive, with 73% of the ten-year periods earning higher returns. If there is no return bias, then theoretically such a screened portfolio would be expected to perform better than the benchmark only half the time. In other words, the historical data may show superior performance, but the model forecasts only risk, not any ongoing excess return. The hypothetical historical tracking error over the period was 0.78%, slightly higher than the currently forecasted 0.60%.

Summary

In deciding whether to implement any divestment, university endowments face compelling arguments on both sides. From the advocates of divestment, endowments hear about the serious environmental damage already incurred, the frightening trajectory of the math and the benefit from taking a public stance on a critical ethical issue. From the skeptics they hear that screening will adversely affect risk and return and that the goal of any endowment should be to focus exclusively on returns. The math shown in Tables 1 and 2 does support the skeptics' view that screening negatively affects a portfolio's risk and return, but it also shows that the impact may be far less significant than presumed. It's beyond the scope of this paper to judge whether endowments should implement or avoid screening, but anyone on an endowment board facing that decision should at least do the math, in this case the investment math.

Appendix I: Calculation of Theoretical Return Penalty

We can convert the uncompensated risk to a theoretical return penalty by using a simplified historical risk premium. Based on S&P 500 returns and risk (as a proxy for the U.S. stock market) from January 1926 to June 2011, we find a total market annual return of 9.88 percent versus T-bills over the same period of 3.60 percent for an excess return of 6.29 percent. From the same data set, the S&P 500 has had an annualized standard deviation of 19.14 percent, giving a simplified market Sharpe ratio of 0.33, calculated as follows: Market Sharpe ratio = $(r_m - r_f) / \sigma_m$, where r_m is return on market, r_f is risk-free rate, and σ_m is the risk of the market as measured by standard deviation. The simplified historical market Sharpe ratio is calculated as follows: $(9.88\% - 3.60\%) / 19.14\% = 0.33$. The theoretical return penalty in Table 1 is calculated as follows: 0.0005% incremental standard deviation times a Sharpe ratio of 0.33 equals 0.0002%, or two one-hundredths of a basis point in theoretical foregone return. In other words, the impact on return, according to standard portfolio theory, is virtually nonexistent for eliminating the Filthy Fifteen.

Appendix II: Screening Impact of Broader Exclusions

In an earlier version of this paper, published in December 2012, Aperio Group analyzed a broader range of industry exclusions, as listed below.

- Oil, Gas & Consumable Fuels
- Metals & Mining
- Electric Utilities
- Independent Power Producers & Energy Traders
- Multi-Utilities

To avoid penalizing cleaner companies in those industries, those scored by MSCI's environmental research as receiving 100% of their revenue from environmentally sustainable businesses have been added back and made available. Table 3 shows the naturally higher tracking error resulting from stricter screens.

Table 3: Impact of Tracking Error for Broad Carbon Exclusion

	Standard Deviation	Variance = (Std. Dev.) ²	Theoretical Return Penalty
Market Risk (Russell 3000)	17.9500%	3.2220%	
Tracking Error vs. R3000	0.6900%	0.0048%	
Screened Portfolio	17.9633%	3.2268%	
Incremental Risk	0.0133%		0.0044%

Source: Barra Aegis and Aperio Group. Estimates as of November 30, 2012.

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Disclosure

The information contained within this presentation was carefully compiled from sources Aperio believes to be reliable, but we cannot guarantee accuracy. We provide this information with the understanding that we are not engaged in rendering legal, accounting, or tax services. In particular, none of the examples should be considered advice tailored to the needs of any specific investor. We recommend that all investors seek out the services of competent professionals in any of the aforementioned areas.

With respect to the description of any investment strategies, simulations, or investment recommendations, we cannot provide any assurances that they will perform as expected and as described in our materials. Past performance is not indicative of future results. Every investment program has the potential for loss as well as gain.

Assumptions underlying simulated back test:

- Based on Barra Aegis multi-factor risk model
- Quarterly rebalancing.
- Exclude stocks from Oil Gas & Consumable Fuels industry as defined by MSCI Barra industry for back test.
- No transaction costs or management fees included.
- Benchmark returns are simulated using underlying holdings to ensure apples-to-apples comparison.

The benchmark for back-test simulation is the Russell 3000 total return index. The simulated portfolios are actively managed, and the structure of the actual portfolios and composites may be at variance to the benchmark index. Index returns reflect reinvestment of dividends but do not reflect fees, brokerage commissions, or other expenses of investing, which can reduce actual returns earned by investors.

Performance results from back tests of particular strategies exclude any trading or management fees that would reduce the return. Furthermore, future returns for any such strategies could be worse than the results shown or the identified benchmark. Back-testing involves simulation of a quantitative investment model by applying all rules, thresholds and strategies to a hypothetical portfolio during a specific market period and measuring the changes in value of the hypothetical portfolio based on the actual market prices of portfolio securities. Investors should be aware of the following: 1) Back-tested performance does not represent actual trading in an account and should not be interpreted as such, 2) back-tested performance does not reflect the impact that material economic and market factors might have had on the manager's decision-making process if the manager were actually managing client's assets, 3) the investment strategy that the back-tested results are based on can be changed at any time in order to reflect better back-tested results, and the strategy can continue to be tested and adjusted until the desired results are achieved, and 4) there is no indication that the back-tested performance would have been achieved by the manager had the program been activated during the periods presented above.

Endnotes

¹ United Nations Environment Programme (UNEP) Finance Initiative and Mercer. 2007. Demystifying Responsible Investment Performance.
http://www.unepfi.org/fileadmin/documents/Demystifying_Responsible_Investment_Performance_01.pdf. *

² The following companies incorporate the thirteen publicly trade stocks of the Filthy Fifteen:
Arch Coal Inc
Ameren Corp
American Elec Pwr Inc
Alpha Natural Resource
Consol Energy Inc
Dominion Res Inc
Duke Energy Corp
Consolidated Edison
Edison Intl
Firstenergy Corp
Genon Energy Inc
PPL Corp
Southern Co

³ Based on a survey of Callan Associates, Inc., Mercer Investment Consulting and Watson Wyatt Worldwide. For details see GMO. 2007. White Paper, "What Should You Pay For Alpha?",
<https://www.gmo.com/NR/rdonlyres/F8E38661-0CD6-49EB-97DF-8D7B6AC32B43/1007/HowMuchPayForAlpha.pdf>. *

⁴ Based on the Global Industry Classification Standards developed by MSCI and Standard & Poor's.

⁵ See the following articles:

Geddes, Patrick. 2012. Measuring the Risk Impact of Social Screening. *Journal of Investment Consulting* 13, no. 1: 45-53.

Jennings, William W., and Gregory W. Martin. 2007. Socially Enhanced Indexing: Applying Enhanced Indexing Techniques to Socially Responsible Investment. *Journal of Investing* 16, no. 2 (summer): 18-31.

Kurtz, Lloyd, and Dan diBartolomeo. 2011. The Long-Term Performance of a Social Investment Universe. *Journal of Investing* (fall): 95-102.

Milevsky, Moshe, Andrew Aziz, Al Goss, Jane Thompson, and David Wheeler. 2006. Cleaning a Passive Index. *Journal of Portfolio Management* 32, no. 3 (spring): 110-118.

* Any link shown above will take you to an external web site. We are not responsible for their content.

Shoshana Blank



Originally from Colorado, Shoshana is a graduate of St. Olaf College where she double majored in Biology and Environmental Studies. Shoshana has conducted research on particulate matter emissions at the University of Colorado and University of Minnesota, and is interested in implementing energy and transportation solutions to cut down on these and other emissions. A Fulbright scholar, her research took her to India where she studied emissions from wood-burning cookstoves. Shoshana joined The Sustainable Endowments Institute, a Boston-based nonprofit organization, in 2011, where her work is focused on assisting universities and K-12 schools to invest in energy efficiency, helping them save money in their operating budgets. Shoshana has been involved as one of the leaders of Fossil Free Somerville since March 2013 and is a proud resident of Davis Square.



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Ms. Leighton is a senior portfolio manager and research analyst at Trillium Asset Management LLC. She has over 25 years investment management experience including fifteen years managing socially responsible institutional and individual portfolios. She is the lead portfolio manager on Trillium's Large Cap Core and Growth and Income strategies and she is co-lead on the firm's All Cap Core strategy. She is also a portfolio manager for the fossil fuel free Green Century Balanced fund. Ms. Leighton serves on the Indigenous People's Working Group of the U.S. Sustainable Investment Forum. Ms. Leighton is a past president of the New England Chapter of the Social Investment Forum. She is a member of the Boston Security Analysts Society, and the CFA Institute. Ms. Leighton is a Chartered Financial Analyst charterholder. Ms. Leighton holds a BA from Bard College and an MBA from Northeastern University.

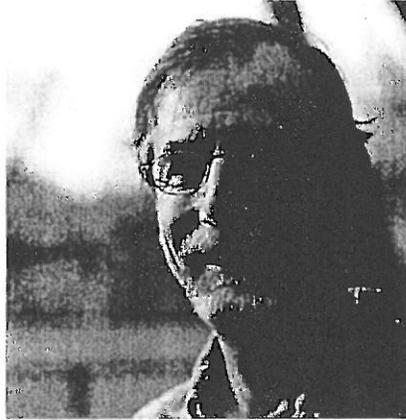
Bob Massie



Bob Massie is the President of the New Economy Coalition. An ordained Episcopal minister, he received his B.A. from Princeton University, M.A. from Yale Divinity School, and doctorate from Harvard Business School. From 1989 to 1996 he taught at Harvard Divinity School, where he served as the director of the Project on Business, Values, and the Economy. His 1998 book, *Loosing the Bonds: The United States and South Africa in the Apartheid Years*, won the Lionel Gelber prize for the best book on international relations in the world. He was the Democratic nominee for lieutenant governor of Massachusetts in 1994 and a candidate for the United States Senate in 2011.

During his career he has created or led three ground-breaking sustainability organizations, serving as the president of Ceres (the largest coalition of investors and environmental groups in the United States), the co-founder and first chair of the Global Reporting Initiative, and the initiator of the Investor Network on Climate Risk, which currently has over 100 members with combined assets of over \$10 trillion. His autobiography, *A Song in the Night: A Memoir of Resilience*, has just been published by Nan A. Talese/Doubleday.

Peter St. Clair



Peter St. Clair retired as a Deputy Chief from the Somerville Fire Department in 2010 after 33 years with the Department. He lives in Cambridge with his wife where they raised their four grown children. He has always been concerned with the preservation of the environment and is especially worried about the consequences of climate change if the human race continues with business as usual.

Patricia Wild



Patricia Wild's full-time writing career began in 1998 when her novel, *Swimming In It*, was published by Flower Valley Press, Gaithersburg, MD. For many years, she had taught adult learners at the Somerville Center for Adult Learning Experiences; *Swimming In It* is based on the stories her homeless students had told her.

Several years ago, she began to wonder: whatever happened to the two African Americans who desegregated her high school—in Lynchburg, Virginia—in 1962? That question became a journey; *Way Opens: A Spiritual Journey*, chronicles that journey. A former bi-monthly columnist for *The Somerville Journal*, currently she posts blogs on her website, www.PatriciaWild.net. Her two-act play, "Those Starving Armenians," is currently under review at Nora Theater Company.

A member of Friends Meeting at Cambridge for over thirty years, Patricia lives in Somerville, Massachusetts.