Attachment E

SFERS
San Francisco Employees' Retirement System

City and County of San Francisco
Employees' Retirement System

Date: January 24, 2018

To: The Retirement Board

Through: Jay Huish
Executive Director

From: William J. Coaker Jr. – CFA, CFP, MBA
Chief Investment Officer

Subject: SFERS CIO Report on Staff's Recommendation on the Motion before the Board to Divest of Fossil Fuel Holdings in SFERS Public Markets Securities

Overview

At the May 17, 2017 Board meeting, a motion was made for SFERS to divest of all fossil fuel holdings in its public markets securities and do so within 180 days.

Staff believes in the science that the earth is warming with potentially horrible impact and that carbon emissions contribute meaningfully to global warming. However, for reasons noted herein, Staff is unable to make the case consistent with what we believe is fiduciary prudence to recommend the Board approve this motion. Hence, Staff recommends that the Board not approve the motion to divest of fossil fuel holdings in our public markets investments.

As an alternative to divestment, Retirement staff recommends that the Board consider a strategy of *positive investment actions* to reduce climate risk within the SFERS investment program. Retirement staff recommends that the Board direct staff to implement the following strategies consistent with Level II engagement of fossil fuel companies under the Board's ESG Policies and Procedures by June 30, 2019:

1) Adopt a "carbon constrained" strategy for $1 billion of SFERS passive public markets portfolio to reduce carbon emissions by 50% versus the S&P 500 Index
2) Hire a Director of Socially Responsible Investing to coordinate SFERS' activities at Level II of the Board's ESG Policies and Procedures
3) Partner with key public pension asset owners (e.g. CalSTRS, NYC Retirement Systems and New York State Common) and other institutional investors to share resources and to develop and support collaborative initiatives to reduce carbon emissions

4) Increase SFERS activities as an asset owner under Level II of the Board's ESG Policies and Procedures through continued participation in CERES and the Principles for Responsible Investment (PRI) and enhancement of proxy voting and engagement activities consistent with PRI principles
5) Pursue renewable energy and carbon-constrained investments
6) Continue a responsible, phased approach to analyze, engage and divest from fossil fuel companies on a "worst of the worst" case basis as the Board has previously approved for certain thermal coal securities (Level III of the Board's ESG Policies and Procedures)

"Carbon Constrained" strategy for a portion of our passive public markets investments

Staff proposes that SFERS adopt a "Carbon Constrained" strategy for $1 billion of our passive public markets portfolio.

We believe the best index to implement a Carbon-Constrained strategy is versus the S&P 500, for the following reasons: 1 - The S&P 500 consists of approximately 500 large U.S. companies totaling about 80 percent of the market capitalization of the U.S. public equity market, and; 2 – The International Equity market is a greater source of alpha for active management; thus, we expect we will usually have regular investment in passive U.S. equity investments but we are less likely to have significant passive exposure in international stocks.

Goldman Sachs has provided SFERS with back-tested data on a strategy that reduces carbon emissions by 50% versus the S&P 500. By reweighting stocks in the S&P 500 in allocations that reduce the carbon emissions by 50 percent, Goldman Sachs' back-tested results would have been as follows:

March 2005 to September 2017 *Gross*	RALE S&P 500	S&P 500
SI Annualized Return	8.43%	8.48%
Excess Return	-0.06%	-
Beta	0.99	1.00
Standard Deviation	13.74%	13.87%
Tracking Error	0.31%	-
Correlation	1.00	
Upside Capture	99.06%	-
Downside Capture	99.10%	-

The results of the back-test are that the Carbon-Constrained Strategy underperformed the S&P 500 by 0.06% annualized gross of fees. The Carbon Reduction portfolio did have very slightly better performance in down markets, and a tad less volatility and beta. While the back-tested results of the Carbon Constrained Strategy have not outperformed, we do anticipate the adoption of electric vehicles is likely to meaningfully accelerate, and that the adoption of solar and wind could soon increase as well. Please see the discussion toward the end of this memo on the potential future adoption of EV's, solar and wind, which explain why adopting a Carbon-Constrained Strategy for a portion of our passive public markets portfolio now makes sense.

Director of Socially Responsible Investing

Staff proposes that SFERS hire a dedicated Director of Socially Responsible Investing as well as an Analyst who will support this newly created management position. These newly created positions would be responsible for ensuring SFERS' compliance with the Principles as well as partnering together with other asset owners to enact changes to bring about positive environmental, governance, and social impact.

A key responsibility of a Director for Socially Responsible Investing will include increasing our efforts at Level II of the Board's ESG Policies and Procedures – namely, engagement with company management to bring about positive change – of our Socially Responsible Investment criteria. Rather than broadly divest of 200 companies, Staff believes each company needs to be evaluated as its own entity, based on its own actions. By having dedicated personnel as well as tethering together with the PRI and their more than 1,700 assets owners, investment managers, and service providers, we will meaningfully increase our impact on corporate action and reduce carbon emissions.

Asset Owner Activities

In 2017 the Retirement Board approved SFERS becoming a member of the Principles for Responsible Investing. The PRI signatories includes 350 asset owners, 1,176 investment managers, and 222 service providers. The Principles are extensive in the breadth and depth of their scope.

The **Principles for Responsible Investing** are as follows:

Principle 1 - *We will incorporate ESG issues into investment analysis and decision-making processes.*

Possible actions:

- Address ESG issues in investment policy statements.
- Support development of ESG-related tools, metrics, and analyses.
- Assess the capabilities of internal investment managers to incorporate ESG issues.
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- Ask investment service providers (such as financial analysts, consultants, brokers, research firms, or rating companies) to integrate ESG factors into evolving research and analysis.
- Encourage academic and other research on this theme.
- Advocate ESG training for investment professionals.

Principle 2 - *We will be active owners and incorporate ESG issues into our ownership policies and practices.*

Possible actions:

- Develop and disclose an active ownership policy consistent with the Principles.
- Exercise voting rights or monitor compliance with voting policy (if outsourced).

- Develop an engagement capability (either directly or through outsourcing).
- Participate in the development of policy, regulation, and standard setting (such as promoting and protecting shareholder rights).
- File shareholder resolutions consistent with long-term ESG considerations.
- Engage with companies on ESG issues.
- Participate in collaborative engagement initiatives.
- Ask investment managers to undertake and report on ESG-related engagement.

Principle 3 - ***We will seek appropriate disclosure on ESG issues by the entities in which we invest.***

Possible actions:

- Ask for standardized reporting on ESG issues (using tools such as the Global Reporting Initiative).
- Ask for ESG issues to be integrated within annual financial reports.
- Ask for information from companies regarding adoption of/adherence to relevant norms, standards, codes of conduct or international initiatives (such as the UN Global Compact).
- Support shareholder initiatives and resolutions promoting ESG disclosure.

Principle 4 - ***We will promote acceptance and implementation of the Principles within the investment industry.***

Possible actions:

- Include Principles-related requirements in requests for proposals (RFPs).
- Align investment mandates, monitoring procedures, performance indicators and incentive structures accordingly (for example, ensure investment management processes reflect long-term time horizons when appropriate).
- Communicate ESG expectations to investment service providers.
- Revisit relationships with service providers that fail to meet ESG expectations.
- Support the development of tools for benchmarking ESG integration.
- Support regulatory or policy developments that enable implementation of the Principles.

Principle 5 - ***We will work together to enhance our effectiveness in implementing the Principles.***

Possible actions:

- Support/participate in networks and information platforms to share tools, pool resources, and make use of investor reporting as a source of learning.
- Collectively address relevant emerging issues.
- Develop or support appropriate collaborative initiatives.

Principle 6 - *We will each report on our activities and progress towards implementing the Principles.*

Possible actions:

- Disclose how ESG issues are integrated within investment practices.
- Disclose active ownership activities (voting, engagement, and/or policy dialogue).
- Disclose what is required from service providers in relation to the Principles.
- Communicate with beneficiaries about ESG issues and the Principles.
- Report on progress and/or achievements relating to the Principles using a comply-or-explain approach

Pursue renewable/alternative energy and carbon-constrained investments

Retirement staff will expand its research of the landscape of renewable, alternative energy and carbon-constrained investments. The Board has approved some sustainable type investments in our private markets portfolio, and staff has been researching even more. Staff will also research similar investments in the public markets, primarily in public equity.

Rationale for Staff's Recommendation Not to Divest of Fossil Fuels

1 - Divestment does not reduce fossil fuels

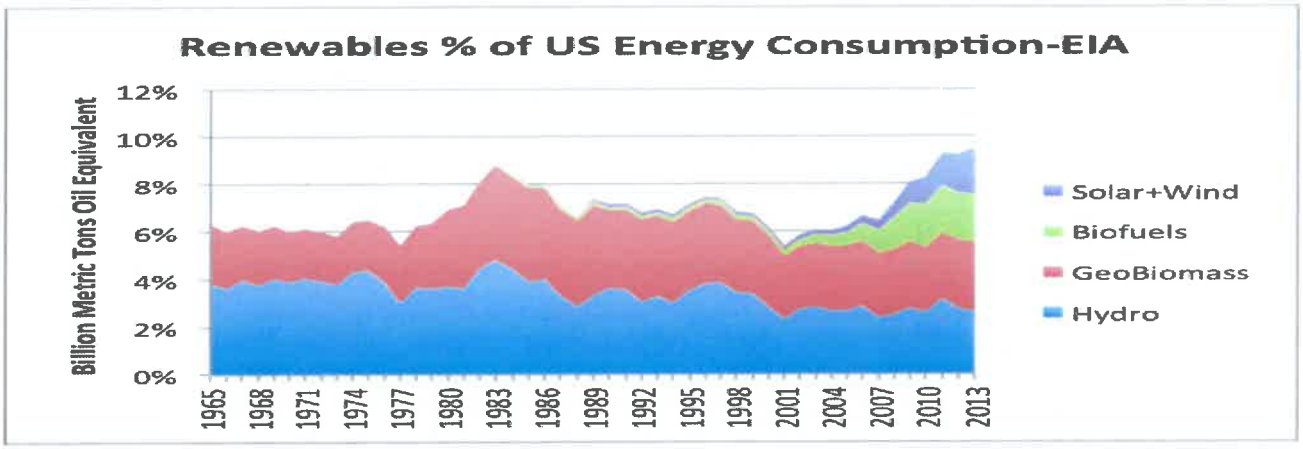
This cannot be emphasized enough: divestment does not reduce fossil fuels. While we think the awareness that proponents of divestment have brought to the issue of global warming is incredibly important, divestment does not even in the smallest way reduce carbon emissions. Divestment simply changes ownership. To accomplish the proponents of divestment's objective to reduce carbon emissions requires reducing the use fossil fuels, not a change in ownership. Reducing the use of fossil fuels requires:

- Consumers, government, and businesses to reduce their use of fossil fuels, or:
- Government legislation that requires consumers and business to reduce the use of fossil fuels.

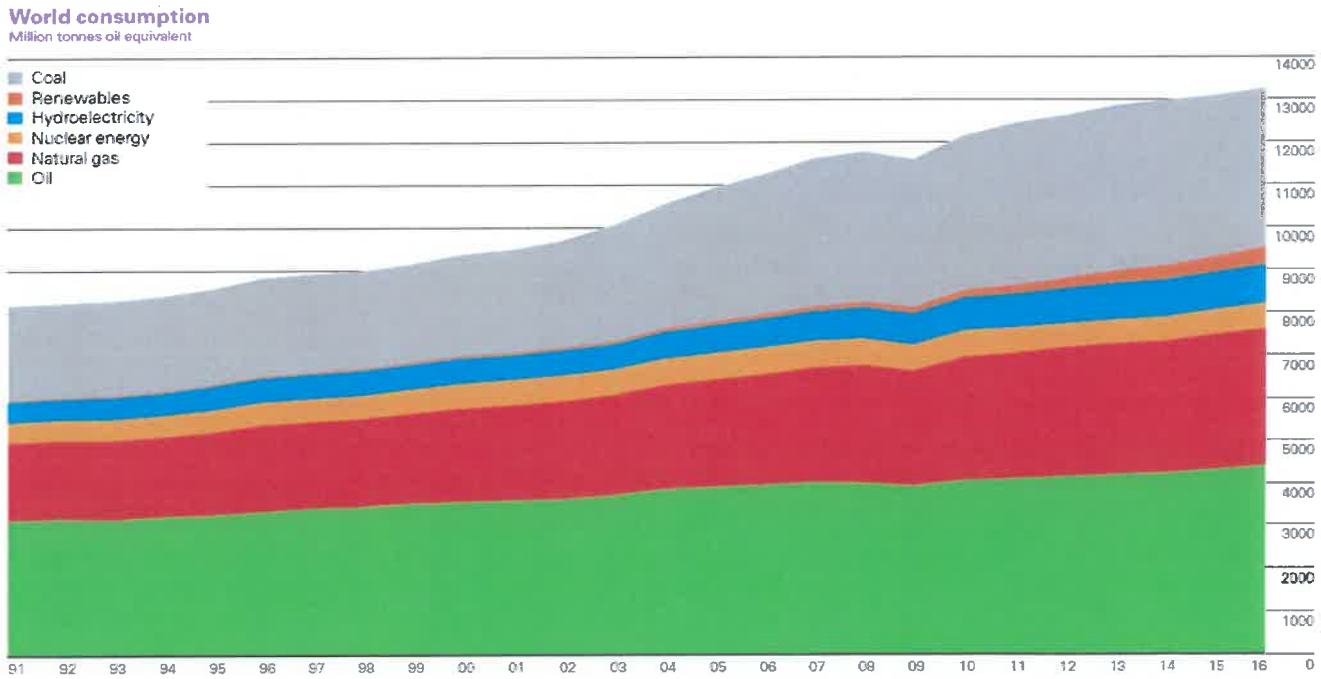
Divestment also does not harm or punish companies that produce fossil fuels, and the only parties that could be negatively impacted by divestment are those that are not invested in them. The profits of fossil fuel companies or the compensation of their employees are not negatively impacted by divestment. That occurs when consumers reduce the use of products made from fossil fuels, or when governments require it. Ironically, if SFERS divests and fossil fuel companies earn good investment returns, we would be harmed, while fossil fuel companies themselves would not be.

2 - Renewables have thus far experienced only minimal adoption

The following chart shows over the past 50 years that renewables have only grown from 6% to 10% of energy production. The limited adoption of renewables over the past 50 years is because there is not a substitute for fossil fuels that meets the enormous global demand for energy.

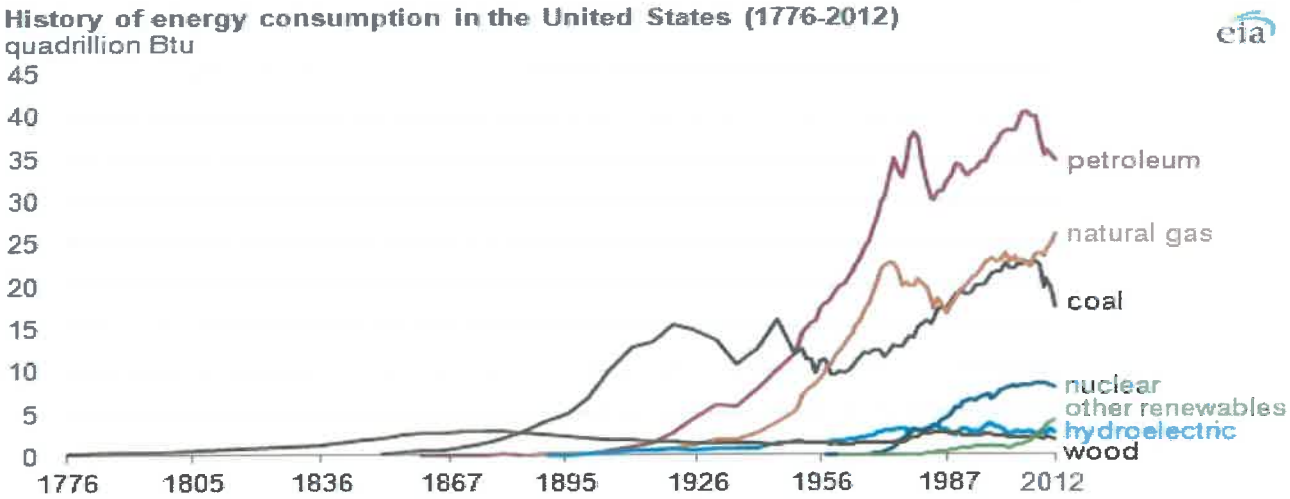


As shown in the chart below, for decades the use of fossil fuels has consistently increased, even as renewables gained traction and have grown faster than the use of oil and the growth of coal has flatlined and more recently begun to decline slightly.



World primary energy consumption grew by 1.0% in 2016, well below the 10-year average of 1.8% and the third consecutive year at or below 1%. As was the case in 2015, growth was below average in all regions except Europe & Eurasia. All fuels except oil and nuclear power grew at below-average rates. Oil provided the largest increment to energy consumption at 77 million tonnes of oil equivalent (mtoe), followed by natural gas (57 mtoe) and renewable power (53 mtoe).

3 – Transitioning to renewables is going to take time, most likely in the range of decades



Fossil fuels worldwide account for approximately 84 percent of our energy use. Even in 2040, or 23 years from now, the International Energy Agency expects fossil fuels will account for 78 percent of global energy production. Due to greater consumption of energy, the IEA also expects the use of fossil fuels will continue to grow over the next two decades. In June 2015, the G7 leaders pledged to the United Nations to transition to a decarbonized world, but their pledge was to do so over a period of 80 years. In short, while staff thinks that humankind is experiencing a revolution in how we produce energy, we also think doing so will take a long time, in the range of decades or longer.

Current Energy Consumption

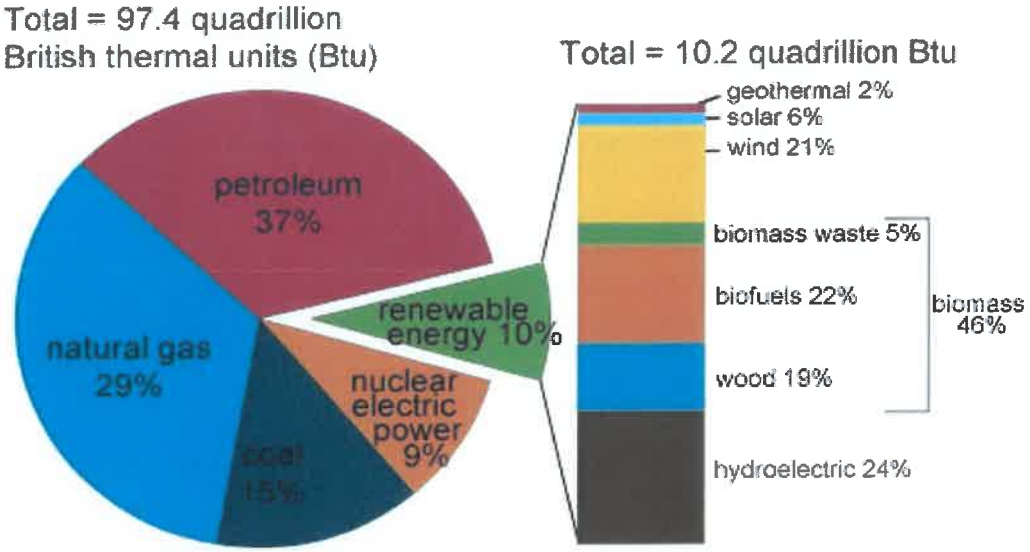
In the U.S., approximately 81 percent of energy comes from fossil fuels, with 9 percent from nuclear power and 10 percent from renewables. The following chart shows:

- Petroleum is the largest source of energy consumption at 37%, Natural Gas is the second largest at 29%, and Coal comprises 15% of U.S. energy consumption;

- Fossil fuels – meaning, petroleum, natural gas, and coal – totals 81% of U.S. energy use;

- Alternative Energy comprises 19% of energy consumption, including 9% from nuclear electric power and 10% from renewables. Among the latter, hydroelectric power totals 2.4%, wind 2.1% and solar 0.6%, respectively, and all other sources of renewable energy total 4.9% of energy consumption.

U.S. energy consumption by energy source, 2016



Note: Sum of components may not equal 100% because of independent rounding.

Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2017, preliminary data

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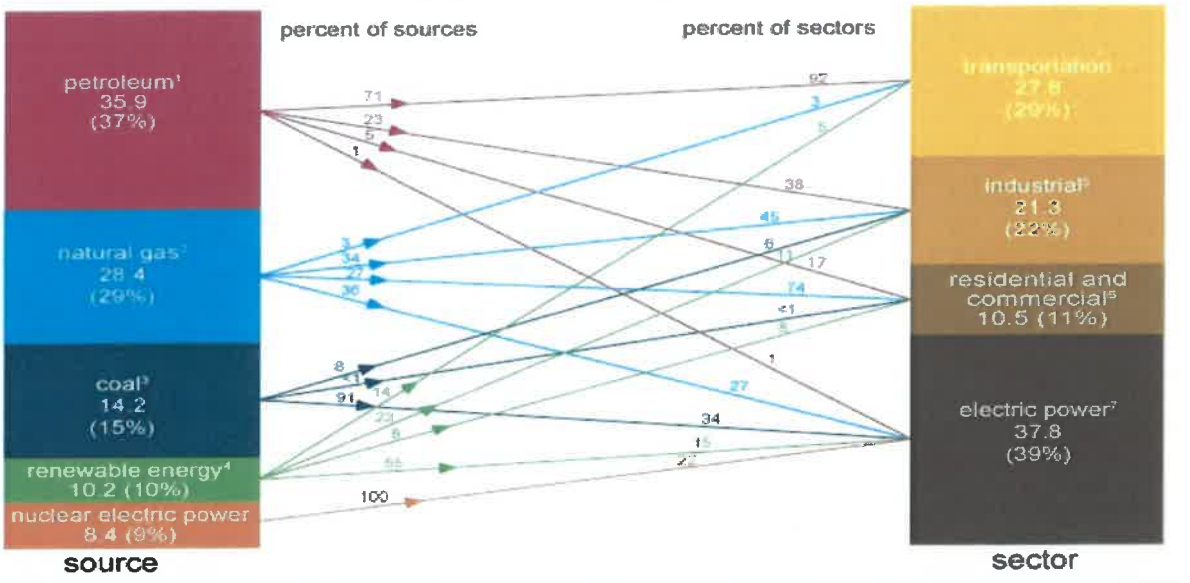
The following chart shows energy consumption in a cross-sectional form including the sources and sectors of energy use. Some of the highlights include:

- 92% of transportation comes from petroleum; renewables only account for 5% of transportation;
- Natural gas is a large provider of energy to industry, residences, businesses, and electrical power;
- Coal is largely used to generate electrical power;
- Renewables generate only 5% of energy for transportation, 15% of electrical power, 11% of industrial power; and just 6% for residences and business. Renewables do not yet supply more than 15% of energy production for any sector of the economy.

U.S. primary energy consumption by source and sector, 2016

Total = 97.4 quadrillion British thermal units (Btu)



[1] Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."
[2] Excludes supplemental gaseous fuels.
[3] Includes -0.02 quadrillion Btu of coal coke net imports.
[4] Conventional hydroelectric power, geothermal, solar, wind, and biomass.
[5] Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.
[6] Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.
[7] Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.24 quadrillion Btu of electricity net imports not shown under "Source."

Notes: • Primary energy is energy in the form that it is accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy occurs (for example, coal before it is used to generate electricity). • The source total may not equal the sector total because of differences in the heat contents of total, end-use, and electric power sector consumption of natural gas. • Data are preliminary. • Values are derived from source data prior to rounding. • Sum of components may not equal total due to independent rounding.

Sources: U.S. Energy Information Administration, *Monthly Energy Review* (April 2017), Tables 1.3, 1.4a, 1.4b, and 2.1–2.6

Recent Trends in Energy Consumption

The following tables and charts shows global consumption of energy consumption by source:

- **Coal:** Use of coal has declined by 4.0% over the past 3 years;

- **Petroleum:** Use of petroleum has risen 4.9% the past 3 years and by 12.6% the past 10 years;

- **Natural Gas:** Use of natural gas has risen by 4.7% over the past 3 years and by 24.3% the past 10 years;

- **Nuclear Energy:** Nuclear energy, an alternative energy but which is not renewable, has declined by 6.8% over the past 10 years, though it has risen by 5.0% the past 3 years;

- **Hydroelectricity:** Hydroelectricity has risen by 5.0% the past 3 years and 32.3% the past 10 years;

- **Other Renewables:** Other Renewables, which consist primarily of solar and wind as well as biomass fuels, has risen by 49.5% the past 3 years and 351.6% the past 10 years;

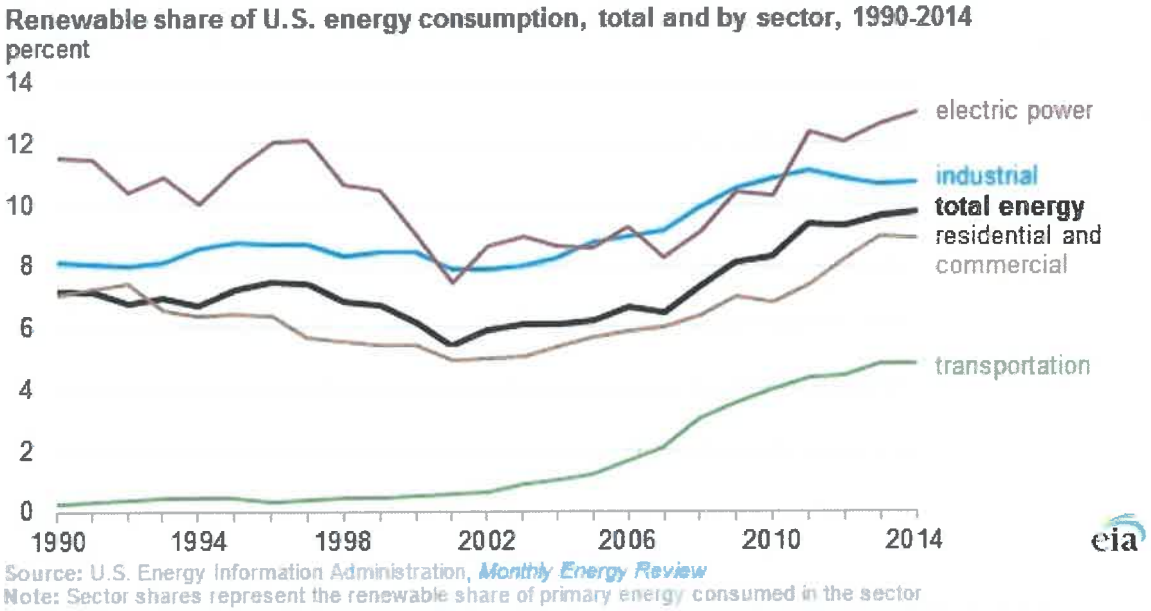
- **Carbon Emissions:** Carbon Emissions have risen by 13.6% the past 10 years, but by just 0.6% the past 3 years. The increase the past 3 years in carbon emissions from 2014-16 is the lowest since 1981-83.

World Energy Consumption Statistics

Year	Fossil Fuels: Coal	Fossil Fuels: Oil	Fossil Fuels: Natural Gas	Non-Renewable Non-Fossil Fuel: Nuclear Energy	Renewables: Hydro-Electricity	Renewables: Other Renewables	Carbon Dioxide Emissions
2006	3,292	85,728	2,851	635	688	93	29,430
2007	3,480	87,087	2,967	622	698	107	30,482
2008	3,528	86,578	3,045	620	739	123	30,800
2009	3,476	85,700	2,966	614	737	144	30,145
2010	3,636	88,765	3,188	626	779	170	31,528
2011	3,807	89,790	3,246	600	792	204	32,413
2012	3,817	90,563	3,323	559	832	239	32,740
2013	3,887	92,049	3,384	564	859	281	33,226
2014	3,889	93,109	3,401	575	879	317	33,342
2015	3,765	95,008	3,480	583	883	367	33,204
2016	3,732	96,558	3,543	592	910	420	33,432
2016 v. 2013	-4.0%	4.9%	4.7%	5.0%	5.9%	49.5%	0.6%
2016 v. 2006	13.4%	12.6%	24.3%	-6.8%	32.3%	351.6%	13.6%

Oil measured in thousands of barrels a day
Coal, Natural Gas and Nuclear Energy measured in million tons oil equivalent
Natural gas measured in millions tons oil equivalent
Hydroelectricity and Other Renewables measured in terawatt hours.
Carbon Dioxide Emissions - See Page 47 of BP Statistical Review of World Energy June 2017

An earlier chart showed that renewables have only increased as a percentage of energy consumption from about 6.0% in 1965 to approximately 9.5% in 2013. The following chart shows the adoption of renewables has been slow going across all sectors of the economy.

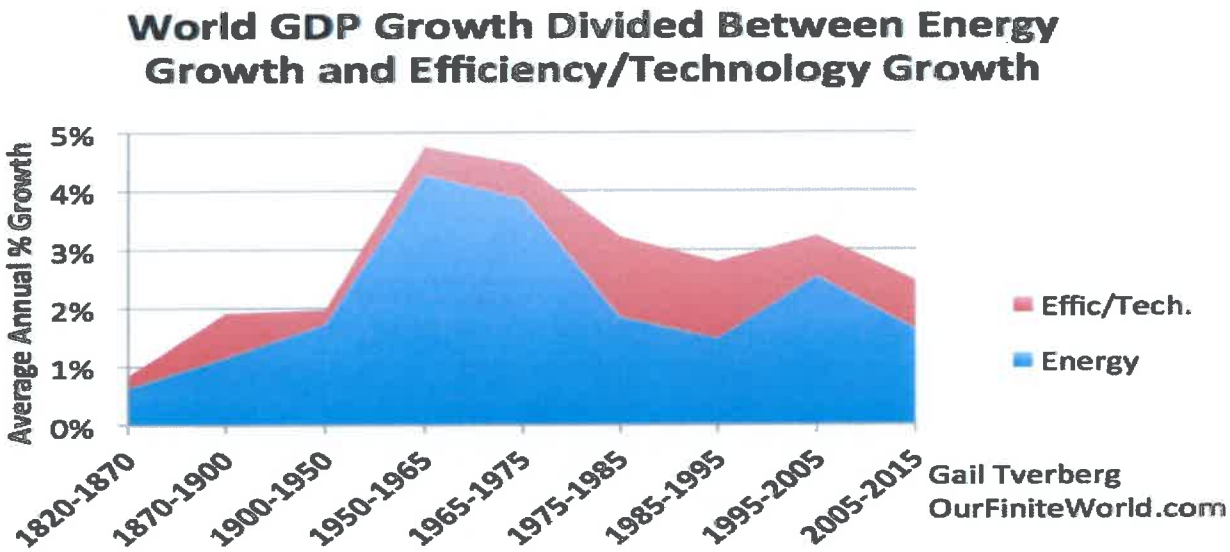


The next table shows the 1-year change from 2015 to 2016 by energy source. It shows that energy consumption increased by 1.3% in 2016. Renewables increased from 9.5% to 10.1%. Coal fell from 28.9% to 28.1% while oil, natural gas, and nuclear energy all rose slightly. The table below and the one above show that even as the use of renewables is increasing at a rapid rate, it is doing so from a small base. These two tables also show that, while the use of coal has declined, that the total use of fossil fuels has continued to edge higher.

Energy Consumption by Source		2015		2016		
		Million Tons	% Total	Million Tons	% Change	% Total
Oil	Fossil Fuel	4341	33.1%	4418	1.8%	33.3%
Natural Gas	Fossil Fuel	3147	24.0%	3204	1.8%	24.1%
Coal	Fossil Fuel	3785	28.9%	3732	-1.4%	28.1%
Nuclear Energy	Non-Renewable	583	4.4%	592	1.5%	4.5%
Hydroelectricity	Renewable	883	6.7%	910	3.1%	6.9%
Other Renewables	Renewable	367	2.8%	420	14.4%	3.2%
Totals		13106	100.0%	13276	1.3%	100.0%

Global GDP Growth and Energy Consumption

The next chart summarizes global GDP growth and total energy consumption over the past 200 years.



The above chart shows the following:

- Global GDP growth has been consistently positive. In fact, global GDP growth has been positive in all but one of the past 50 years.
- Energy consumption has always been less than global GDP growth, due to gains in technological efficiency.

Energy consumption is expected to continue rising, due to population growth, economic growth, and rising living standards in the emerging markets. Further efficiency improvements are also expected due to ongoing technological advancements.

It's going to take a long time to find other ways to create the products made from fossil fuels

To gain a sense as to why transitioning from fossil fuels to renewables is going to take time – even a long time – consider the lists below which show the products people consume which are made from fossil fuels. Many hundreds of millions of people are using products made from fossil fuels all throughout their day, including at home while awake or asleep, how we eat, how we travel, our leisure and entertainment, the places we work, and how we conduct our work.

Products Made from Oil

People consume 95 million barrels of oil per day, and there are 42 gallons of oil in each barrel. In total, people consume 1.45 trillion gallons of oil annually. About half our oil consumption is used for transportation. Oil also is used to make about 6,000 products, including those listed below.

Ammonia	Diesel fuel	Insecticides	Shoe Polish
Anesthetics	Dishes	Life Jackets	Shoes
Antifreeze	Dishwasher parts	Linings	Shower Curtains
Antihistamines	Dresses	Linoleum	Skis
Antiseptics	Drinking Cups	Lipstick	Soap
Artificial limbs	Dyes	Luggage	Soft Contact lenses
Artificial Turf	Electric Blankets	Model Cars	Solvents
Aspirin	Electrician's Tape	Mops	Speakers
Awnings	Enamel	Motor Oil	Sports Car Bodies
Balloons	Eyeglasses	Motorcycle Helmet	Sun Glasses
Ballpoint Pens	Fan Belts	Movie film	Surf Boards
Bandages	Faucet Washers	Nail Polish	Sweaters
Basketballs	Fertilizers	Nylon Rope	Synthetic Rubber
Bicycle Tires	Fishing Boots	Oil Filters	Telephones
Boats	Fishing Rods	Paint	Tennis Rackets
Cameras	Floor Wax	Paint Brushes	Tents
Candles	Folding Doors	Paint Rollers	Tires
Car Battery Cases	Food Preservatives	Parachutes	Toilet Seats
Car Enamel	Football Cleats	Percolators	Tool Boxes
Cassettes	Football Helmets	Perfumes	Tool Racks
Caulking	Footballs	Petroleum Jelly	Toothbrushes
CD Player	Gasoline	Pillows	Toothpaste
CD's & DVD's	Glycerin	Plastic Wood	Transparent Tape
Clothes	Golf Bags	Purses	Trash Bags
Cold cream	Golf Balls	Putty	TV Cabinets
Combs	Guitar Strings	Refrigerant	Umbrellas

Cortisone	Hair Coloring	Refrigerators	Upholstery
Crayons	Hair Curlers	Roller Skates	Vaporizers
Curtains	Hand Lotion	Roofing	Vitamin Capsules
Dashboards	Heart Valves	Rubber Cement	Water Pipes
Denture Adhesive	House Paint	Rubbing Alcohol	Wheels
Dentures	Ice Chests	Safety Glasses	Yarn
Deodorant	Ice Cube Trays	Shag Rugs	
Detergents	Ink	Shampoo	
Dice	Insect Repellent	Shaving Cream	

Products Made from Coal

Following is a list of products made from coal. Coal is used to make steel, concrete, and insulation, as well as batteries, fertilizers, paint, pens, and plastics.

Abrasives	Golf Balls	Plastic
Baking Powder	Insulation	Rubber Bands
Batteries	Paint	Steel
Chalk	Paper Clips	Tray
Concrete	Perfumes	
Fertilizer	Pens	

Products Made from Natural Gas

Allergy Medicine	Fertilizer	Parachutes
Artificial Limps	Footballs	Perfume
Bandages	Golf Balls	Pipes
Camera Monitors	Guitar Strings	Refrigerators
Cameras	Helmets	Safety Glasses
Cellphones	Insect Repellent	Tires
Cleats	Insecticides	Tires
Cortisone	Life Vests	Tool Racks
Crayons	Lipstick	Toothpaste
Dentures	Paintbrush	Vitamin Capsules

Despite greater use of renewable energy sources, worldwide fossil fuel usage has never been higher than it is today. Since the end of the Global Financial Crisis, from 2010 to 2016, usage of fossil fuels has increased seven straight years.

4 – Energy has significant diversification benefits that cannot be replicated through other investments

The Value of Energy in a Portfolio Context

In a portfolio context, the value of energy exposure is that its returns act differently than the broad market and it acts differently than all other sectors. In other words, we can't sell energy and invest the proceeds in another sector or index and achieve similar diversification. The table below summarizes the correlations of each sector in the S&P 500 and to every other sector.

Correlations 10/89-9/17		1	2	3	4	5	6	7	8	9	10
Financials	1	1.00									
Technology	2	0.52	1.00								
Health Care	3	0.58	0.39	1.00							
Industrials	4	0.80	0.66	0.56	1.00						
Energy	5	0.48	0.36	0.35	0.58	1.00					
Consumer Discretionary	6	0.78	0.71	0.52	0.85	0.43	1.00				
Consumer Staples	7	0.58	0.30	0.69	0.58	0.35	0.56	1.00			
Telecommunications	8	0.43	0.48	0.40	0.49	0.33	0.52	0.41	1.00		
Utilities	9	0.34	0.15	0.37	0.37	0.44	0.26	0.45	0.35	1.00	
Materials	10	0.68	0.54	0.45	0.83	0.64	0.74	0.48	0.39	0.29	1.00
S&P 500		0.84	0.80	0.68	0.80	0.61	0.89	0.65	0.62	0.42	0.79

- The above table shows that Energy's correlation to the Index is unique:
- Energy has the second lowest correlation to the S&P 500 at 0.61; only Utilities has a lower correlation to the index at 0.42;
- Comparatively, Technology's correlation to the S&P 500 is 0.80, Financials is 0.84, and Consumer Discretionary is 0.89.
- The above table also shows that Energy's correlation to all other sectors is also unique:
- Energy has a correlation of less than 0.50 to 7 of the S&P 500's 9 other sectors (there are 10 sectors in the index, so excluding energy there are 9);
- Industrials and Consumer Discretionary have had correlations of less than 0.50 to just 2 of the other 9 sectors;
- Financials have had a correlation of less than 0.50 to only 3 of the 9 other sectors;
- Materials have had a correlation of less than 0.50 to 4 of the other 9 sectors;
- Consumer Staples, Health Care and Technology have had a correlation of less than 0.50 to 5 of the other 9 sectors;
- Only Telecommunications and Utilities have had a lower correlation to all other sectors than Energy, but Energy also has a low correlation to both Telecom and Utilities of 0.33 and 0.44, respectively.

In short, Energy provides unique exposure in a portfolio context because it provides high-levels of diversification that cannot be replicated through other investments.

5 – Lack of a substitute to fossil fuels that meets the large demand for energy

An earlier chart showed that renewables have only grown from 6% to 10% of energy production over the past 50 years. Another chart showed that every sector of the economy obtains 15% or less of its energy from renewables. In short, there is not a substitute for fossil fuels that meets the enormous global demand for energy.

Why Has Adoption of Renewables Been Slow?

There are many reasons why renewables have only gained a few percent market share of global energy production over the past several decades, including the following:

Demand for Fossil Fuels Remains High: Earlier tables listed dozens of the thousands of products made from fossil fuels that are regularly used by hundreds of millions or billions of people.

85% of fossil fuel growth will come from emerging countries, not from the West: Even if people in advanced countries were to reduce their consumption, the use of fossil fuels is poised to increase. That's because 85 percent of the future growth in the use of fossil fuels is expected to come from developing countries.

Lack of renewables on a scale that meets demand: There is not a substitute available in the magnitude of supply that meets the enormous demand for products made from fossil fuels.

Despite several decades of research and development, wind and solar total less than 3% of energy consumption. Battery power and storage has recently improved, but they still have a long way to go, and we need a much larger infrastructure grid of battery power for EV's to become widely used. Carbon capture and storage seeks to capture and store carbons underground, but the technology is still in its infancy. Nuclear power is available in large volume and it is not a fossil fuel, but it is also controversial.

Consumers Are Willing to Pay More, but Only a Little: In 2016 Gallup reported that Americans who are worried "a great deal" about climate change is at a three-decade high, but it's still just 45 percent. Just 42 percent of Americans think that climate change will pose a serious threat in their lifetimes. An Associated Press-NORC-University of Chicago poll reports that just 38 percent of Americans are extremely or very worried about it.

The AP-NORC-University of Chicago poll also found that Americans are willing to pay for reducing carbon emissions, but only a little. That poll also found that only 54% of Americans supported President Obama's rules to cut pollution from coal power plants, and, when the question also included that thousands of jobs would be lost, that support fell to 45%.

Lack of Government Regulations That Require Reduced Carbon Emissions: Legislation by governments across many nations that sets standards is the only action with certainty that will reduce carbon emissions. Ultimately, as David Victor from the University of San Diego and a member of the working

group that prepared the 2014 Intergovernmental Panel on Climate Change report stated, the solution to global warming is going to have to be governments enacting legislation that requires it.

The following is an excerpt from the Energy Realities blog which highlights why renewables have not been widely adopted yet, and what needs to be done to achieve greater use of renewables:

Facilitating renewables

When it comes to renewable energy, there are two basic problems: supply and transport. Unlike traditional nuclear or coal power plants, which deliver predictable, steady streams of electricity to houses and factories, wind, solar and hydro power depend on weather, which can be fickle and unpredictable. That means supplies can dip too low at crucial times or soar too high, sending excess electricity into a carefully calibrated power grid.

And renewable energy supplies are often located far from the cities and factories where electricity is needed most. The wind whistling across the wide-open plains of just three U.S. states – North Dakota, Kansas, and Texas – could power the entire nation. But without massive investments in new high-voltage power lines to move electricity from the Great Plains to the heavily populated coasts, windmills are useless.

The problem is that our electrical grids are relics, dating back a century. In the U.S., power supplies are still local affairs, supplying nearby cities or at best patching into rickety local networks that cover a few states. In Europe, the picture is further complicated by national borders, which require reconciling the competing and conflicting regulations of dozens of different countries.

If renewable energy sources are going to be a part of our electricity supply, the grid needs a wholesale overhaul. While discussions about the smart grid often focus on smart meters in private homes and other micro-fixes, the most important investments will be massive, on the scale of the interstate highway system that changed the face of America a half century ago.

Planners are focusing on making power grids larger and more interconnected, to make sure that excess power can be moved where it's needed easily and efficiently. That's important because larger networks equal more stable energy supplies – and a higher percentage of renewables.

"If you have a large area, the wind is always blowing somewhere," says Paul Wilczek of the European Wind Energy Association. "If we're able to combine wind farms over a large area, output is pretty flat."

As it stands, Europe's grid can't manage it all – and isn't yet ready for the thousands of windmills nine countries plan to install in the stormy North Sea, let alone pie-in-the-sky plans like filling the Sahara with solar panels.

Getting it done

Big decisions need to be made now if we have any intention of getting improved grids in place in the next decade. In Europe, regulators hope to add more than 25,000 miles of power lines — a quarter of them long-distance, high-voltage wires to move electricity from coastal regions deep inland – by 2020. It's a tremendous task. "Short term in grid planning is not really short," Wilczek says. "This is infrastructure that's going to be there for 50 years, so you don't put it in fast."

Like a river, electricity flows indiscriminately whether or not customers are using their power at any given moment. Right now, anything that's not used is simply wasted, making up-to-the-second data provided by smart meters valuable to energy companies looking to fine-tune their output.

And in the long term, a steady energy supply will also require ways to store energy produced during off-peak hours, when supply is high but demand is low. Pilot projects to smooth out supply and demand using smart meters, batteries, water pumps, hydrogen fuel cells and even warehouses full of frozen fish are already in place. Electric cars, like the Nissan Leaf or Chevy Volt, are another way to store energy, by charging the car batteries using electricity produced during off-peak hours.

Improving the world's electricity infrastructure isn't sexy, but it's vital. When the lights still go at the flick of a switch half a century from now, we'll be glad we took the leap.

6 – Use of alternative energy will increase, quite probably significantly, but the winners could include existing oil, gas, or utility companies that have entered or could enter the alternative energy space

While technological progress will be made and the use of alternatives will rise, nobody knows who the winners will be. They could include companies that have not been formed yet or current alternative energy companies. But the winners could also include existing oil, gas, and utility companies. Large sums of research and development into alternative energy are being made by utilities, oil and gas companies, governments, and philanthropists. The companies noted below, whose business is primarily oil and gas, have made the following investments in renewable energy:

- Total has made investments in battery power, solar, and biofuels, and has stated they will invest $500 million annually in renewables. Five years ago, Total bought SunPower for $1.4 billion, and set up a division called New Energies that will develop low-carbon technologies.

- Shell has set up a New Energies division, under the control of Executive Board member Maarten Wetselaar, with an annual budget of $200 million. Investments so far have included two windfarms in the Netherlands that could generate electricity power for 825,000 households. Shell however, did eliminate its wind power projects.

- Exxon recently initiated plans to evaluate Carbon Capture and Storage with a fuel cell company.

- In May 2015, executives from six large oil and gas companies in Europe – BG, BP, Eni, Shell, Stateoil, and Total – wrote to the United Nations, highlighting initiatives they were already undertaking to reduce carbon emissions, and pledging to do more.

But these oil and gas executives also wrote "For us to do more, we need governments across the world to provide us with clear, stable, long-term, ambitious policy frameworks." Quotes such as these from energy executives as well as the quote from Mr. David Victor on behalf of the IPCC highlight Staff's view that reducing and eventually eliminating the use of fossil fuels needs government legislation and enforcement that requires it.

7 – Regarding whether existing assets could become stranded, technological advancements are always underway in every segment of the economy

Some proponents of divestment of fossil fuels argue that holding such investments will result in large losses because such assets will become obsolete, also called "stranded assets." Staff points out that economic advancement, modernization, and obsolescence are taking place all the time in every sector of the economy. As shown in the table below, 365 companies in the S&P 500 in 1987 are no longer in the index, while there have been 371 new additions to the index since then.

Technological Advancement and Modernization Takes Place in Every Industry	--- Companies in the S&P 500	
	#	%
In the index in 1987 but not in 2017	365	73%
New additions to the index from 1987 to 2017	371	74%

Once household names that were in the S&P 500 index in 1987 but are no longer include:

- Acme
- Albertson's
- Eastman Kodak
- Federated Department Stores
- Heinz
- ITT
- JC Penney
- Kmart
- Long's Drugs
- Lucky's
- Macy's
- MCI
- National Semiconductor
- Pitney Bowes
- Ramada Inn
- Reebok
- RJR Nabisco
- Rubbermaid
- Sears Roebuck
- Tandem Computers
- Rubbermaid

Additions to the S&P 500 since 1987 include:

- AFLAC
- Berkshire Hathaway
- Blackrock
- Charles Schwab
- Chipotle
- E*TRADE
- Electronic Arts
- Facebook
- Google
- Harley Davidson
- Intuit
- Lowe's
- Mastercard
- Microsoft
- Nasdaq
- Netflix
- O'Reilly's Automotive
- Priceline
- Progressive
- Public Storage
- Qualcomm
- Robert Half
- Ross Stores
- Salesforce
- Southwest Airlines
- Starbucks
- State Street
- T. Rowe Price
- Trip Advisor
- Target
- TJX
- United Parcel Service
- Ulta
- Verizon
- Visa
- Xerox

In short, arguments that assets may become stranded is not new. Technological advances are taking place all the time all throughout the economy.

8 – Past predictions of peak oil and declining supply of traditional energy sources have proved to be completely incorrect, due to rising demand and technological improvements

"Petroleum has been used for less than 50 years, and it is estimated that the supply will last about 25 or 30 years longer." July 19, 1909, Titusville Herald, Titusville, PA

"...within two to five years the oil fields of this country will reach their maximum production and from that on we will face an ever-increasing decline." October 23, 1919, Oil and Gas News

"The best information is that present supply will last only 15 years. That is a conservative estimate. "Captain H.A. Stuart, Director of the Naval Petroleum Reserves, March 9, 1937, Brooklyn Daily Eagle

"As a nation, Americans have become reluctant to accept the prospect of physical shortages. We must recognize that world oil production will likely peak in the early 1990's, and from that point on will be in a declining curve. By the early part of the 21st century, we must face the prospect of running out of oil and natural gas." 1977, Department of Energy

"...the world will reach peak oil production before the year 2000. Production of oil worldwide will then drop to zero over about 20 years. October 17, 1980, Syracuse Post Standard, Syracuse, New York, quoting physicist Dr. Hans Bethe

"Unfortunately, oil production will likely peak by 2020 and start declining. Without a change, developing countries will be ultimately be left out in the dark, and developed countries will struggle to keep the lights on." Richard Smalley, Nobel Laureate in Chemistry, 1996

Doomsday forecast of peak oil and the world running out of food and energy have been proven completely wrong for the past 100 years, even as global GDP has risen approximately 20-fold. That's because advances in technology and new discoveries have repeatedly proven predictions of peak supply to be incorrect.

Advances in increased supply and reduced cost have occurred in solar, wind, batteries, and electric vehicles, and we all of this will continue. However, improvements in precision drilling and the discovery of huge volumes of cheap natural gas have also occurred.

In 2014 the IEA stated that the supply of oil, liquid hydrocarbons, and biofuels is expected to meet global demand for liquid fuels for at least the next 25 years. Their forecast contradicts the views of some analysts that supply will peak and then decline. Finally, the IEA projects that global reserves will likely increase, not decline, as innovative technologies increase production.

9 – Alternative Energy ETF's have lost money the past 10 years

Some proponents of divestment might suggest that if Staff does not recommend divestment, then at least Staff should recommend investments in alternative energy. Even rapid growth of an industry such as renewables does not mean that the sector will provide excess returns. Below is a table

showing that almost all alternative energy ETF's have lost money the past 10 years, even as renewables have grown by 350%.

For example, 15 to 20 years ago, mobile phones began to experience explosive growth. Blackberry was an original leader in the rapid adoption of mobile phones, and its stock appreciated by 115% annualized for five years from late 2002 to late 2007. However, Blackberry was displaced as the market leader when Apple. In the past 10 years, Blackberry's stock has declined by 21.6% annualized, a total loss of more than 85 percent. Erickson, another one-time leader in mobile phones, has seen their stock decline by 70.2% annualized the past 5 years, a cumulative loss of more than 99%. Nokia's stock has fallen by 14.1% annualized the past 10 years, a total loss of 78%.

In short, even though mobile phones experienced rapid growth, an investor could have lost a great deal of money if they chose the wrong companies. Even an equally weighted basket of Apple, Samsung, Blackberry, Erickson, and Nokia would have lost money the past 10 years, despite the massive adoption of mobile phones and regular upgrades and new capabilities during that time. As noted below, even though renewables have grown over 4x the past 10 years, the industry's returns have been negative.

Clean Energy ETF Returns thru 9-30-2017	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
First Trust Global Wind Energy ETF	6.6%	9.1%	17.9%	6.1%	
First Trust Nasdaq Clean Energy Edge Green Energy ETF	27.7%	1.1%	17.6%	4.1%	-2.1%
Guggenheim Solar ETF	11.9%	-16.7%	9.2%	-14.7%	
iShares Global Clean Energy ETF	1.6%	-3.2%	8.6%	-6.1%	
MSCI Global Alternative Energy	15.3%	-1.0%	15.0%		
PowerShares Cleantech ETF	26.4%	13.2%	14.8%	9.1%	3.4%
PowerShares Global Clean Energy ETF	15.7%	0.9%	12.2%	0.2%	-6.9%
PowerShares Wilderhill Clean Energy ETF	23.4%	-7.5%	4.6%	-8.0%	-13.3%
PowerShares Wilderhill Progressive Energy ETF	9.7%	-3.1%	2.2%	2.3%	-0.2%
VanEck Vectors Global Alt Energy ETF	15.0%	1.3%	15.8%	1.0%	-7.4%
Average of 10 Clean Energy ETF's	15.3%	-0.6%	11.8%	-0.7%	-4.4%
S&P 500	18.6%	10.8%	14.2%	14.4%	7.4%
S&P 500 Energy	0.2%	-5.7%	1.0%	5.3%	1.0%
MSCI ACWI	19.3%	8.0%	10.8%	9.8%	4.5%
MSCI ACWI Energy	8.3%	-4.9%	-0.1%	2.3%	-0.5%

10 – Energy has slightly outperformed the S&P 500 since 1974, has outperformed in 26 of the past 43 ¾ years, and has significantly outperformed when the S&P 500 has declined; from 2000 to 2007 energy outperformed the S&P 500 by 233.3% v. 14.2%; from 1983 to 2007 energy outperformed the S&P 500 by 3,799% v. 1,862%; divestment back in these periods would have cost SFERS an enormous amount of money

Calendar Year Returns			
Year	S&P Energy	S&P 500	Over / Under
1974	-24.3%	-26.4%	2.1%
1975	24.0%	37.2%	-13.2%
1976	35.1%	23.9%	11.2%
1977	-1.9%	-7.1%	5.2%
1978	11.8%	6.6%	5.2%
1979	45.5%	18.6%	26.9%
1980	74.5%	32.5%	42.0%
1981	-23.6%	-4.9%	-18.7%
1982	-12.3%	21.6%	-33.9%
1983	25.9%	22.5%	3.4%
1984	8.1%	6.3%	1.8%
1985	18.5%	31.7%	-13.2%
1986	17.0%	18.7%	-1.7%
1987	8.8%	5.3%	3.5%
1988	21.4%	16.6%	4.8%
1989	40.4%	29.0%	11.4%
1990	2.9%	-3.1%	6.0%
1991	6.9%	30.5%	-23.6%
1992	2.3%	7.6%	-5.3%
1993	15.9%	10.1%	5.8%
1994	3.7%	1.3%	2.4%
1995	31.0%	37.6%	-6.6%

Calendar Year Returns			
Year	S&P Energy	S&P 500	Over / Under
1996	25.9%	23.0%	2.9%
1997	25.3%	33.4%	-8.1%
1998	0.6%	28.6%	-28.0%
1999	18.7%	21.0%	-2.3%
2000	15.7%	-9.1%	24.8%
2001	-10.4%	-11.9%	1.5%
2002	-11.1%	-22.1%	11.0%
2003	25.6%	28.7%	-3.1%
2004	31.5%	10.9%	20.7%
2005	31.4%	4.9%	26.5%
2006	24.2%	15.8%	8.4%
2007	34.4%	5.5%	28.9%
2008	-34.9%	-37.0%	2.1%
2009	13.8%	26.4%	-12.6%
2010	20.5%	15.1%	5.4%
2011	4.7%	2.1%	2.6%
2012	4.6%	16.0%	-11.4%
2013	25.1%	32.4%	-7.4%
2014	-7.8%	13.7%	-21.5%
2015	-21.1%	1.4%	-22.5%
2016	27.3%	12.0%	15.4%
2017	-6.6%	14.3%	-20.9%

Annualized Returns through 09/2017			
	S&P Energy	S&P 500	Over / Under
5 Yr	1.0%	14.2%	-13.2%
10 Yr	1.0%	7.4%	-6.4%
20 Yr	7.2%	7.0%	0.2%
30 Yr	10.5%	9.5%	1.1%
40 Yr	11.5%	11.6%	-0.1%
1974-3q2017	11.0%	10.9%	0.1%

Note: 2017 returns are thru 9-30-2017.
Peach = Energy outperformed the S&P 500.

The above table shows the following:

- The Energy sector outperformed the S&P 500 in 26 of the past 43 3/4 years.

- From 1974 to June 2017, Energy slightly outperformed the S&P 500 by 0.1% annualized.

- Even though the Energy sector has dramatically underperformed the S&P 500 over the past 5 and 10 years, it has outperformed the index over the past 20 and 30 years.

- In the 8 years in which the S&P 500 declined between 1973 and 2016, the Energy sector outperformed in the index in 7 of those 8 years.

- As recently as 2000 to 2007, the energy sector outperformed the S&P by 233.3% v. 14.2%. If that were to occur again, on a portfolio with approximately $500 million in fossil fuel holdings, that could cost SFERS approximately $1.1 billion in just eight years.

- In the 25-year period from 1983 to 2007, the energy sector outperformed the S&P by a whopping 3,799% v. 1,862%. If that were to occur again, on a portfolio with approximately $500 million currently in fossil fuel holdings, divestment could cost SFERS nearly $10 billion over 25 years.

Note: The above two bullet points are based on returns of the S&P 500 energy sector v. the S&P 500 index. Returns are compounded and reinvested each year.

11 – Our existing holdings in the CU200 have been profitable

Attached is a spreadsheet showing our holdings in the CU200 with a market value of $502.88 million as of September 30, 2017. The cost basis on these holdings is $450.15 million, meaning SFERS has earned a profit of $52.74 million on our current CU200 holdings (all rounded) (see Attachment A). As the energy sector returned 6.99% the past three months, the estimated profit on our CU200 holdings as of December 31, 2017 is approximately $80 million.

The motion for SFERS to divest of all its fossil fuels was made on May 17, 2017. From July 1, 2017 to December 31, 2017, the MSCI ACWI Energy Sector returned 17.42%, significantly outperforming the MSCI ACWI which returned 11.46%. If SFERS had divested of $450 million in equity investments in fossil fuel companies by July 1, 2017, between that date and December 31, 2017, it would have cost SFERS approximately $78 million in gains and about $27 million in excess returns over the MSCI ACWI.

12 – Our oil and natural gas investments are potentially profitable

The U.S. Energy Information Agency forecasts an ongoing transition from coal to natural gas, potentially making our investments in the latter profitable. They also project oil prices will be $109 a barrel in 2040, from roughly $65 today, a projected increase of 70 percent. Just in the past 15 months, from November 2016 to January 2018, oil prices have risen from about $42 to $65 a barrel, a rise of more than 50 percent.

Further, on January 12, 2018, the Wall Street Journal noted that due to shrinking inventories, production cuts, and strong demand, that more and more forecasters are expecting oil to rise to $80 a barrel in 2018. That means prices would rise another 20 percent this year, and would have risen nearly 90 percent in less than 2 ½ years.

Lastly, in 2040 the EIA global demand for oil will be about 20 percent higher than today. Higher expected prices and rising demand could make our existing investments profitable. Even if demand flattens, investments can be profitable due to technological enhancements. Further, even if demand for fossil fuels rise, carbon emissions could be flat or decline, again due to technological improvements, increased use of renewables, more use of natural gas, and less use of coal.

13 – Being an engaged owner to promote change can be very impactful

Retirement Staff favors engagement over divestment because being an engaged owner helps shape how companies will do business in the future, including the ability to impact investments in solar, wind, carbon capture and storage, and other efforts to reduce carbon emissions.

Earlier we summarized positive actions by several large oil and gas companies and their investments in renewables. Engagement by institutional investors has been instrumental in the recent investments by large oil and gas companies to reduce their carbon emissions.

At SFERS Investment Committee meeting on November 16, 2017, Mr. Ophir Bruck, Senior U.S. Network Manager for the PRI, provided SFERS Board with examples of engagement that are having a positive impact that reduces carbon emissions.

Also, attached please find a paper written by Mr. Martin Skancke, Chair of the United Nations Principle for Responsible Investing, discussing why he favors engagement. (see Attachment B)

In summary, since more than 80 percent of global energy consumption comes from fossil fuels, nuclear power is also controversial, renewables are not ready for mass production and delivery, and existing oil and gas companies have vast resources, we believe that further engagement by shareholders is the best course of action to reduce carbon emissions.

14 - SFERS divested of tobacco stocks, which have significantly outperformed and cost SFERS approximately $62 million; divestment from energy stocks is potentially much more impactful

Even if the use of fossil fuels were in decline, that does not mean our investment returns in fossil fuel companies would be poor. Tobacco stocks are an example. SFERS divested of tobacco stocks in May 1998, just over 19 years ago. Smoking among adults in the U.S. has declined from 25 percent in 1997 to about 15 percent today. Despite the decline in the population that smokes, in the 19 ¼ years since SFERS divested of tobacco stocks, the restriction has cost SFERS nearly $62 million in returns, as noted in the next table.

SFERS US Public Equity Market Value as of:		Forward 1-year Returns for Russell 3000			Estimated FY-end market values		Impact of Tobacco
		R3000	ex Tobacco	Tobacco	R3000	ex Tobacco	Restriction on Returns
6/30/2017	$5,140,421,895	4.57%	4.75%	-8.52%	$5,375,409,065	$5,384,636,372	$9,227,307
6/30/2016	$4,793,960,754	18.51%	18.53%	16.22%	$5,681,302,046	$5,682,444,423	$1,142,377
6/30/2015	$5,241,683,766	2.14%	1.72%	38.27%	$5,353,763,247	$5,331,597,547	-$22,165,700
6/30/2014	$5,448,659,970	7.29%	7.25%	8.34%	$5,846,095,222	$5,843,723,383	-$2,371,839
6/30/2013	$4,718,615,534	25.22%	25.38%	11.00%	$5,908,661,379	$5,916,332,738	$7,671,359
6/30/2012	$4,169,624,629	21.46%	21.75%	4.35%	$5,064,574,543	$5,076,561,190	$11,986,647
6/30/2011	$4,167,178,778	3.84%	3.41%	36.04%	$4,327,185,579	$4,309,138,514	-$18,047,065
6/30/2010	$3,159,882,005	32.37%	32.16%	48.05%	$4,182,621,028	$4,176,079,598	-$6,541,429
6/30/2009	$2,957,393,796	15.72%	15.72%	16.02%	$3,422,336,758	$3,422,166,029	-$170,729
6/30/2008	$4,158,652,097	-26.56%	-26.82%	-9.38%	$3,053,947,572	$3,043,455,385	-$10,492,187
6/30/2007	$4,978,646,452	-12.69%	-12.84%	1.83%	$4,347,048,916	$4,339,490,251	-$7,558,665
6/30/2006	$4,245,660,683	20.07%	19.90%	30.78%	$5,097,726,747	$5,090,566,597	-$7,160,150
6/30/2005	$4,277,084,577	9.57%	9.43%	15.03%	$4,686,455,554	$4,680,466,922	-$5,988,632
6/30/2004	$4,035,453,895	8.06%	7.80%	33.45%	$4,360,785,945	$4,350,262,412	-$10,523,533
6/30/2003	$3,438,882,342	20.45%	20.48%	18.10%	$4,142,188,854	$4,143,323,602	$1,134,748
6/30/2002	$3,177,001,513	0.76%	0.70%	9.34%	$3,201,148,606	$3,199,222,035	-$1,926,571
6/30/2001	$3,638,498,420	-17.25%	-17.33%	-5.67%	$3,010,953,130	$3,007,991,946	-$2,961,184
6/30/2000	$4,533,448,388	-13.94%	-14.44%	95.24%	$3,901,620,986	$3,878,996,189	-$22,624,797
6/30/1999	$4,268,846,805	9.59%	10.02%	-26.56%	$4,678,120,567	$4,696,426,535	$18,305,968
6/30/1998	$3,681,156,391	20.10%	20.29%	8.14%	$4,421,116,952	$4,428,190,493	$7,073,541
Total Impact of Tobacco Restriction July 1998 to September 2017							-$61,990,534

SFERS tobacco restrictions have hurt our returns when the overall market has declined. In the four years when the Russell 3000 lost money (highlighted in yellow), our tobacco restrictions caused us to lose more than $43 million beyond the impact of the market decline.

The following table shows the annual returns of tobacco stocks and the S&P 500. Even as the percentage of adults in the U.S. who smoke declined from about 25% in the late 1990's to approximately 15% today, tobacco stocks outperformed the SP 500 by 8.2% annualized since the inception of SFERS ex-tobacco policy in 1998. Tobacco stocks have outperformed in 14 of the past 19 ¾ years, and, in the four years in which the S&P 500 declined, tobacco stocks outperformed the index by a total of 159.8%.

Calendar Year Returns			
Year	S&P Tobacco	S&P 500	Over / Under
1998	21.3%	28.6%	-7.3%
1999	-51.7%	21.0%	-72.7%
2000	94.7%	-9.1%	103.8%
2001	10.1%	-11.9%	22.0%
2002	-6.8%	-22.1%	15.3%
2003	41.3%	28.7%	12.6%
2004	19.8%	10.9%	8.9%
2005	25.2%	4.9%	20.3%
2006	22.2%	15.8%	6.4%
2007	19.9%	5.5%	14.4%
2008	-18.3%	-37.0%	18.7%
2009	25.6%	26.4%	-0.8%
2010	27.7%	15.1%	12.6%
2011	36.4%	2.1%	34.3%
2012	10.4%	16.0%	-5.6%
2013	17.0%	32.4%	-15.5%
2014	13.8%	13.7%	0.1%
2015	21.9%	1.4%	20.5%
2016	15.6%	12.0%	3.6%
2017	10.9%	14.3%	-3.4%

Annualized Returns through 09/2017			
	S&P Tobacco	S&P 500	Over / Under
5 Yr	14.6%	14.2%	0.3%
10 yr	16.2%	7.4%	8.8%
1998-3q2017	15.1%	6.9%	8.2%

Note: Peach = Years in which tobacco stocks outperformed the S&P 500.

CALPERS reports that divestment of tobacco stocks from their global equity portfolio has cost them over $3.7 billion.

15 – Barring external managers from making investments that they, as fiduciaries, deem prudent is inconsistent with fiduciary prudence when they are evaluating individual securities every day and we are not

It is not consistent with fiduciary prudence to restrict external managers from using their judgement on which securities to invest in, and to replace their judgement with ours when they are constantly evaluating individual companies and we are not.

When CALPERS Board approved their divestment of tobacco stocks, they did not restrict their active managers from owning them. As noted earlier, divestment of tobacco stocks in their passive strategies has cost CALPERS $3.7 billion.

16 – The Principle's for Responsible Investing does not recommend divestment; To promote a cleaner environment, the PRI recommends becoming a more engaged owner

The PRI supports engagement; they do not recommend divestment of fossil fuels. Attached is a report from Mr. Martin Skancke, the Board Chair for the PRI, which outlines the PRI's view supporting engagement rather than divestment. (see Attachment B)

17 – By restricting SFERS investable universe, it may become necessary to reduce our assumed rate of return and increase required contributions from the city-county of San Francisco as well as active employees

The proposed motion reduces SFERS investable universe by approximately 3-4 percent. Divestment would reduce SFERS investable universe and thus potentially making it necessary to reduce our assumed rate of return. Reducing the investment universe also reduces the potential for diversification, and thus could increase our risk.

Staff notes that over the past 10 years SFERS has returned 6.00% annualized. NEPC estimates that our future 5 to 7 year returns will be 6.9%, and Staff's sample of other institutional investment consultants indicates their expected returns over the next 10-years is approximately 6.6%.

Any action taken by the Board that materially reduces the capital market return assumptions will certainly impact Cheiron's considerations on a reasonable assumed rate of return in the July 1, 2018 valuation. Cheiron has estimated that a 25 basis point reduction in the Plan's assumed rate of return (from 7.5% to 7.25%) would increase the employer contribution rate by 2.7% (from 20.6% to 23.3%) and increase the City's contributions by $89 million and prolong the high level of employee contribution rates under Proposition C cost-sharing provisions.

Summary

A monumental transition is underway in how humankind produces energy. However, the scale and timing of the transition from fossil fuels to alternative equity is still highly uncertain. Staff cannot forecast whether such transition will take place over 20, 30, 40 years, or longer, even as we see the transition is underway and that it will continue.

Indeed, past predictions of peak supply have been proven completely wrong for about 100 years, and the use of fossil fuels has risen every year since the Global Financial Crisis. In the past 50 years renewables have risen from 6% of energy consumption to only 10%, as new supplies of oil and enormous supplies of natural gas have been discovered, and such discoveries have accelerated in the past decade.

There is greater potential than in the past that the pace of adoption of renewables is about to accelerate. However, there are still major technological issues to solve including the inconsistent supply of solar and wind, the need to build an enormous storage and distribution network for them, the need to build a huge charging grid for electric vehicles, more need for improved battery power, increased production of lithium, reduced costs, and less dependency on government subsidies. Hence, we still think that substantial use of renewables is going to take quite some time.

Meanwhile, less use of coal, greater use of natural gas, gains in fuel efficiency, consumers becoming smarter about how they consume energy, and technological gains that reduce carbon emissions from oil and natural gas, can all be helpful in reducing emissions while the world transitions toward renewables.

Staff's Recommendation:

For the reasons noted herein, Staff's recommendation is to not approve the motion to divest of all our CU200 securities in the public markets portfolio.

Additional Information

Investment Returns of the CU200 Companies

The following chart summarizes the investment returns of the publicly traded stocks for the most recent Carbon Underground 200 list. The returns of each stock are found in Attachment C.

Investment Returns of Co's in the CU200 as of 9-30-2017	Years 1	3	5	10	15	20	30
Oil Gas							
# of Companies:	95	93	89	75	57	57	57
# with Positive Returns	51	24	43	33	55	53	53
% with Positive Returns	54%	26%	48%	44%	96%	93%	93%
Average Return	1.9%	-10.3%	-3.1%	-0.4%	10.5%	7.3%	7.4%
Median Return	3.6%	-10.2%	-1.1%	-0.4%	10.8%	7.4%	7.8%
Coal							
# of Companies:	90	89	84	66	34	32	27
# with Positive Returns	70	55	37	30	32	29	23
% with Positive Returns	78%	62%	44%	45%	94%	91%	85%
Average Return	32.1%	3.2%	-3.4%	-2.1%	9.5%	5.8%	5.0%
Median Return	23.9%	2.7%	-2.9%	-0.6%	11.9%	6.7%	5.9%
Totals							
# of Companies:	185	182	173	141	91	89	84
# with Positive Returns	121	79	80	63	87	82	76
% with Positive Returns	65%	43%	46%	45%	96%	92%	90%
Average Return	16.6%	-3.7%	-3.2%	-1.2%	10.1%	6.8%	6.6%
Median Return	13.5%	-3.9%	-2.0%	-0.5%	11.2%	7.1%	7.2%

Note: Oil and Gas average and median 1 year returns exclude one stock, Sand Ridge, which returned 167316.7% in the past year, recovering from a penny stock to $20 per share.

Overall the above chart shows the following:

- Coal and Oil & Gas companies in the CU200 have had negative returns over the past 5 and 10 years. Coal has had very strong returns in the past year of 24-32%.

- Over the past 15 years, stocks in the CU200 have earned on average double digit returns of 10.1% to 11.2% annualized.

- Over the past 30 years coal stocks in the CU200 have returned on average 5.0-5.9%, and oil and gas stocks on the list have returned 7.4-7.8%, all annualized.

Carbon Emissions: Recent Developments

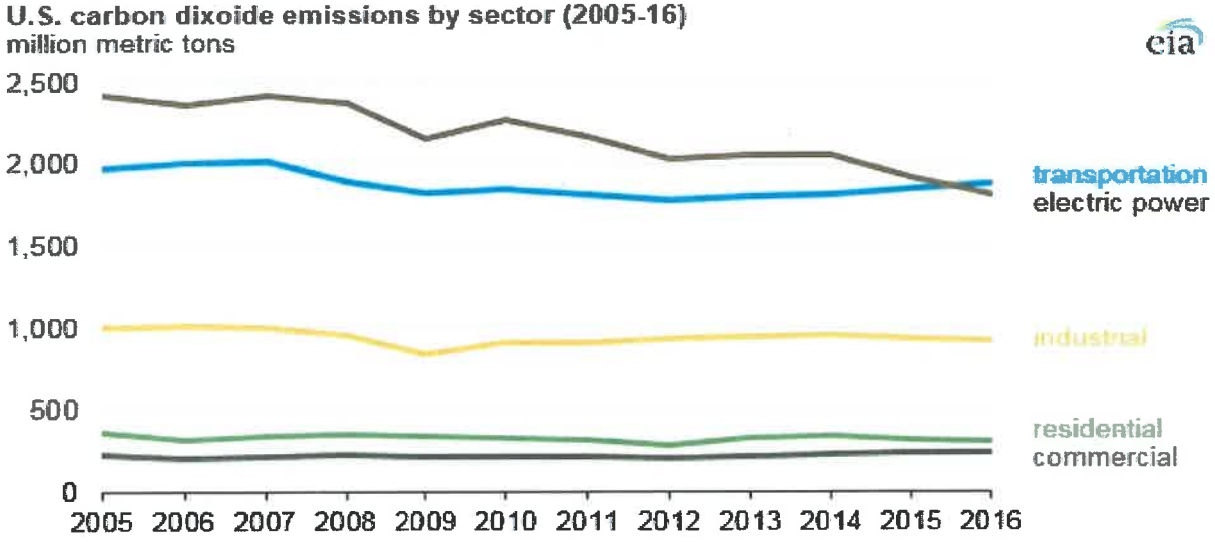
Key Takeaways

- Global carbon emissions have increased by only 0.3% annualized the past three years.
- In the U.S. carbon emissions have declined by 1.4% annualized from 2005 to 2016, a total reduction of 15.5%.
- Carbon emissions in the U.S. in 2017 are at the same level as they were in 1992, even as GDP grew by 80 percent and the population grew by 40 percent.
- Alternatives and natural gas have increased sharply while the use of coal has declined.
- The Executive Director of the IEA recently stated, "These three straight years of flat emissions in a growing global economy signal an emerging trend and that is certainly a cause for optimism, even if it is too early to say that global emissions have definitely peaked."

Growth in Carbon Emissions Has Declined

The International Energy Agency (IEA) reported that global carbon dioxide emissions in 2016 were essentially flat for the third straight year, even as global economic growth was 3.1 percent. In 2014, global carbon emissions grew by 0.7 percent, were flat in 2015, and edged up by 0.2 percent in 2016. The recent trend is a significant slowdown from the annual rate of 3.5 percent in carbon emission growth from 2000 to 2009. The 3-year growth in carbon emissions of less than 1 percent from 2014-16 was the slowest rate of growth since 1981-83.

In the U.S., carbon dioxide emissions fell by 3 percent in 2016, while the economy grew by 1.6 percent. The decline in carbon emissions in the U.S. was driven by robust growth in shale gas supplies and renewable power and a significant decline in coal. The U.S. has reduced carbon emissions by 15.6 percent since 2005. Emissions in the U.S. in 2016 are now at their lowest level since 1992, even as the economy grew by 80 percent and the population grew by 40 percent.



In 2016, worldwide coal demand fell, led by an 11 percent decline in the U.S. In China, emissions edged up just 1 percent, even as their economy grew by 6.7 percent. There were several reasons for China's modest increase of emissions in 2016: increased use of renewables, nuclear and natural gas, a switch from coal to gas in the industrial sector, five new nuclear power plants which increased nuclear output by 25 percent, and a decline in their use of coal. In Europe, emissions were flat, as demand for gas rose by 8 percent and use of coal fell by 10 percent.

From 2010 to 2015, energy from renewable sources grew by 15.2 percent annually, while natural gas rose by 1.7 percent, and use of oil and gas rose by 1.1 percent annually. In 2016, the use of coal on a global basis declined, replaced by increases in renewables and natural gas.

Dr. Fatih Birol, Executive Director of the International Energy Agency, stated "These three straight years of flat emissions in a growing global economy signal an emerging trend and that is certainly a cause for optimism, even if it is too early to say that global emissions have definitely peaked."

Carbon Emissions: Future Forecasts

Key Takeaways

- Global carbon emissions are expected to grow at 1/3rd their rate of growth from 2000-2009.
- Carbon emissions in the U.S. are projected to decline from 2017 to 2040 by 0.2 percent annually.
- Increased use of alternatives and natural gas, declining use of coal, adoption of electric vehicles, and technological improvements are expected to keep the growth of carbon emissions 2/3rds lower than in the previous decade.

Forecast is for slow growth in carbon emissions even as global GDP growth is high

From 2017 to 2035, global GDP is expected to increase by 80 percent, or 3.4 percent annualized, led by growth in emerging market countries. Growth in undeveloped countries is expected to lift 2 billion people out of poverty. Rising global prosperity is expected to drive increased energy demand, but energy demand is expected to rise by only 30 percent, or 2/3rds less than the rate of GDP growth.

Why is energy consumption expected to rise only 30 percent over the next 19 years while global GDP increases by 80 percent?

- The fuel mix will continue to adjust, as it has in recent years, with half of energy growth being produced by renewables.
- Renewables will be by far the fastest growing energy source due to improvements in technology, increased supply, and more competitive pricing.
- Among fossil fuel sources, natural gas will grow the fastest.
- Oil demand will grow over the next 20 years, but the pace of demand will slow as use of electric vehicles increases.
- Global coal consumption is set to peak.

Adopting a Carbon-Constrained Strategy for Part of SFERS Passive Public Equity Portfolio Now Makes Sense

1 - Transition to Electric Vehicles Could Soon Accelerate Significantly

Why EV's Have Not Yet Been Widely Adopted

In 2015, electric vehicles were still only 0.86% of all new vehicles sold, and only 0.15% of all vehicles on the road. People have been predicting that electric vehicles will replace gas powered transportation for many decades. It hasn't happened for several reasons: the cost of EV's, the lack of a grid to power them, the limited distance electric vehicles can travel before needing to be recharged, the time required for recharging, limited battery storage capabilities, insufficient production of lithium needed for battery power, and lower vehicle performance.

Recent Developments

- Price and Performance

Over the past 5 years, battery power has improved. Regarding performance, some electric vehicles can now get to 60 mph faster than a gas-powered sedan. The price of electric vehicles has also declined. Tesla's base model EV costs $35,000 and the base model Chevy Bolt is $37,500. However, including usual add-ons that people want, as well as sales taxes and registration, the all-in cost appears to still be around $50,000 or more.

- Battery Charging

Time to charge an EV takes as little as 30 minutes to as much as 12 hours, depending on the size of the battery and the speed of the charging point. For short distance driving, charging an EV will be similar to how we charge our mobile phones: we'll do so at home, often while we sleep. That still leaves a problem with long distance traveling. Public and workplace charging points are increasingly available. However, a 7kW public charging point provides just 30 miles of driving for every one hour of charge, or a 7-hour charge needed to drive 200 miles.

- EV's Currently on the Road

EV sales have averaged 32% annualized growth the past four years.

- EV sales appear to still be significantly dependent on tax subsidies

EV sales oftentimes still appear to be significantly dependent on government subsidies for consumers to buy them. In Hong Kong, in March 2017 Tesla sold nearly 3,000 electric vehicles, the last month subsidies were available. The subsidies reduced the cost from about $130,000 to $75,000. When the subsidies ended, the next month Tesla did not sell a single electric vehicle in Hong Kong. In Denmark, sales of EV's plunged 70% when government subsidies were ended.

▪ Are EV subsidies a giveaway to the rich?

Critics of subsidies for EV's note that they enable wealthy people to buy an expensive vehicle at a significant discount. They also point out that, even after-tax credits, it's still very expensive for most people to buy an EV. That's because a base model cost at least $35,000, and after sales tax, registration, and with usual features, a fully equipped EV still costs around $55,000.

Forecast for adoption of EV's

There is a wide range of forecasts for adoption of EV's. The IEA forecast that EV's will total just 1% of vehicle sales in 2020, while the Deutsche Bank forecast is 11%. The average of seven forecasts we reviewed is that 5.4% of sales in year 2020 will be EV's, or 62% annualized growth over the next four years. But it would still represent just 1 in nearly 20 vehicles sold.

Currently, there are 1.1 billion cars on the road. The International Energy Agency (IEA) has made the following forecasts: in 2040, they expect 2 billion vehicles on the road; in 2040, EV's are projected to be 35% of new car sales and 25% of all cars on the road. That means the IEA expects 500 million EV's on the road in 2040. But it also means they expect 1.5 billion gas powered vehicles on the road in 2040, or nearly 400 million more than today.

Bloomberg New Energy Finance and the IEA both predict that EV's and hybrids could represent 35% of light-vehicle sales by 2040. That means the projected Cumulative Annual Growth Rate (CAGR) for EV sales is 28% annualized from 2017 to 2040. However, since the IEA forecasts the number of cars on the road will rise from 1.1 billion today to 2 billion in 2040, the BNEF forecast suggests that only about 27% of vehicles on the road in 2040 will be electric.

The IEA forecasts that EV's will grow from less than 1% of current vintage year sales to 35% in 2040, and that the number of EV's on the road will increase from 0.15% today to 25% in 2040. OPEC this year raised their forecast for EV sales in 2040 from 46 million, a prediction they made just two years ago, to 266 million.

Volvo announced in July 2017 that it will manufacture only electric or hybrid vehicles starting in 2019. A few days later France stated it would ban the sale of cars with gas or diesel-powered engines starting in 2040.

China announced a goal to have 10 percent of vehicle sales be EV's by 2019 and 12 percent by 2020.

India announced plans to have 100 percent of vehicle sales by electric by 2030.

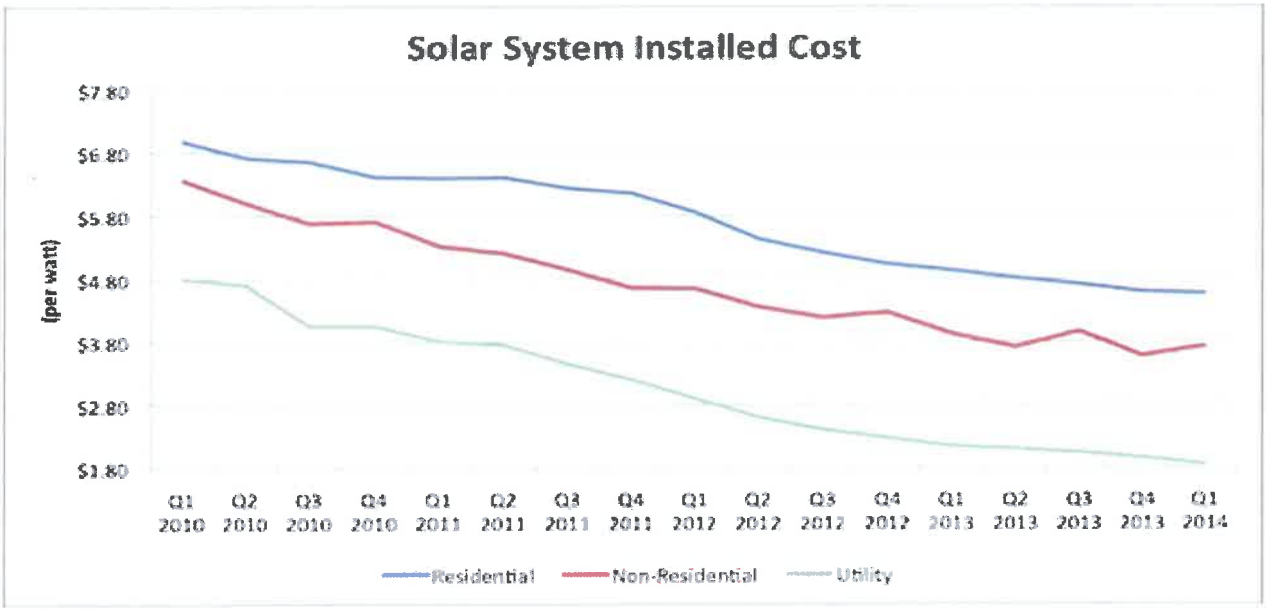
In the first 10 months of 2017, the sale of EV's rose by 50% compared to the same period in 2016, an increase from the 32% annualized sales growth from 2013 to 2016. Even so, just over 1% of all vehicles sold in 2017 will be EV's. That said, due to improvements in price and performance, more charging stations, greater selection and customer awareness, the sale of EV's appears to be

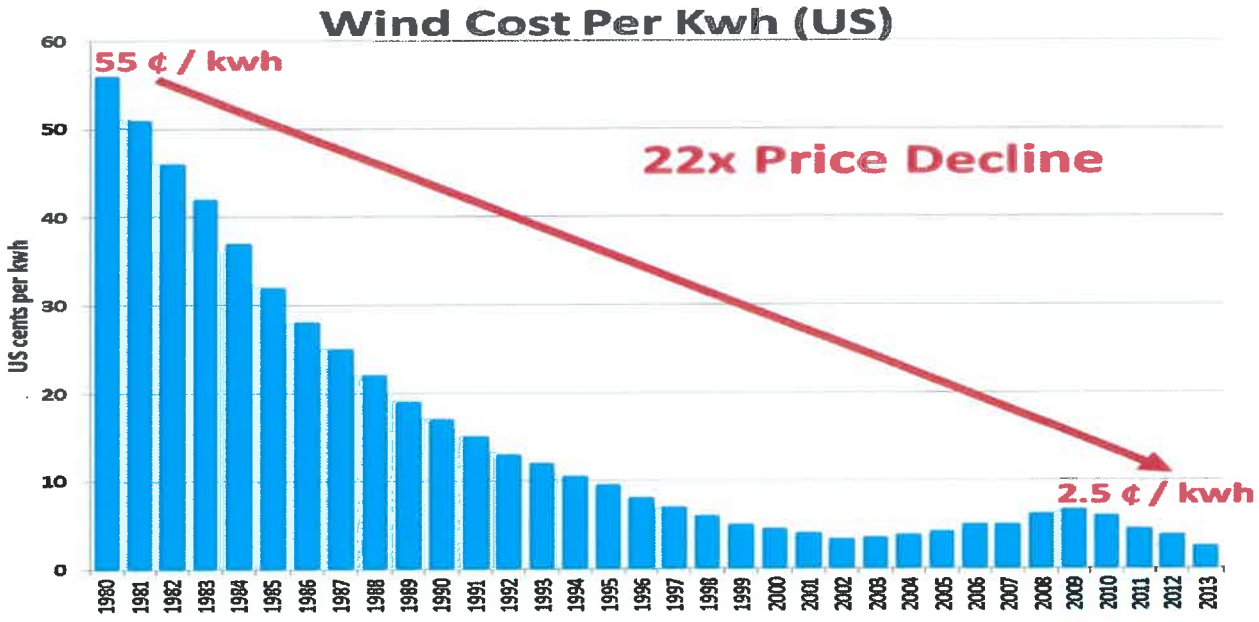
accelerating. This is one reason why Staff thinks a "carbon constrained" strategy for a portion of our passive public markets investments makes sense.

2 – Prospects for Greater Adoption of Solar and Wind Are Improving

- Falling Prices for Solar and Sharply Lower Prices for Wind

The next two charts show that the cost of solar and wind have declined significantly in the 2010's.





Residential solar has declined by about 20%, non-residential solar by around 25%, and solar used by utilities has fallen about 60%. Meanwhile, the cost of wind power generation has plunged by 95%.

Most forecasts are that widespread adoption of solar, wind, and electric vehicles will take 20 years or longer, though some forecasters believe we are nearing a tipping point and could be ready for meaningfully larger adoption in the next 10-20 years.

The Bloomberg New Energy Finance group forecasts the following:

- Renewable energy sources will represent almost 75% of the world's investment (not use, rather, investment) in new power generation until 2040.

- Rapidly falling costs for solar and wind power, and a growing role for batteries;

- Solar's challenge to coal will become larger. Solar is already as cheap or cheaper than coal in Germany, Australia, the U.S., Spain, and Italy. By 2021 solar will be cheaper than coal in China, India, Mexico, the U.K., and Brazil.

- Onshore wind costs are expected to decline by 47% by 2040, thanks to cheaper, more efficient turbines. Offshore wind costs will plunge 71% thanks to experience, competition, and economies of scale.

- China, India and Asia Pacific, where economic growth will outpace the world, will lead in energy investment. The BNEF forecasts that about 30% of Asia Pacific's investment in energy will go to wind, 33% to solar, 18% to nuclear, and just 10% to coal.

- Batteries increasingly compete with natural gas to provide system flexibility. Renewable energy reaches 74% in Germany, 38% in the U.S., 55% in China, and 49% in India, by 2040.

- Coal use declines by 87% in Europe and 45% in the U.S. Coal production does continue to increase in China, but China's use of renewables grows more than coal, and only 18% of China's planned new power plants ever get built.

- Gas-fired power experiences more than $800 billion in new investment, and 16% more capacity by 2040. Gas plants will provide cheap, abundant, and flexible technology as the world transitions toward less use of fossil fuels and more use of renewables.

Additional forecasts on the adoption of renewables have been made public by the following:

- Cornell University states that most people inside and outside of the energy industry expect that oil and natural gas production will decline before the middle of the 21st century.

- Forbes does not expect oil demand to decline before 2035.

▪ The CEO for Total SA says oil demand will peak in the 2040's, which is why the French energy company is investing heavily in solar.

▪ The CEO of Royal Dutch Shell states that oil demand could decline a lot sooner, in the next 15 years or so, if EV's become real popular, adding that "The energy transition is unstoppable. In the most aggressive scenario, you can see oil already peaking in the late 2020's or early 2030's."

BNEF notes that the cost of renewables is plunging faster than forecasters anticipated just a few years ago. They estimate that clean energy will capture 86% of the estimated $10.2 trillion to be invested in power generation in 2040. They also predict that in Japan it will be cheaper to build a new PV plant than a coal-fired power generator by 2025, and in India it will be cheaper to produce wind power versus coal by 2030. The tipping point for cheaper production of wind power in Germany and China are expected to be achieved by the mid-2030's.

In the U.S., the Energy Information Agency forecasts that domestic carbon emissions continue to decline, but at a slower rate than what we have achieved in recent years, of 0.2 percent annually from 2017 to 2040.

Wind capacity in the U.S. grew by 8 to 13 percent each year from 2014 to 2016, and solar capacity is growing even faster. The prices for wind and solar have also declined.

A recent edition of the Wall Street Journal reported, "while most big oil companies foresee a day when the world will need less crude, timing when that peak in oil demand will materialize is one of the hottest flash points within the industry. It's tough to predict because changes in oil demand will hinge on future disruptive technologies."

Summary

The adoption of EV's will soon accelerate significantly faster than current consensus expects, and prospects for faster adoption of solar and wind have recently improved. Hence, it is fiduciarily prudent to adopt a carbon-constrained strategy for a portion of our passive public investments.

Attachment A

Attachment A: SFERS Holdings in CU200 Companies as of 9-30-2017	Type	Company Name	Sedol (BNY)	CUSIP (BNY)	Shares	Market Value	Cost Basis	Gain / (Loss)	% Change
Coal Companies									
Adaro Energy Tbk PT	Stock	Adaro Energy	B3BQFC4		2,525,500.00	342,197.99	315,198.46	$26,999.53	8.6%
AGL Energy Ltd	Stock	AGL Energy	BSS7GP5		85,920.00	1,575,538.28	1,787,002.65	$(211,464.37)	-11.8%
Anglo American PLC	Stock	Anglo American	B1XZS82		44,695.00	803,231.81	639,709.75	$163,522.06	25.6%
ArcelorMittal	Stock	ArcelorMittal	BYPBS67		71,570.00	1,846,614.43	1,365,507.26	$481,107.17	35.2%
Black Hills Corp	Stock	Black Hills	2101741	092113109	2,543.00	175,136.41	93,904.16	$81,232.25	86.5%
CLP Holdings Ltd	Stock	CLP Holdings	6097017		56,500.00	579,055.01	486,602.06	$92,452.95	19.0%
FirstEnergy Corp	Stock	FirstEnergy	2100920	337932107	43,447.00	1,339,471.01	1,734,880.72	$(395,409.71)	-22.8%
FirstEnergy Corp	Stock	FirstEnergy	2100920	337932107	2,403.00	74,084.49	75,712.52	$(1,628.03)	-2.2%
FirstEnergy Corp	Stock	FirstEnergy	2100920	337932107	26,268.00	809,842.44	1,035,471.18	$(225,628.74)	-21.8%
Glencore PLC	Stock	Glencore	B4T3BW6		1,297,389.00	5,952,995.48	5,146,503.55	$806,491.93	15.7%
Glencore PLC	Stock	Glencore	B4T3BW6		199,183.00	913,939.84	965,549.29	$(51,609.45)	-5.3%
ITOCHU Corp	Stock	ITOCHU	6467803		158,200.00	2,590,171.00	2,050,453.00	$539,718.00	26.3%
Mitsubishi Chemical Holdings Corp	Stock	Mitsubishi Chemical	6640541		54,700.00	647,274.02	645,725.34	$1,548.68	0.2%
Mitsubishi Electric Corp	Stock	Mitsubishi Electric	6597045		112,600.00	1,758,546.61	1,392,732.74	$365,813.87	26.3%
Mitsubishi Gas Chemical Co Inc	Stock	Mitsubishi Gas	6596923		198,100.00	4,640,782.63	3,307,718.21	$1,333,064.42	40.3%
Mitsubishi Gas Chemical Co Inc	Stock	Mitsubishi Gas	6468356		12,100.00	370,852.39	289,212.24	$81,640.15	28.2%
Mitsubishi Materials Corp	Stock	Mitsubishi Materials	6597089		41,300.00	1,427,237.59	1,359,160.95	$68,076.64	5.0%
Rio Tinto Ltd	Stock	Rio Tinto	6220103		20,098.00	1,049,171.16	961,010.40	$88,160.76	9.2%
Rio Tinto PLC	Stock	Rio Tinto	0718875		55,732.00	2,596,860.66	2,188,922.29	$407,938.37	18.6%
Rio Tinto PLC	Stock	Rio Tinto	0718875		43,100.00	2,008,266.24	2,101,306.68	$(93,040.44)	-4.4%
Rio Tinto PLC	Stock	Rio Tinto	2740434	767204100	52,600.00	2,482,194.00	2,559,742.42	$(77,548.42)	-3.0%
Rio Tinto PLC	Stock	Rio Tinto	0718875		105,897.00	4,934,324.14	4,227,015.60	$707,308.54	16.7%
South32 Ltd	Stock	South32	BWSW5D9		2,485,771.00	6,378,004.90	5,098,365.12	$1,279,639.78	25.1%
Vale SA	Stock	Vale	2857334	91912E105	460,161.00	4,633,821.27	4,353,525.73	$280,295.54	6.4%
Vale SA	Stock	Vale	2933900	91912E204	217,402.00	2,032,708.70	1,625,513.67	$407,195.03	25.1%
Vale SA	Stock	Vale	2196286		92,000.00	926,936.76	928,822.71	$(1,885.95)	-0.2%
Vale SA	Stock	Vale	2857334	91912E105	290,889.00	2,929,252.23	1,857,236.35	$1,072,015.88	57.7%
Vale SA	Stock	Vale	2257127		55,100.00	514,567.44	494,753.84	$19,813.60	4.0%
Vale SA	Stock	Vale	2857334	91912E105	164,145.00	1,652,940.15	1,670,523.34	$(17,583.19)	-1.1%
Subtotal of Public Equity Holdings in Coal Companies						**$57,986,019.08**	**$50,757,782.23**	**$7,228,236.85**	14.2%
ArcelorMittal	Bond	ArcelorMittal	BYNTS74	03938LAZ7	1,175,000.00	1,351,250.00	1,321,847.09	$29,402.91	2.2%
ArcelorMittal	Bond	ArcelorMittal	B7MPB86	03938LAX2	225,000.00	257,906.25	237,757.81	$20,148.44	8.5%
ArcelorMittal	Bond	ArcelorMittal	BBM4N07	03938LAU8	3,400,000.00	3,731,500.00	3,706,000.00	$25,500.00	0.7%
Glencore PLC	Bond	Glencore	BVYP892	378272AL2	1,460,000.00	1,482,411.00	1,354,258.30	$128,152.70	9.5%
Glencore PLC	Bond	Glencore	BLTW6B6	378272AH1	2,780,000.00	2,944,715.00	2,458,849.50	$485,865.50	19.8%
Vale SA	Bond	Vale	B9DCRR1	91911TAM5	2,000,000.00	2,084,000.00	1,680,000.00	$404,000.00	24.0%
Vale SA	Bond	Vale	B5B54D9	91911TAK9	200,000.00	229,240.00	223,068.00	$6,172.00	2.8%
Subtotal of Public Bond Holdings in Coal Companies						**$12,081,022.25**	**$10,981,780.70**	**$1,099,241.55**	**10.0%**
Coal Companies Totals						**$70,067,041.33**	**$61,739,562.93**	**$8,327,478.40**	**13.5%**

Attachment A: SFERS Holdings in CU200 Companies as of 9-30-2017	Type	Company Name	Sedol (BNY)	CUSIP (BNY)	Shares	Market Value	Cost Basis	Gain / (Loss)	% Change
Oil Companies									
Aker Solutions ASA	Stock	Aker Solutions	BQN1C50		146,700.00	776,596.11	1,687,459.73	$(910,863.62)	-54.0%
Anadarko Petroleum Corp	Stock	Anadarko Petroleum	BYZWQ99	032511404	14,086.00	551,326.04	469,683.38	$81,642.66	17.4%
Anadarko Petroleum Corp	Stock	Anadarko Petroleum	2032380	032511107	54,836.00	2,678,738.60	3,263,415.88	$(584,677.28)	-17.9%
Anadarko Petroleum Corp	Stock	Anadarko Petroleum	2032380	032511107	79,600.00	3,888,460.00	4,974,442.80	$(1,085,982.80)	-21.8%
Anadarko Petroleum Corp	Stock	Anadarko Petroleum	2032380	032511107	34,272.00	1,674,187.20	1,365,019.62	$309,167.58	22.6%
Antero Resources Corp	Stock	Antero Resources	BFD2WR8	03674X106	11,307.00	225,009.30	332,355.23	$(107,345.93)	-32.3%
Apache Corp	Stock	Apache	2043962	037411105	35,730.00	1,636,434.00	2,005,096.21	$(368,662.21)	-18.4%
Apache Corp	Stock	Apache	2043962	037411105	23,412.00	1,072,269.60	1,232,013.87	$(159,744.27)	-13.0%
BASF SE	Stock	BASF	5086577		52,327.00	5,569,962.59	4,635,032.87	$934,929.72	20.2%
BASF SE	Stock	BASF	5086577		73,900.00	7,866,306.78	3,262,672.24	$4,603,634.54	141.1%
BASF SE	Stock	BASF	5086577		162,921.00	17,342,172.77	14,286,042.63	$3,056,130.14	21.4%
BHP Billiton Ltd	Stock	BHP Billiton		88606108	147,692.00	5,985,956.76	5,300,840.18	$685,116.58	12.9%
BHP Billiton Ltd	Stock	BHP Billiton	6144690		149,797.00	3,030,135.21	4,340,007.72	$(1,309,872.51)	-30.2%
BHP Billiton Ltd	Stock	BHP Billiton	2144337	088606108	43,301.00	1,754,989.53	1,916,547.91	$(161,558.38)	-8.4%
BHP Billiton PLC	Stock	BHP Billiton	0056650		48,446.00	854,393.14	892,566.71	$(38,173.57)	-4.3%
BHP Billiton PLC	Stock	BHP Billiton	0056650		75,233.00	1,326,808.39	909,066.87	$417,741.52	46.0%
BHP Billiton PLC	Stock	BHP Billiton	0056650		237,476.00	4,188,124.18	3,765,886.74	$422,237.44	11.2%
BP PLC	Stock	BP	0798059		1,298,400.00	8,314,558.17	10,985,973.54	$(2,671,415.37)	-24.3%
BP PLC	Stock	BP	0798059		2,486,847.00	15,925,010.82	14,550,761.86	$1,374,248.96	9.4%
BP PLC	Stock	BP	0798059		56,592.00	362,397.94	362,761.42	$(363.48)	-0.1%
Cabot Oil & Gas Corp	Stock	Cabot Oil	2162340	127097103	13,137.00	351,414.75	324,613.82	$26,800.93	8.3%
Cabot Oil & Gas Corp	Stock	Cabot Oil	2162340	127097103	28,694.00	767,564.50	519,206.05	$248,358.45	47.8%
Canadian Natural Resources Ltd	Stock	Canadian Natural	2171573	136385101	292,454.00	9,772,240.56	10,103,537.28	$(331,296.72)	-3.3%
CDS SP GAZPROM INDEX	Stock	CDS SP			100,000.00	628.65	-	$628.65	
CDS SP PETROBRAS (PGC) INDEX	Stock	CDS SP			1,000,000.00	(10,649.38)	-	$(10,649.38)	
CDS_SP GAZPROM INDEX	Stock	CDS_SP GAZPROM			(100,000.00)	-	(5,828.68)	$5,828.68	-100.0%
Centrica PLC	Stock	Centrica	B033F22		1,093,500.00	2,743,466.29	5,833,141.74	$(3,089,675.45)	-53.0%
Chesapeake Energy Corp	Stock	Chesapeake Energy	2182779	165167107	81,522.00	350,544.60	1,353,177.29	$(1,002,632.69)	-74.1%
Chesapeake Energy Corp	Stock	Chesapeake Energy	2182779	165167107	45,680.00	196,424.00	1,137,719.16	$(941,295.16)	-82.7%
Chevron Corp	Stock	Chevron	2838555	166764100	57,056.00	6,704,080.00	5,489,395.89	$1,214,684.11	22.1%
Chevron Corp	Stock	Chevron	2838555	166764100	185,359.00	21,779,682.50	13,108,863.54	$8,670,818.96	66.1%
Chevron Corp	Stock	Chevron	2838555	166764100	116,894.00	13,735,045.00	5,553,240.27	$8,181,804.73	147.3%
Cimarex Energy Co	Stock	Cimarex Energy	2987521	171798101	617.00	70,134.39	52,991.25	$17,143.14	32.4%
Cimarex Energy Co	Stock	Cimarex Energy	2987521	171798101	5,859.00	665,992.53	630,993.35	$34,999.18	5.5%
Concho Resources Inc	Stock	Concho Resources	B1YWRK7	20605P101	14,573.00	1,919,555.56	1,666,786.63	$252,768.93	15.2%
Concho Resources Inc	Stock	Concho Resources	B1YWRK7	20605P101	9,076.00	1,195,490.72	1,083,010.17	$112,480.55	10.4%
Continental Resources Inc/OK	Stock	Continental Resources	B1XGWS3	212015101	4,785.00	184,748.85	209,972.25	$(25,223.40)	-12.0%
Devon Energy Corp	Stock	Devon Energy	2480677	25179M103	128,400.00	4,713,564.00	5,604,834.50	$(891,270.50)	-15.9%
Devon Energy Corp	Stock	Devon Energy	2480677	25179M103	48,278.00	1,772,285.38	1,973,128.08	$(200,842.70)	-10.2%
Devon Energy Corp	Stock	Devon Energy	2480677	25179M103	32,271.00	1,184,668.41	1,239,290.86	$(54,622.45)	-4.4%
Encana Corp	Stock	Encana	2793193	292505104	943,892.00	11,086,853.62	9,612,207.89	$1,474,645.73	15.3%
Energen Corp	Stock	Energen	2012672	29265N108	9,384.00	513,117.12	434,826.63	$78,290.49	18.0%
Engie SA	Stock	Engie	B0C2CQ3		641,720.00	10,901,676.69	11,379,405.72	$(477,729.03)	-4.2%
Engie SA	Stock	Engie	B0C2CQ3		149,000.00	2,531,243.89	2,276,566.12	$254,677.77	11.2%
Engie SA	Stock	Engie	B0C2CQ3		129,826.00	2,205,511.87	2,107,480.04	$98,031.83	4.7%
Eni SpA	Stock	Eni	7145056		140,366.00	2,323,169.59	2,313,410.46	$9,759.13	0.4%
Eni SpA	Stock	Eni	7145056		239,703.00	3,967,276.41	3,705,656.51	$261,619.90	7.1%
EOG Resources Inc	Stock	EOG Resources	2318024	26875P101	51,170.00	4,950,185.80	4,483,973.88	$466,211.92	10.4%

Attachment A: SFERS Holdings in CU200 Companies as of 9-30-2017	Type	Company Name	Sedol (BNY)	CUSIP (BNY)	Shares	Market Value	Cost Basis	Gain / (Loss)	% Change
EOG Resources Inc	Stock	EOG Resources	2318024	26875P101	35,543.00	3,438,429.82	1,135,763.69	$2,302,666.13	202.7%
EQT Corp	Stock	EQT	2319414	26884L109	17,234.00	1,124,346.16	1,336,288.87	$(211,942.71)	-15.9%
EQT Corp	Stock	EQT	2319414	26884L109	10,657.00	695,262.68	406,098.85	$289,163.83	71.2%
Exxon Mobil Corp	Stock	Exxon Mobil	2326618	30231G102	136,044.00	11,152,887.12	9,690,267.16	$1,462,619.96	15.1%
Exxon Mobil Corp	Stock	Exxon Mobil	2326618	30231G102	415,521.00	34,064,411.58	34,398,980.35	$(334,568.77)	-1.0%
Exxon Mobil Corp	Stock	Exxon Mobil	2326618	30231G102	260,905.00	21,388,991.90	12,688,243.95	$8,700,747.95	68.6%
Galp Energia SGPS SA	Stock	Galp Energia	B1FW751		73,950.00	1,310,918.23	1,019,682.90	$291,235.33	28.6%
Gulfport Energy Corp	Stock	Gulfport Energy	2398684	402635304	13,869.00	198,881.46	487,944.33	$(289,062.87)	-59.2%
Hess Corp	Stock	Hess	BD5JYW2	42809H404	19,892.00	1,172,832.32	1,442,446.42	$(269,614.10)	-18.7%
Hess Corp	Stock	Hess	2023748	42809H107	28,266.00	1,325,392.74	1,705,727.72	$(380,334.98)	-22.3%
Hess Corp	Stock	Hess	2023748	42809H107	16,452.00	771,434.28	629,909.89	$141,524.39	22.5%
JXTG Holdings Inc	Stock	JXTG Holdings	B627LW9		336,600.00	1,731,068.62	1,277,904.15	$453,164.47	35.5%
JXTG Holdings Inc	Stock	JXTG Holdings	B627LW9		246,700.00	1,268,730.33	1,053,563.79	$215,166.54	20.4%
LUKOIL PJSC	Stock	LUKOIL	BYZDW27		41,371.00	2,189,767.03	1,734,813.74	$454,953.29	26.2%
LUKOIL PJSC	Stock	LUKOIL	BYZF386	69343P105	45,632.00	2,429,173.89	2,109,266.03	$319,907.86	15.2%
Lundin Mining Corp	Stock	Lundin Mining	2866857	550372106	1,134,866.00	7,767,523.25	6,166,489.60	$1,601,033.65	26.0%
Lundin Mining Corp	Stock	Lundin Mining	2866857	550372106	398,900.00	2,730,247.47	1,424,799.73	$1,305,447.74	91.6%
Marathon Oil Corp	Stock	Marathon Oil	2910970	565849106	52,282.00	708,943.92	822,503.22	$(113,559.30)	-13.8%
Marathon Oil Corp	Stock	Marathon Oil	2910970	565849106	85,089.00	1,153,806.84	1,813,172.32	$(659,365.48)	-36.4%
Marathon Petroleum Corp	Stock	Marathon Petroleum	B3K3L40	56585A102	102,300.00	5,736,984.00	5,247,284.13	$489,699.87	9.3%
Marathon Petroleum Corp	Stock	Marathon Petroleum	B3K3L40	56585A102	3,058.00	171,492.64	156,714.86	$14,777.78	9.4%
Marathon Petroleum Corp	Stock	Marathon Petroleum	B3K3L40	56585A102	32,570.00	1,826,525.60	428,235.69	$1,398,289.91	326.5%
Marathon Petroleum Corp	Stock	Marathon Petroleum	B3K3L40	56585A102	49,420.00	2,771,473.60	2,141,187.57	$630,286.03	29.4%
Mitsui Chemicals Inc	Stock	Mitsui Chemicals	6597368		67,800.00	2,059,929.81	1,284,119.80	$775,810.01	60.4%
Murphy Oil Corp	Stock	Murphy Oil	2611206	626717102	9,988.00	265,281.28	483,562.38	$(218,281.10)	-45.1%
Murphy Oil Corp	Stock	Murphy Oil	2611206	626717102	15,766.00	418,744.96	732,879.39	$(314,134.43)	-42.9%
Murphy USA Inc	Stock	Murphy USA	BCZWJ63	626755102	3,262.00	225,078.00	207,285.79	$17,792.21	8.6%
National Fuel Gas Co	Stock	National Fuel	2626103	636180101	7,840.00	443,822.40	421,937.31	$21,885.09	5.2%
Newfield Exploration Co	Stock	Newfield Exploration	2635079	651290108	12,161.00	360,816.87	888,466.85	$(527,649.98)	-59.4%
Newfield Exploration Co	Stock	Newfield Exploration	2635079	651290108	166,100.00	4,928,187.00	5,955,897.06	$(1,027,710.06)	-17.3%
Noble Energy Inc	Stock	Noble Energy	2640761	655044105	27,909.00	791,499.24	1,116,573.65	$(325,074.41)	-29.1%
Noble Energy Inc	Stock	Noble Energy	2640761	655044105	47,904.00	1,358,557.44	1,940,573.30	$(582,015.86)	-30.0%
Novatek PJSC	Stock	Novatek	B0DK750		9,731.00	1,141,446.30	1,052,107.98	$89,338.32	8.5%
Occidental Petroleum Corp	Stock	Occidental Petroleum	2655408	674599105	47,154.00	3,027,758.34	1,543,561.17	$1,484,197.17	96.2%
Occidental Petroleum Corp	Stock	Occidental Petroleum	2655408	674599105	74,710.00	4,797,129.10	5,876,502.81	$(1,079,373.71)	-18.4%
PDC Energy Inc	Stock	PDC Energy	B89M5F2	69327R101	5,987.00	293,542.61	214,048.82	$79,493.79	37.1%
Pioneer Natural Resources Co	Stock	Pioneer Natural	2690830	723787107	10,466.00	1,544,153.64	540,449.70	$1,003,703.94	185.7%
Pioneer Natural Resources Co	Stock	Pioneer Natural	2690830	723787107	16,620.00	2,452,114.80	2,339,032.95	$113,081.85	4.8%
PTT Global Chemical PCL	Stock	PTT Global	B736PF3		139,500.00	322,083.95	257,091.33	$64,992.62	25.3%
QEP Resources Inc	Stock	QEP Resources	B60X657	74733V100	23,890.00	204,737.30	551,637.38	$(346,900.08)	-62.9%
Range Resources Corp	Stock	Range Resources	2523334	75281A109	11,432.00	223,724.24	759,868.27	$(536,144.03)	-70.6%
Range Resources Corp	Stock	Range Resources	2523334	75281A109	22,173.00	433,925.61	967,236.09	$(533,310.48)	-55.1%
Repsol SA	Stock	Repsol	5669354		351,900.00	6,485,692.25	5,033,937.95	$1,451,754.30	28.8%
Repsol SA	Stock	Repsol	5669354		437,861.00	8,069,996.28	6,307,255.01	$1,762,741.27	27.9%
Rice Energy Inc	Stock	Rice Energy	BJ2SP10	762760106	7,989.00	231,201.66	217,454.71	$13,746.95	6.3%
Royal Dutch Shell PLC	Stock	Royal Dutch	B03MM40		695,748.00	21,418,017.23	17,124,890.23	$4,293,127.00	25.1%
Royal Dutch Shell PLC	Stock	Royal Dutch	B03MM40		93,500.00	2,878,318.89	3,001,153.91	$(122,835.02)	-4.1%
Royal Dutch Shell PLC	Stock	Royal Dutch	B09CBL4		497,077.00	15,026,068.06	13,504,780.69	$1,521,287.37	11.3%
Royal Dutch Shell PLC	Stock	Royal Dutch	B09CBL4		18,878.00	570,660.31	527,758.58	$42,901.73	8.1%
Royal Dutch Shell PLC	Stock	Royal Dutch	B03MM40		59,700.00	1,837,814.31	1,536,472.45	$301,341.86	19.6%
Royal Dutch Shell PLC	Stock	Royal Dutch	B03MLX2		1,998.00	60,273.67	52,513.57	$7,760.10	14.8%

Attachment A: SFERS Holdings in CU200 Companies as of 9-30-2017	Type	Company Name	Sedol (BNY)	CUSIP (BNY)	Shares	Market Value	Cost Basis	Gain / (Loss)	% Change
Royal Dutch Shell PLC	Stock	Royal Dutch	B03MM40		193,276.00	5,949,839.16	6,130,579.38	$(180,740.22)	-2.9%
RSP Permian Inc	Stock	RSP Permian	BJ0JSM7	74978Q105	6,310.00	218,262.90	202,112.46	$16,150.44	8.0%
Sasol Ltd	Stock	Sasol	6777450		38,558.00	1,059,434.77	1,195,281.14	$(135,846.37)	-11.4%
Sasol Ltd	Stock	Sasol	6777450		110,835.00	3,045,346.04	3,373,892.80	$(328,546.76)	-9.7%
SK Innovation Co Ltd	Stock	SK Innovation	B232R05		17,789.00	3,090,769.44	2,021,210.85	$1,069,558.59	52.9%
SM Energy Co	Stock	SM Energy	2764188	78454L100	10,704.00	189,888.96	433,686.30	$(243,797.34)	-56.2%
Southwestern Energy Co	Stock	Southwestern Energy	2828619	845467109	48,822.00	298,302.42	282,710.67	$15,591.75	5.5%
TOTAL SA	Stock	TOTAL	B15C557		182,800.00	9,820,944.44	9,999,371.72	$(178,427.28)	-1.8%
TOTAL SA	Stock	TOTAL	B15C557		14,252.00	765,689.83	721,063.95	$44,625.88	6.2%
TOTAL SA	Stock	TOTAL	B15C557		61,117.00	3,283,515.66	3,001,574.95	$281,940.71	9.4%
Whiting Petroleum Corp	Stock	Whiting Petroleum	2168003	966387102	34,790.00	189,953.40	805,823.49	$(615,870.09)	-76.4%
WPX Energy Inc	Stock	WPX Energy	BYRH595	98212B202	18,327.00	973,713.51	1,013,492.07	$(39,778.56)	-3.9%
WPX Energy Inc	Stock	WPX Energy	B40PCD9	98212B103	38,270.00	440,105.00	466,602.44	$(26,497.44)	-5.7%
Subtotal of Public Equity Holdings in Oil and Gas Companies						**$409,925,619.99**	**$366,132,988.42**	**$43,792,631.57**	12.0%
Anadarko Petroleum Corp	Bond	Anadarko Petroleum	BH86FD6	032511BB2	12,000,000.00	5,048,640.00	4,335,000.00	$713,640.00	16.5%
Anadarko Petroleum Corp	Bond	Anadarko Petroleum	B96B2C5	032511BF3	3,200,000.00	3,448,256.00	3,466,208.00	$(17,952.00)	-0.5%
Antero Resources Corp	Bond	Antero Resources	BYZ0MQ2	03674XAF3	410,000.00	427,425.00	405,650.00	$21,775.00	5.4%
Canadian Natural Resources Ltd	Bond	Canadian Natural	BF1TQL3	136385AW1	3,102,000.00	3,083,853.30	3,097,440.06	$(13,586.76)	-0.4%
Chesapeake Energy Corp	Bond	Chesapeake Energy	BD3VQB3	165167CV7	145,000.00	143,550.00	144,970.77	$(1,420.77)	-1.0%
Chesapeake Energy Corp	Bond	Chesapeake Energy	BYZNB19	165167CT2	280,000.00	282,800.00	275,861.60	$6,938.40	2.5%
Chesapeake Energy Corp	Bond	Chesapeake Energy	B9J8494	165167CK1	365,000.00	347,662.50	367,555.00	$(19,892.50)	-5.4%
Chesapeake Energy Corp	Bond	Chesapeake Energy	BYYHM20	165167CR6	2,748,000.00	2,521,290.00	2,779,424.67	$(258,134.67)	-9.3%
Denbury Resources Inc	Bond	Denbury Resources	BDGLCR8	247916AF6	120,000.00	117,150.00	127,230.47	$(10,080.47)	-7.9%
Gulfport Energy Corp	Bond	Gulfport Energy	BYZDX79	402635AE6	490,000.00	496,125.00	502,824.47	$(6,699.47)	-1.3%
Marathon Petroleum Corp	Bond	Marathon Petroleum	BZ02G24	56585AAL6	1,881,000.00	1,941,229.62	1,878,592.32	$62,637.30	3.3%
Novatek PJSC	Bond	Novatek	B929K07		200,000.00	205,552.00	204,500.00	$1,052.00	0.5%
Oasis Petroleum Inc	Bond	Oasis Petroleum	BQ8NZY1	674215AG3	315,000.00	320,512.50	320,397.86	$114.64	0.0%
Oasis Petroleum Inc	Bond	Oasis Petroleum	B7QFG09	674215AE8	295,000.00	299,425.00	207,839.27	$91,585.73	44.1%
Oasis Petroleum Inc	Bond	Oasis Petroleum	BD8GL85	674215AJ7	1,129,000.00	1,229,198.75	1,148,283.25	$80,915.50	7.0%
PDC Energy Inc	Bond	PDC Energy	BD37K19	69327RAD3	1,528,000.00	1,487,890.00	1,588,052.61	$(100,162.61)	-6.3%
Range Resources Corp	Bond	Range Resources	BYQBFM1	75281AAX7	125,000.00	124,843.75	117,031.25	$7,812.50	6.7%
Range Resources Corp	Bond	Range Resources	BDHC311	75281AAS8	235,000.00	231,475.00	234,983.63	$(3,508.63)	-1.5%
SM Energy Co	Bond	SM Energy	BYN78K1	78454LAK6	120,000.00	120,300.00	120,300.00	$.00	0.0%
SM Energy Co	Bond	SM Energy	BXCJ180	78454LAL4	290,000.00	275,500.00	266,450.00	$9,050.00	3.4%
Southwestern Energy Co	Bond	Southwestern Energy	BZ0WZG1	845467AM1	90,000.00	93,600.00	90,000.00	$3,600.00	4.0%
Southwestern Energy Co	Bond	Southwestern Energy	B96TSX2	845467AH2	285,000.00	273,956.25	234,161.33	$39,794.92	17.0%
Ultra Petroleum Corp	Bond	Ultra Petroleum	BYXKT18	90400GAB7	245,000.00	247,450.00	241,342.15	$6,107.85	2.5%
Ultra Petroleum Corp	Bond	Ultra Petroleum	BYXKT07	90400GAA9	120,000.00	122,400.00	120,000.00	$2,400.00	2.0%
Subtotal of Publicly Traded Bonds in Oil and Gas Companies						**$22,890,084.67**	**$22,274,098.71**	**$615,985.96**	2.8%
Oil and Gas Totals						**$432,815,704.66**	**$388,407,087.13**	**$44,408,617.53**	11.4%
Totals for Coal, Oil & Gas						**$502,882,745.99**	**$450,146,650.06**	**$52,736,095.93**	**11.7%**

Attachment A: SFERS Holdings in CU200 Companies as of 9-30-2017	Type	Company Name	Sedol (BNY)	CUSIP (BNY)	Shares	Market Value	Cost Basis	Gain / (Loss)	% Change
Active									
Coal						67,843,643.39	58,893,498.51	8,950,144.88	15.2%
Oil & Gass						288,137,761.07	267,508,664.67	20,629,096.40	7.7%
Total						**$355,981,404.46**	**$326,402,163.18**	**$29,579,241.28**	9.1%
Passive									
Coal						2,223,397.94	2,846,064.42	(622,666.48)	-21.9%
Oil & Gass						144,677,943.59	120,898,422.46	23,779,521.13	19.7%
Total						**$146,901,341.53**	**$123,744,486.88**	**$23,156,854.65**	18.7%

Attachment B

FOSSIL FUEL INVESTMENTS

A report for Unipension, Denmark

Martin Skancke

Executive summary

By engaging on climate resilience, capital spending and transition strategies for fossil fuel companies, investors can actively manage climate change related risk to their portfolios and protect the long-term value of their investments. At the same time, investors can promote responsible investing by acting to limit the total level of carbon risk in the financial system.

The large-scale **transformation** of our energy systems away from fossil fuels will take many years. Global energy use today is totally dominated by fossil fuels, and although renewables are growing at a fast rate, it is from a very low base. Even in the most optimistic scenarios, there is still significant consumption of fossil fuels for a long time to come.

Climate change and climate policies are **highly relevant** for long-term investors. They will not only affect the fossil fuel industry, but also give substantial spillover effects into all sectors that consume energy – thus affecting major parts of the portfolio of a diversified investor.

The transformation of our energy systems will be sluggish as long as we **lack proper pricing** of CO_2 emissions – a result of a global political failure to act.

Lack of proper carbon pricing also means that extractors of fossil fuels may invest in future projects that would otherwise not be viable. This risk is amplified by potential **misalignment of interests** between owners and managers of fossil fuel companies. If fossil fuel companies overinvest, this will create an excessive amount of "**carbon risk**" in our financial system.

Even if individual investors are effectively managing their portfolio carbon risk, the *total level of carbon risk* in the financial system may be unacceptably high for our global society. Investors should therefore focus on actions that address the *source* of that risk by limiting the capacity of fossil fuel companies to invest in projects that are not viable under reasonable assumptions about climate policies. Investors' most effective tool in this aspect is engagement.

Extracting and burning all available fossil fuels in the world is not consistent with limiting global warming. Some resources will have to stay in the ground and can become "**stranded assets**". This does not necessarily imply that there is a "**carbon bubble**" in current pricing of fossil fuel assets. The risk of "stranding" lies relatively far into the future and should thus have relatively little impact on today's valuations, since giving up an income stream a number of years from now will mean relatively little in current value terms. There is nothing inherently new about "stranded assets" as, in principle, any asset can become "stranded". All companies face various degrees of political and/or technological risks that can have a significant impact on the demand for, and therefore the value of, their assets.

A clear and reasonably simple governance structure is crucial for good long-term management of any fund. Aiming to exclude an entire sector based on assumptions of a "carbon bubble" is *not* appropriate as part of the strategic benchmark set by the fund owners. In general, it is generally not a proper role for fund owners to make time-critical investment decisions based on perceptions of mispricing in the market.

The more investors who want to reduce their exposure to a particular sector or a particular risk factor through **divestment**, the lower will be the equilibrium pricing of these assets, and the higher the expected return for those who buy them. While divestment can reduce carbon risk for the seller, it does this by shifting that risk to the buyer. The primary effect of

divestment is thus to *redistribute* carbon risk between investors, while the links to the overall risk in the system is weak.

Divestment/exclusion is sometimes seen as **an instrument to achieve change**. We discuss two potential channels of influence from divestment: Effects through the relevant companies' **cost of capital** and through their so-called "**social license**" to operate. We argue that these effects are likely to be limited when applied to the fossil fuel sector.

If divestment is "successful" and pushes down the price of fossil fuel assets, unwanted consequences may occur. For example, long-term coal supplies can be secured at low cost, and the incentive to switch to other sources of energy becomes weaker. So there is a potential risk that divestment and the resulting change of ownership of coal-related assets will delay the transition to a low carbon economy.

Climate change is potentially a serious threat to society and as such it has important environmental and intergenerational ethical aspects. Energy is an input in all economic activity to various degrees, and **taking part in the global economic system also means contributing to climate change**. Emissions are a result of a complex system of production and use of energy involving producers as well as consumers: The energy industry should not be seen as sole creators of the problem as long as global markets remain inextricably linked to fossil fuels. It therefore seems unreasonable to consider fossil fuel companies' energy production, energy use or CO_2 emissions *per se* to be contrary to generally accepted ethical norms, as these products and activities constitute a key foundation for our society. We have collectively created an energy system that is unsustainable, but fossil fuels will remain part of the energy mix for decades to come. This is true for both petroleum and coal. While coal clearly is the least climate-friendly energy input today, it is still the case that coal is a major world energy input with vital importance for the livelihood of millions of people, particularly in the developing world.

Nonetheless, responsible investors can and should require that fossil fuel companies meet certain **minimum standards** with respect to how their business activities impact the climate. This means that there is a role for ethically motivated exclusions at the individual company level. Many responsible investors use an exclusion mechanism which is calibrated to target the "worst forms" of ethical breaches: Certain forms of production of fossil fuels or certain activities linked to the use of fossil fuels may be considered seriously unethical due to the link to climate change.

A relevant **criterion for exclusion** could focus on cases where there is an unacceptable risk that the company is responsible for acts or omissions that are severely harmful to the climate. The assessment of each company should be forward-looking and emphasise concrete and credible plans for reducing carbon emissions. Importantly, the exclusion criteria will help *establish* norms for acceptable behaviour for fossil fuel companies and will constitute an important basis for engagement efforts.

There are important synergies between a company-based exclusion criteria and **active ownership** efforts directed at climate change. **Engagement** can play an important role in the fossil fuel industry by focusing on the profitability of new investments, capital structure and dividend policy. An engagement strategy focusing on capital expenditures is a direct and targeted approach to managing carbon risk. The starting point for engagement could focus on increasing **transparency** on companies' underlying demand and price assumptions and the robustness of their business models. This is particularly linked to engagement on dividend

policy as this is an approach that targets the root cause of carbon risk in the financial system through limiting the investment capacity of companies targeting high carbon-risk projects.

Responsible investors should focus on **environmental consequences** and be conscious of the potential effects if all environmentally aware investors divest from fossil fuel companies. As a transformation of our energy system toward a low-carbon society will take many years, fossil fuel companies will necessarily exist for a long time still. The issue is thus not *whether* investors will own these assets, but *which* investors will hold them. From a broader societal point of view, it is relevant to consider which characteristics the "optimal owners" of such assets should have. These companies should have active, engaged owners who can discipline capital spending. It is therefore unlikely that it is better for the climate that ownership is concentrated in the hands of investors who presumably care less about the climate than the investors who are divesting.

Investors cannot through their own actions bring about a sufficient reduction in greenhouse gas emission to achieve climate change objectives. It is simply not reasonable to expect that investors can solve a climate policy problem where the political system – so far – has failed. Pension fund investors are *not* a climate policy instrument, but actions and policies of investors can have positive effects on climate issues.

Research on engagement suggests that successful engagements are followed by positive abnormal returns. Moreover, collaboration among investors is instrumental in increasing the success rate of engagements. Clearly, engagement strategies should be a central part of the toolkit of institutional investors. By engaging on climate resilience, capital spending and transition strategies for fossil fuel companies, investors will be **actively managing the climate change related risk exposure** to their portfolios and protecting the long-term value of their investments. At the same time, investors can promote responsible investing by acting to limit the total level of carbon risk in the financial system.

Contents

1. Introduction

I am honored to have been asked to advise Unipension on the issue of fossil fuel investments.[1] Fossil fuel investments and the broader issue of transitioning to a low-carbon economy are important issues for investors as well as for society at large. I hope that this report can contribute to a fact-based and constructive debate leading to good decisions for Unipension and its beneficiaries.

Mandate

I was given the following mandate for this report:

"Audience	Pension fund members, labor market organizations and pension fund board of directors.
Purpose	Address the question of how best to approach climate change challenges and associated financial risks and expected return when pursuing pension fund investments.
Context	Framework of financial regulation, the fundamental purpose of the pension funds, Unipension's investment philosophy and its implementation of the investment strategy, as well as the general, NGO-led climate change debate and political initiatives.

Background

Unipension has a strong commitment to being a responsible investor and has built an extensive platform for ensuring such practice with a solid foundation in our Guidelines for Responsible Investments. These guidelines are built on international legislation and treaties, so that they are general and globally relevant in nature. A strong driver in our daily work with responsible investments is the practice of active ownership and engagement. Going forward, Unipension finds it crucial to deepen understanding of climate risk and anticipate developing the necessary analytical tools when data becomes more reliable and methodologies mature.

Further objective of report

The theme of climate change risk related to investments has become critical in the general debate, and as a valuable and qualifying input to our stakeholders, Unipension would like a report addressing the following –

- In considering how to approach climate change risks as a pension fund, what tools are available? What are the ethical aspects worth considering, what are the risks associated with the different approaches, and what will have an actual effect?
    - Can we address climate change issues by excluding fossil fuel related assets or even just coal? Does ethical substance underpin such exclusion?
        - What are the expected risks and effects resulting from the effort?
    - What are the merits of using active ownership and engagement instead?
        - What are the expected risks and effects resulting from the effort?
- Is the discussion of stranded assets related to fossil fuels relevant to investors?
- What are the fundamental differences between exclusion and divestment, and how is this important to an active, responsible investor?

[1] This report is written in a personal capacity and does not necessarily reflect the views of organizations I am associated with

- What meaningful role can a labor market pension fund play in the global transition into a low-carbon economy?"

Acknowledgements

I have previously chaired an Expert Group appointed to advise the Norwegian Ministry of Finance on similar issues.[2] I am indebted to the group members Elroy Dimson, Michael Hoel, Magdalena Kettis, Gro Nystuen and Laura Starks, as well as the Group's secretary Wilhelm Mohn, for discussions that have informed many of my views on this issue. The report from the Expert Group forms an important background document for this report, and some of the material from that report will be found again here. The members of the Group are however not responsible for any errors or omissions in this report, nor do they necessarily share the views presented here.

2. Climate change and fossil fuels

CO_2 emissions and climate change

There is broad agreement that a relationship exists between man-made CO_2 emissions and climate change. Global emissions of greenhouse gases have risen to unprecedented levels, despite a growing number of policies to reduce climate change. Based on current emissions trends, IPCC projections show global warming of up to 5°C by the end of this century.[3]

Furthermore, there is a clear link between increased CO_2 emissions and the use of fossil fuels. Emissions from fossil fuels have increased by more than 50 percent since 1990 (IPCC, 2013). In particular, emissions from coal have increased in recent years. This is a reflection of population growth, economic growth in developing countries, and the abundance of coal as a relatively cheap energy input.

At the heart of this issue is what economists call a "market failure"; CO_2 emissions have a social cost that is not reflected in costs to the emitter. So emissions are (much) higher than socially desirable. This is a variation on the well known "tragedy of the commons" – a situation where individuals acting independently and rationally according to each's self-interest behave contrary to the best interests of the whole group by depleting some common resource.[4] In this case, the common resource is the earth's atmosphere with its limited capacity to absorb CO_2. Since the atmosphere is not "owned" by anyone, an appropriate price for emitting CO_2 can only be set through a political process. So the market failure reflects a political failure to properly address the issue of climate change.

The Copenhagen Accord first established a "2-degree target" for climate change, often referred to as the "2-degree scenario" or "2DS". This target is defined as limiting global mean temperature increase to two degrees above pre-industrial level, which in turn leads to an estimate of maximum allowable emissions of CO_2 into the atmosphere. This "budget" for emissions requires significant reductions in emissions from today's levels.

According to estimates from the Grantham Research Institute on Climate Change at the London School of Economics (LSE), 2DS translates to a carbon budget of around 900 gigatons

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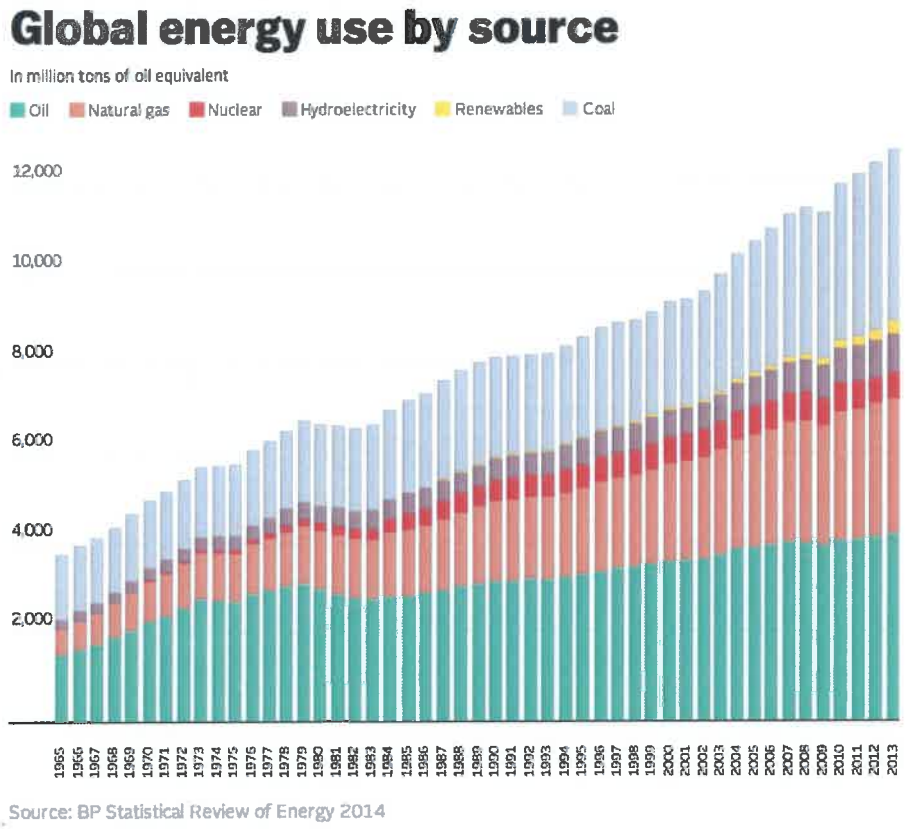
[2] Available at https://www.regjeringen.no/contentassets/d1d5b995b88e4b3281b4cc027b80f64b/expertgroup_report.pdf

[3] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

[4] Hardin, G (1968). "The Tragedy of the Commons". *Science* **162** (3859): 1243–1248.

of CO_2 in total accumulated emissions for the 2013-2050 period.[5] Along similar lines, the International Energy Agency (IEA), in its World Energy Outlook (2012), estimated that in order to have a 50 percent chance of reaching the 2DS, only a third of current fossil fuel reserves can be burned before 2050. This is the IEA 450 scenario. In this version of the "2-degree world", oil demand starts to fall after 2020. Gas demand continues to increase, at least until 2035.[6] [7] Coal demand and generation of electricity from coal both start to fall almost immediately from current levels, and coal demand is reduced by roughly a third by 2035. Fossil fuels' total share of the energy mix falls from about 80 percent today to 64 percent in 2035. In the IEA's 2014 Energy Technologies Perspective, in the "2-degree scenario" (which in warming terms roughly corresponds to the 450 scenario in the World Energy Outlook publication) total energy demand increases by 25 percent to 2050 and fossil fuels deliver some 40 percent of world energy at this point in time.

Figure 1



Source: BP Statistical Review of Energy 2014

As Figure 1 shows, global energy use today is totally dominated by fossil fuels. Even if renewables are growing at a fast rate, it is from a very low base. For instance, Bloomberg's New Energy Report 2015 finds that some USD 12.2 trillion will be invested in global power

[5] Grantham Institute (2013) Unburnable Carbon 2013: Wasted Capital and Stranded Assets, available at: http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/02/PB-unburnable-carbon-2013-wasted-capital-stranded-assets.pdf

[6] IEA (2014), World Energy Outlook 2013, p 58.

[7] This, however, assumes a rapid development and deployment of carbon capture and storage (CCS) relative to current trends.

generation between 2015 and 2040.[8] Renewables will account for two thirds of that total over the next 25 years, with coal, gas and nuclear generation attracting respectively USD 1.6 trillion, USD 1.2 trillion and USD 1.3 trillion. Nevertheless, even in 2040, fossil fuels will still account for 44 pct of world generation in this forecast – down from 67 pct in 2014.

In any case, a total restructuring of the world's energy system away from fossil fuels will have to take time. And since overall global energy demand is increasing, a reduction in the relative *share* of fossil fuels in the global energy mix is in itself not enough to bring about reductions in the absolute *level* of consumption and CO_2 emissions.

Climate science is complex. There are always many unknowns in future projections, such as the size and timing of emissions. The models are by necessity simplifications. While the warming trend is clear, future estimates will always be subject to much uncertainty. There will also be uncertainty – and disagreement – about assumptions of growth in overall energy demand, technological change and the speed with which new technology will be put to practical use.

For instance, some commentators have noted the similarity between some forms of renewable energy – notably solar – and information and communications technology in terms of development of marginal costs.[9] The argument is that with technology driven changes not bound by the same physical restrictions as fossil fuels, marginal costs will *decrease* when demand increases whereas the opposite is true for traditional fuels where the cheapest and most accessible reserves are extracted first. This leads to estimates of a significantly faster transition to renewables than forecast in the report referenced above. Other commentators have noted the significant reduction in the cost of solar power and compared to historic experiences from other industries where average costs have fallen significantly as technology has matured and volumes have increased.[10]

But some facts remain undisputed:

- Climate change is clearly linked to CO_2 emissions, and the use of fossil fuels is a main component of such emissions.
- CO_2 emissions are accumulated in the atmosphere, and it is the accumulated amount of CO_2 that determines climate impact, not the annual emissions. This implies that the later climate action is taken, the more drastic measures are needed to reach a specific climate target (because we need to get faster down to zero new emissions if we are close to the maximum allowable accumulated amount). It also implies that we at some point (preferably sooner rather than later) must come down to net zero CO_2 emissions for the economy as a whole – or net negative, if we overshoot the maximum allowable accumulated amount of CO_2 in the atmosphere for a given climate target.
- This means, in practice, that we must achieve a large-scale transformation of our energy systems away from fossil fuels.
- However, even in the most optimistic climate scenarios, there is still significant consumption of fossil fuels for a long time to come. This is not necessarily incompatible with a 2-degree target. But delayed action now will necessitate more drastic action later.

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[8] See http://www.bloomberg.com/company/new-energy-outlook/

[9] See for instance http://paulgilding.com/2015/07/13/dont-be-fossil-fooled/

[10] See for instance http://rameznaam.com/2015/08/10/how-cheap-can-solar-get-very-cheap-indeed/

The relevance of climate issues for investors

It should be noted at the outset that climate change and climate policies are highly relevant issues for investors for several reasons:

- A large-scale transformation of the world's energy system is necessary to address the challenges of global warming. This is a disruptive event that will provide both risks and opportunities to investors.
- The current lack of proper pricing of CO_2 emissions represents a significant market failure and can lead to an allocation of investment capital that is unsustainable – locking invested capital into uses with low or even negative long-term returns.
- Climate policies will potentially affect not just the fossil fuel industry, but may have important spillover effects into all sectors that consume energy – thus affecting large parts of the portfolio of a typical investor.
- Climate change can in itself also have direct effects on portfolios – for instance the value of real estate and infrastructure investments.
- The consequences of climate change and climate policies will play out over a long period of time, making it a particularly important issue for long-term investors.

A full examination of all of these issues lies well outside the scope of this document. We will focus on investments in fossil fuels companies and the possible roles of divestment and ownership strategies in addressing the climate issues associated with these investments for investors. But it will be useful to start with some general observations on investing.

3. Issues for investors

Some general issues

Financial instruments generally give the right to some defined streams of income in the future. In the case of equity investments, this stream of income has the form of dividends paid from the investee company to the holder of equity. The value of the equity is the expected net present value of such future payments. The discount rate used to convert future cash flows into present value will generally reflect the perceived riskiness of the investment and the willingness of investors to take risk – the higher the risk (or the degree of risk aversion), the higher the discount rate and the lower is the willingness to pay for a given expected future stream of dividends. Conversely, a lower price on a share today relative to expected future dividends implies a higher expected return.

These simple facts of investing have implications that are relevant for the issues in this report:

- The fact that investors look at discounted future cash flows to assess a "fair" price for an investment means that potential risks that lie far into the future will have relatively little impact on valuations today. This is not irrational – it just reflects that potential income far into the future contributes relatively little to an asset's value today.
- Even if you believe fossil fuel companies will at some point go out of business and hence be worthless at that time, it does *not* follow that the "fair" price *today* is zero. Ownership of these companies gives the right to receive dividends while these companies are still in business, and that right clearly has value. Believing that there will be a "rush to the door" to get out of a declining business and that one can profit from outrunning other investors must be based on an assumption of mispricing of assets today. We will come back to this when we discuss market efficiency later.

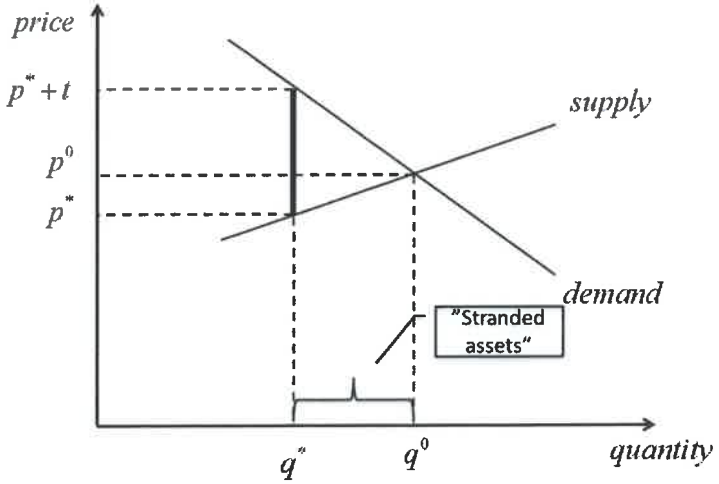
- If many investors sell shares in a particular sector – either for non-financial reasons or because they perceive that the investment has become more risky – the equilibrium price of those shares will be lower. Since investors can now buy a given expected cash flow at a lower price, the expected return for holding these shares will be higher. This corresponds to intuition; If you want to transfer more risk to other investors, you need to offer a higher expected return. The mechanism for bringing this higher expected return about is a lower price today relative to future expected cash flows. The more investors want to reduce their exposure to a particular sector or a particular risk factor, the lower will be the equilibrium price of these assets and the higher will be the expected return for those who buy them.

Carbon risk and "stranded assets"

With current technologies, it is clear that the extraction of all identified petroleum and coal reserves in the world today is incompatible with the "two degree target". At the same time, costs for renewable energy – especially solar energy – are coming down rapidly while the extraction of fossil fuels has become more expensive. As approximately 60 percent of total greenhouse gas emissions are related to the production and use of energy, it is clear that policies to combat climate change will have a large impact on the energy sector and that such policies could lead to capital being "stranded" in projects that are not viable at a higher carbon price. This risk is sometimes called "carbon risk" as it specifically relates to risks associated with business models built on the production and/or use of fossil fuels.

"Stranded assets" can be analyzed through simple supply and demand curves. A price increase for greenhouse gas emissions – be it from increased taxation or quota prices (t) – will lead to a fall in demand for greenhouse gas-intensive energy sources, and production will shift to the left as illustrated in Figure 2. The equilibrium production will fall from q^0 (without the tax/quota) to q* (with the tax/quota). This will have exactly the same effect as a fall in demand (due to, for instance, lower global economic growth) to the point q*/p* on the supply curve. The tax/quota (or equivalent fall in demand) would "strand" the resources available to the right of this quantity on the supply curve – those resources that are relatively more costly to produce. Another source of "stranding" can be substitution along the supply curve, with newer, cheaper sources of supply making more expensive sources uncompetitive for a given demand level.

Figure 2: Supply and Demand and the Concept of Stranded Assets



There is thus nothing inherently new about "stranded assets". The terminology of stranded assets is new language for an old idea. In principle, any asset can become "stranded" – a commercial property can lose much of its value if a nearby main road is moved away from it or a train station close by closes down, a production facility for patented drugs can lose value when the patent expires, a hotel can lose value if there is political unrest in the country where it is located, a power distribution system can lose value if government-controlled tariffs are cut, and a factory for mobile phones can lose value if competitors develop superior products. All companies face various degrees of political and/or technological risk that can have a significant impact on the demand for, and therefore value of, its assets.

But the significance of "stranded assets" in the context of fossil fuels is the sheer scale of the fossil fuel industry and the size of potentially stranded assets. For instance, data from Bank of America show that oil and gas investment in the US has soared to USD 200 bn per year. It has reached 20 percent of total US private fixed investment, the same share as home building.[11] The Carbon Tracker Initiative has published reports that look at the carbon supply cost curve specifically. The reports highlight marginal resources and resources at risk from a higher carbon price. According to the Carbon Tracker Initiative (2014),[12] listed companies have more exposure than national oil companies, especially as one moves up the cost curve. Oil sands and arctic drilling projects have been mentioned as being particularly at risk. The Carbon Tracker Initiative writes that companies are committing USD 1.1 trillion over the next decade to projects that require prices above USD 95 to break even. Prices today are of course much below this level and we should expect significant scaling down of new investments compared to these estimates.

Stranded assets will have no economic value given a price on CO_2 emissions corresponding to sustainable emission levels. It is therefore natural to assess what implications – if any – this would have for institutional investors' investments in the fossil fuel sector.

Carbon risk and financial markets

We should now examine more closely the links between carbon risk as described above and the associated financial risks and returns faced by investors. It is useful to start this discussion by illustrating the relationship between investors, fossil fuel companies and the fossil fuel projects these companies invest in as seen in Figure 3 below.

The fossil fuel companies undertake projects in extraction and use of fossil fuels, such as mining, exploration and power generation. Carbon risk is *created* when fossil fuel companies undertake projects that are not economically viable under reasonable assumptions about climate policies. This risk is passed on to and *distributed* between the investors who own these companies through financial markets.

The market for CO_2 emissions is clearly inefficient – there is no price on these emissions that reflects their cost to society. But this does *not* necessarily imply that the market for financial instruments that are exposed to carbon risk is inefficient. Or from a risk perspective: It is likely that the total level of carbon risk in the financial system is too high, but that does not in itself imply that the risk that is there is distributed in an inefficient way. These are two separate issues.

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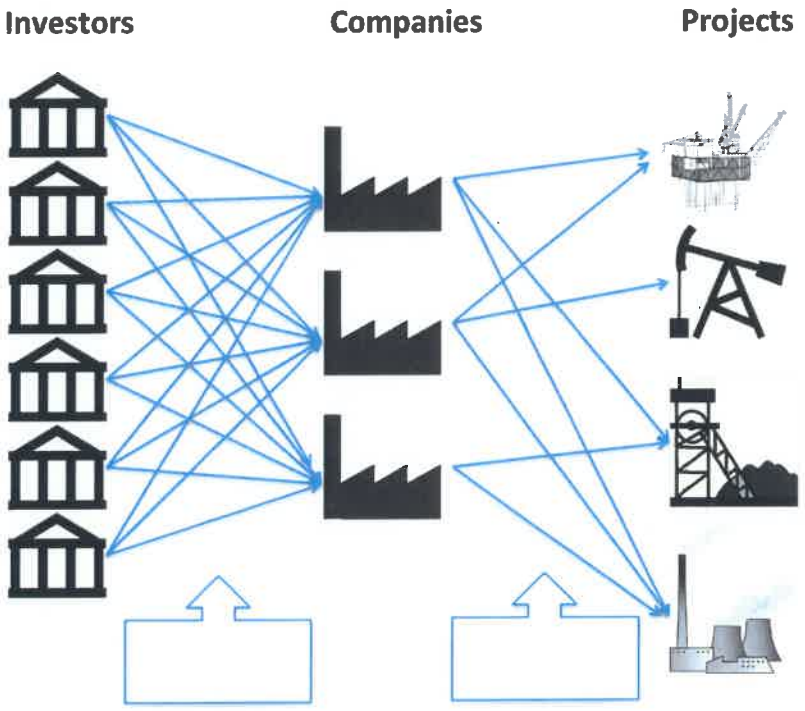
[11] Evans-Pritchard (2014), Daily Telegraph Website, see http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/10957292/Fossil-industry-is-the-subprime-danger-of-this-cycle.html

[12] Carbon Tracker Initiative (2014), report available at: http://www.carbontracker.org/site/carbon-supply-cost-curves-evaluating-financial-risk-to-oil-capital-expenditure

It should be noted that carbon risk is not restricted to fossil fuel companies – *all* investments that are influenced by carbon pricing will be subject to (upside or downside) carbon risk, including renewables projects that will profit if emission is priced effectively. Since carbon risk is a reflection of a political failure to set a proper price on carbon emissions, political action – or the lack of such – has the largest potential effect on the level of carbon risk and the potential reward from carbon risk taking.

Figure 3: Creation and distribution of carbon risk



One argument given for divestment is that "*Fossil Fuel investments are a risk for investors and the planet -- that's why we're calling on institutions to divest from these companies.*"[13] While it is true that fossil fuel investments are a risk for both investors and the planet, it is misleading to imply that this issue can be resolved by divestment for all investors simultaneously. While one individual investor may reduce his or her exposure to the risk of stranded assets by divesting, this option is not available to the sum of all investors collectively. Whenever one investor sells assets to reduce risk, there must by definition be a buyer on the other side of that trade – after all, divestment in practice means *selling your shares to some other investor.* The market price set in such trades must be such that it gives the buyers a perceived fair compensation for the risk that they take on – otherwise the trade would not happen.

Of course, different investors can have very different expectations regarding future carbon prices and the implicit risk of assets being stranded. This is, in principle, no different from having different expectations regarding *any* future event that could influence the value of an

[13] http://gofossilfree.org/frequently-asked-questions/

investment. In a competitive market, equilibrium prices should, by and large, reflect the best collective judgment of buyers and sellers regarding the probability of such events. Market prices of various assets today should adjust to give an expected return that provides adequate compensation for investment risks. So divestment clearly has a role in *distributing* risk between investors according to their individual appetite for risk – but it is not at all obvious that it reduces the *overall* risk in the system.

It may be argued that this represents an altogether too optimistic view on the efficiency of markets and its ability to price and allocate risk correctly. It is, of course, true that market prices again and again have been shown to misprice various forms of risk *in retrospect*. But it is equally true that there is little or no empirical evidence suggesting that it is easy for investors to systematically create risk-adjusted excess returns by exploiting publicly available information. There may be a "carbon bubble", but as with other bubbles we will only know for sure after it has burst – so it is not possible to state with certainty that a carbon bubble exists. And even if there is a bubble, the risk associated with that bubble is not necessarily distributed in a non-optimal way. We will return to this when we discuss active management strategies as a response to carbon risk.

There have been attempts by analysts to illustrate the impact stranding would have on individual companies and their share prices. HSBC[14] writes that because of carbon risks' long-term nature, it is doubtful that markets price the risk of loss of value. But as described above, such an evaluation might be rational from an investment point of view depending on how one values wealth today relative to tomorrow – that is, how one discounts future cash flows into present value. For instance, with a 7 pct. discount rate, the present value of a one dollar loss in 2050 is only 9 cents. So if assets risk becoming stranded only far into the future, it is not obvious that the effect on present pricing should be significant.

Research by the Grantham Institute at the LSE, Rystad Energy and the organization Carbon Tracker have tried to quantify the extent of stranded resources in more detail. Rystad Energy finds that most lost production is expected to occur after 2050 and that *"oil fields currently in production or under development could be produced under the 2DS scenario, emitting in total 259 Gt. For fields not yet sanctioned for development, 59 percent of the resources must remain in the ground over the period 2013-2050. For undiscovered resources, 45 percent of the likely finds must remain in the ground to keep the emissions within the 2DS scenario."*[15] This analysis indicates that "stranding" would primarily affect cash flows that are projected to come well into the future. So even if financial markets misprice this risk factor, it is by no means certain that the mispricing is significant in terms of today's "fair" value of these investments. In any case, this risk seems small compared to other risks investors in these companies are facing, for instance the risks associated with changes in *present* prices of coal and petroleum prices – as has been experienced recently.

It should also be noted that there is significant risk sharing between petroleum companies and host governments through taxation of upstream activities. Only changes in after-tax cash flows are relevant for the pricing of financial assets. It is also clear that companies can redirect investments during a project's lifetime. In other words, that a resource has been discovered does not mean that the capital expenditure needed to extract it will necessarily be incurred. Stating "carbon risk" in terms of potential losses of gross revenue in the future overstates the effect on the share price, which reflects expectations about net after-tax cash flows.

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[14] HSBC (2013) Oil & Carbon Revisited: Value at Risk from 'Unburnable' Reserves.

[15] The Rystad Energy Report is available at:
http://www.regjeringen.no/pages/38425303/2013_Rystad_Energy_Climate_report_Norwegian_Ministry_of_the_environment.pdf

Principal-agent problems

It is natural to ask why fossil fuel companies would undertake a project that has a high probability of not being profitable under reasonable assumptions about climate policies. After all, their aim should – in theory – be to maximize shareholder value, and committing resources to investments with a high probability of low or even negative returns would be incompatible with this objective.

One explanation may of course be that these companies simply have a very different assessment of demand growth, the probabilities of technological change and/or stricter climate policies than their owners have. But investors should also be aware of the risk of misalignment of interests between themselves and the managers of the companies they have invested in. These misalignments usually go under the name "principal-agent problems". They arise whenever a manager (agent) does not have the same incentives and interests as the ultimate owner (principal), and may therefore behave in a way that is not optimal from the owner's point of view. Principal-agent problems may therefore hamper investment performance. In capital markets, principal-agent problems generally arise between shareholders and company managers and between asset owners and asset managers.

For instance, a company manager can have a particular skillset that is not easy to utilize in a different business. If you are a mining engineer and manager of a coal mine, you may be tempted to invest in that mine beyond the level that maximizes shareholder value simply to keep your own job. Managers may also have a shorter time horizon for their investment decisions than their owners have for their investments, tying up capital in uses that can give short term gains but low or negative returns over the longer term. Sometimes investors have even created incentive structures that potentially create problems of this kind – for instance in the focus on "replacement rate" as a performance indicator for petroleum companies. This indicator measures new petroleum reserves in relation to the extraction rate and thus whether the total reserve base of a company is increasing or decreasing. But in a *value* perspective it is not necessarily appropriate to reward increased *volume* – if you are adding new reserves that have a production cost far above the market price, you are not creating shareholder value. In addition, there may be significant external pressures on fossil fuel companies from other stakeholders – for instance labor unions or governments – to invest and create jobs even when the expected economic returns from a shareholder perspective are inadequate. There is also the risk of behavioral biases in decision-making, where scenarios that require "out of the box"-thinking are simply suppressed in internal planning processes.

These types of principal-agent problems are of course not only found in fossil fuel companies. They can – and do – exist in all types of companies. But the negative consequences of such problems may be greater in the fossil fuel industry than in other industries. In the absence of principal-agent problems, the managers of fossil fuel companies would fully internalize the time horizon of the companies' owners and avoid investments that would probably be unprofitable if and when climate policies put a proper price on greenhouse gas emissions. But if they assess profitability using a *shorter* time horizon than the owners, the lack of proper pricing of CO_2 emissions *now* may give incentives to invest more in fossil fuel projects than the optimum level from the point of view of a long-term investor. So the negative effects of underpriced emissions today may be amplified through principal-agent problems.

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We can sum up this section on the issues facing investors in regard to fossil fuel investments thus:

- Extracting and burning all available fossil fuels in the world today is not consistent with meeting climate objectives under reasonable assumptions about the rate of technological change. So if we are to be anywhere near a "two degree scenario", some resources will have to stay in the ground, and investments associated with extracting and burning these will become "stranded assets".
- The lack of a proper price on CO_2 emissions combined with potential misalignment of interests between owners and managers of fossil fuel companies gives a risk of overinvestments in extraction and use of fossil fuels extraction.
- This "carbon risk" is *created* by the investment decisions of companies that extract and use fossil fuels and *distributed* among the owners of these companies through the financial system.
- In a competitive market, prices of assets should generally reflect relevant risk factors – including carbon risk. It is thus important to distinguish between imperfections in the market for greenhouse gas emissions (which are obvious) and possible imperfections in the market for financial assets that are exposed to carbon risk (which are not that obvious) – these are *not* the same.
- The phenomenon of "stranded assets" is not new; in a dynamic world investors are constantly at risk of being exposed to assets loosing value because of political, regulatory or technological changes, and it is not at all clear that financial markets are incapable of pricing this risk properly. Moreover, in current value terms, the loss may be limited due to discount factors reflecting the timing of any stranding and investor risk appetite.
- The fossil fuel sector is large, and projected investments in maintaining and expanding production capacity in the coming years are significant. Even if the market may have *priced* carbon risk correctly and *distributed* it in an optimal way between market participants, the *total level of risk* may be unacceptably high, both from an investment and a broader societal point of view. In that case, the proper focus is on actions that will bring the total level of risk in the financial system down, rather than actions that will only bring about a redistribution of existing risks between investors. Importantly, investors with an active investment strategy can manage their carbon risk exposure, but it will require political intervention to effectively address the market failure that is the root cause of the total level of risk.

Having set the scene in terms of outlining issues investors should be aware of; it is time to examine the instruments available to investors to address this. But first it is necessary to discuss some of the ethical issues associated with investments in the fossil fuel sector.

4. Ethics and exclusions

We have so far discussed investments in fossil fuel purely in financial terms. This is inadequate. Climate change is potentially a serious threat to life on Earth as we know it today. It clearly has important environmental and intergenerational ethical aspects. These aspects of fossil fuel investments should be part of the decision making process of investors.

An important aspect of responsible investing is captured in the concept of stewardship. Investors are generally acting on behalf of some ultimate beneficiaries – for instance members of a pension plan – and should act in their best interests. This requires attention to climate change as a long-term risk issue.

But investors should also feel responsibility in a wider sense as members of society with an obligation to act in a way that is consistent with broader societal values. In the words of the

great Swedish philosopher Pippi Longstocking: "If you are very strong you have to be very nice".[16] And large institutional investors are "very strong" in the sense that they have power to influence societal development through their investment activities and the values they promote as investors. Of course, investors – who are generally acting on behalf of some ultimate beneficiaries – are themselves dependent on legitimacy and proper social license to fulfill their role as stewards of other people's assets over time. They should therefore ensure that their investment activities properly reflect the values of their beneficiaries.

One aspect of the ethical dimensions of investing that is perhaps not immediately apparent is the issue of discounting. We have discussed earlier how investors value financial instruments by converting expected future cash flows into present value. Mathematically, this is straightforward; If you expect to receive 100 dollars in ten years and the (risk adjusted) interest rate is 7 pct, you would value those 100 dollars at 50,83 dollars today, since 50,83 dollars invested at 7 pct over 10 years would give 100 dollars.

But this mathematical simplicity hides a more complicated ethical issue; Discounting is a process for comparing future benefits against present sacrifices (or vice versa). When we are talking about long-term issues such as climate change, we are comparing costs of transitioning to a sustainable energy system today against benefits for future generations. The discount rate we use will determine how we evaluate this trade-off. This is clearly an ethical issue in its own right – discounting is not value-neutral. And is it not clear that the discount rates that we routinely use to compare cash flows accruing at different points in time are even relevant for assessing questions like climate change. An expected cash flow coming in 2050 has little economic value today, but that does not mean that potential disruptive climate change in 2050 and beyond is – or should be – irrelevant to us.

Approaches to ethical considerations

It is of course far beyond the scope of this report to give a full account of possible ethical dilemmas connected to fossil fuel investments, drawing on a body of philosophical and religious thinking that has developed over millennia. For the purposes of this discussion, we will constrain ourselves to looking at two approaches to ethical considerations:

- Ethics based on the application of ethical norms and standards, and
- Ethics based on evaluation of the outcomes of various actions

Of course, these are not mutually exclusive. In many cases, emphasis on norms and emphasis on outcomes will lead to the same result – considering outcomes is of course how many norms have been established in the first place. In other cases it is not so clear-cut. It is a violation of ethical norms to lie, but a "white lie" can still be ethically acceptable.

In the area of fossil fuel investments, it is also clear that the two approaches will often be seen in context. You may find that fossil fuel investments (or some of them) are against your norms, but if the probability of achieving change through ownership strategies is sufficiently high, you may still choose to remain invested – at least until ownership strategies have been tested.

Exclusions based on norms

Exclusions based on norms have a long history – going back at least to the 17th century when Quakers avoided investments linked to the slave trade – and are a regular feature of ethical

[16] Astrid Lindgren (1947): *"Do you know Pippi Longstocking?"*

guidelines.[17][18] The norms-based approach has as its main purpose to achieve consistency between a fund's investments and the values of its beneficiaries. The focus is thus on avoiding making profits in a way that is seen as illegitimate.

For instance, in the Norwegian Government Pension Fund Global (GPFG), exclusion is used to avoid investments in companies involved in the production of either certain weapons or of tobacco, or when there is a risk that a company might be responsible for or contribute to unethical conduct, currently or in the future.[19] The exclusion criteria are thus forward-looking. Exclusions in the GPFG are not intended to "punish" companies for things they have done in the past, but rather to avoid association with the Fund through ownership in possible future violations of norms. Similarly, many investors investing according to the principles of Islamic finance will avoid investments linked to alcohol and gambling.

Norm-based exclusions are generally aimed at making investments consistent with a given set of norms. As such, the primary objective is to avoid the investor being complicit to – or profiting from – activities that are in breach of these norms. Exclusions achieve this by severing the link between the investor and the activity in question. That others buy it, and that the unethical conduct may continue, is not relevant. With a purely norms-based approach, any effect on company behavior is incidental. When investors have excluded tobacco, weapons or alcohol from their portfolios, it is often not because they think it will affect the companies in question in a material way, but simply because these activities are seen as illegitimate sources of profit.

It should be noted at this stage that investors are not only *applying* norms to their portfolios – they may also be *creating* norms through their actions. When certain thresholds are set for exclusion, for instance, this sends a signal about what constitutes acceptable behavior. Similarly, norms may be set through expectations documents, voting and other instruments of ownership strategies. We will return to these aspects of investor strategies later.

For now, we will discuss how relevant a norms-based approach is for the fossil fuel industry. It will be useful to distinguish between the production and use of fossil fuels as such (*what* a company produces) and ways of producing and using fossil fuels (*how* a company produces). In this context, the issues will thus be:

- Is it reasonable to exclude some or all fossil fuel-related investments through a products-based approach – in other words, can the production and/or use of fossil fuels *in itself* be considered to be in breach of relevant norms for an investor?
- Can there be cases in which the production or use of fossil fuels is carried out *in a way* that represents a breach of norms for conduct at a level that should lead to exclusion, and what should the criteria for such exclusions be?

A product-based approach

It should be said at the outset that there is no "right" or "wrong" answer to the question of which norms should underpin product-based exclusions. Of course, in many cases there will be strong *external* norms that will guide these decisions – for instance domestic or international law and binding treaties. In the case of the GPFG, for instance, emphasis has been placed on consistency with Norwegian policies and commitments, for example as

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[17] We will use "exclusion" to denote avoidance of investments based on purely ethical considerations and "divestment" when the primary objective of selling an asset is financial, but sometimes the lines between these considerations are blurred.

[18] One can argue that the history of norms-based exclusions go back even further; In biblical times, Jewish laws laid down directives on how to invest according to ethical values and other religious texts have similar rules.

[19] The guidelines can be found at https://www.regjeringen.no/globalassets/upload/fin/statens-pensjonsfond/guidelines-for-observation-and-exclusion-14-april-2015.pdf

expressed through treaties on disarmament or human rights. This has led to exclusion of a number of weapons producers and other companies.

It is, however, not straightforward to apply such external norms to fossil fuel investments. An alternative approach is to take as a starting point any existing exclusion criteria and the general threshold for the use of such a mechanism set there. If the existing exclusion mechanism is calibrated to target the "worst forms" of ethical breaches, the question becomes whether it is reasonable to claim that *certain forms of production* of fossil fuels or *certain activities linked to the use of fossil fuels* may be defined as being seriously unethical because of the link to long-term climate change.

As a starting point, it is perhaps useful to emphasize that energy is an input in all economic activity to various degrees. The process of climate change is not regionally specific – it is global. Attributing greenhouse gas emissions to a specific part of the chain of energy production and consumption is therefore not an easy exercise. As access to energy is a key determinant of economic development worldwide, taking part in the global economic system also means contributing to climate change. Currently, the necessary energy infrastructure is to a large extent based on energy derived from fossil fuels. Coal is the least climate-friendly of these sources. The transition to a low-carbon economy, however, will not happen overnight, as we have seen earlier. In fact, the social costs of a quick transition may be unacceptably high. At the same time, the consequence of a too slow transition may be environmental, social, and economic collapse due to rapid climate change.

Emissions are a result of a complex system of production and use of energy involving producers as well as consumers. In some cases, the end users are the billions of people consuming, for example, fuel for transportation. As has been pointed out by the Interfaith Center on Corporate Responsibility[20] (ICCR) "*the energy industry should not be seen as sole creators of the problem as long as global markets remain inextricably linked to fossil fuels to propel growth.*" The ICCR therefore argues for a policy of holding fossil fuel companies to account through active ownership and "maintaining a seat at the table". Other faith-based investors have reached different conclusions. The Swedish Church has decided to divest from all pure coal companies and has gradually reduced its fossil fuel exposure since 2009, whereas the Church of England thus far has decided on a policy of engagement, with divestment reserved as a potential response to the worst cases. Similarly, Stanford University Endowment has decided to sell its investments in pure coal companies, while Harvard and Brown have decided to retain their coal mining stocks.

On balance, it seems unreasonable to consider fossil fuel companies' energy production, energy use or CO_2 emissions *per se* to be contrary to generally accepted ethical norms, as these products and activities constitute an important basis for our society. Fossil fuels will remain part of the energy mix for decades to come, even in a 2-degree scenario. This is true for both petroleum and coal. While coal clearly is the least climate-friendly energy input today, it is still the case that coal is a major world energy input with vital importance for millions of people, and that the production of coal will not end in the near future, even in the "2 degree scenario".

Some will obviously disagree with this view. To some extent it may be a question of differing time horizons. When the underlying problem is that we have created an unsustainable energy system dependent on fossil fuels, it seems difficult to justify setting a norm that implies that we would have liked these companies to stop producing their products overnight. But this does not mean that fossil fuels will *always* be ethically acceptable. As we transition to a low-

[20] ICCR (2013), Insights for Investors Working for Bolder Intervention on Climate Change, p 5.

carbon energy system, we will (hopefully) reach a point were fossil fuel production is unneeded and unwanted. Then the ethical considerations would also be different than today. Of course, some may believe that divestment today will help the transition to a low-carbon energy system. But this is not a question of norms, but of consequences, and implies an instrumental approach to divestment. We will come back to this in section 5 when we discuss asset allocation approaches more generally.

A further consideration on this issue is the following: Since the average investor by definition must hold a market-weighted portfolio of assets, the issue is not *whether* investors will own these assets (as long as they exist), but *which* investors will hold them. A relevant question is, then, what the characteristics of the "optimal investors" of such assets are from an investment and a broader societal point of view. It is not obvious that investors who presumably care less about the climate than those who are divesting will be "better" owners in this respect. We will come back to this when we discuss the importance of engagement strategies.

A company-based approach

We argued above that the ethical issue at the heart of the fossil fuel debate is not that all fossil fuel companies are inherently unethical, but rather that we have collectively created an entire energy system that is unsustainable. But stating that *all* fossil fuel companies (even all coal companies) are not unethical *per se* is not the same as stating that *none* of them are. While it is clearly difficult to establish a direct causal link between the conduct of individual companies and climate change, it seems reasonable to expect that they meet certain minimum standards with respect to how their business activities impact climate change.[21] We must therefore ask what these standards might be.

The Expert Group established to evaluate fossil fuel investments in the GPFG set out some possible criteria for this. As a general rule, the Group suggested that companies should be excluded "*if there is an unacceptable risk that the company contributes to or is responsible for acts or omissions that, on an aggregate company level, are severely harmful to the climate*".

The Group discussed some of the implications of the wording of this criterion. First, it noted that the proposed new criterion explicitly refers to "acts or omissions". All of the other conduct-based criteria of the GPFG have also been consistently interpreted as comprising both acts and omissions, so there is no difference between this new proposed criterion and the others when it comes to encompassing both active and passive unethical conduct. For the fossil fuel sector, an "omission" could for instance be failure to invest in commercially available new technology for reducing emissions.

Second, the Group noted that the proposed new criterion refers to conduct that, "on an aggregate company level", is severely harmful to the climate. This qualification is necessary in order to specify that in this case, one must assess the totality of a company's operations, because it is the totality of CO_2 emissions and impact on climate change that is at the core of the criterion. In considering the severity of a breach of ethical norms in this area, it seems reasonable to focus on emission intensity, not necessarily absolute emissions. It could be problematic to have a system in which a large emitter of CO_2 in absolute terms were to be excluded, while the exact same emissions would be allowable if the company had been split into smaller pieces that individually had much lower emissions. The issue of measuring emission intensity is closely linked to the concept of "carbon footprinting", to which we will return in Section 5 below.

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[21] There are of course many *other* standards that should be met, for instance regarding local environmental impact, labor standards etc. These may also constitute grounds for exclusion under a system to exclude worst offenders. But the focus here will be strictly on climate-related exclusions.

The qualifying term "severely harmful to the climate" is meant to indicate that the criterion should only apply to the "worst" offenders, in line with the current practice of the GPFG in other areas. The assessment of individual companies should take into consideration such "worst forms" within specific comparable operations, sectors, and industries, based on, for example, what is considered generally acceptable international standards.

One specific issue for carbon emissions relates to the location of emissions. The system of curbing CO_2 emissions and limiting global climate change is based on an underlying supposition that activities in one area can be offset by activities in other areas, for example by the trading of quotas. This is a fundamental difference from the usual application of norms-based exclusion criteria. The whole idea behind emissions trading schemes is that a political decision is made to regulate the total level of emissions from activity covered by the scheme, and that the price signals from the quota market contribute to achieving this level in the most efficient way. It may thus be hard to argue that CO_2 emissions covered by an efficient trading scheme are unethical since the emitter must have contributed to offsetting reductions elsewhere by buying quotas. This is not to say that buying quotas (or adhering to any type of regulation or scheme) would necessarily be regarded as sufficient to avoid exclusion. There have been instances in the GPFG in which exclusions of companies based on an environmental criterion have followed from activities in areas with weak institutions or insufficient regulations, for example in cases concerning illegal logging. Decisions to move production to inadequately policed areas or areas with insufficient climate legislation or other attempts to benefit from weak institutions, coupled with actual severe environmental damage through very high carbon intensity in production, could in this way lead to exclusion.

As with the present criteria, it follows from the wording of the Ethical Guidelines of the GPFG *("if there is an unacceptable risk")* that the assessment should be forward-looking. Companies with concrete and credible plans for reducing carbon emissions from their operations to an acceptable level should not necessarily be excluded, even if present emissions are high. Conversely, companies can be excluded if there is sufficient reason to believe that their carbon footprint is about to get significantly worse through new investments in carbon-intensive activities.

The company-based criteria outlined above are derived from an application of existing ethical guidelines for the GPFG and may not be directly applicable for other investors. But they illustrate some features that could be relevant to include in a norms-based exclusion criterion directed at individual companies in the fossil fuel sector (rather than the whole sector):

- The criteria are directed at the worst offenders, and as such will contribute to establishing norms for unacceptable behavior from companies with respect to climate change. This establishes an important *principle of responsibility* – even if it is difficult to characterize the entire fossil fuel sector as unethical given society's dependence on their products, this does not mean that these companies should have a "free pass" in terms of individual behavior. Fossil fuel companies are not the *only* ones responsible for our dependence on fossil fuels, but they are *also* responsible, and they must abide by some minimum standards of corporate responsibility also in respect of climate change.
- It seems natural to base criteria on emissions intensity and benchmark each company against relevant peers. This ensures that the criterion is dynamic – the norms for acceptable emissions will change over time as new technology is developed and industries transition to a low-carbon economy.
- The criteria should in principle not be directed at a particular sector. The issue is greenhouse gas emissions; the sector from which these emissions emanate is

irrelevant. For reasons of practicality it may be natural in the first instance to focus on companies within industry sectors with significant absolute levels of emissions. It is clear that, in particular, the energy sector and the production of electricity from fossil fuels will be central in this respect.

- The application of company-based criteria should be linked to active ownership efforts directed at climate change risk, so as to achieve a concerted and integrated exclusion and ownership effort. This reflects that there are important synergies between exclusion and engagement. We will return to this issue in Section 6 below.

The discussion so far has centered on emissions from companies. It is natural that this forms a central part of company-based criteria since emissions from companies is a root cause of climate change. However, other elements could be relevant.

We have argued that the market failure of insufficient pricing of greenhouse gas emissions reflects a political failure to implement carbon pricing. Investors should be concerned that lack of proper carbon pricing sends wrong price signals to companies, which in turn can have serious negative effects on capital allocation and long term capital returns. Investors should thus generally support the introduction of carbon pricing or other measures to address the market failure regarding proper pricing of emissions. Likewise, investors should engage with companies that actively lobby against international agreements aiming at reducing greenhouse gas emissions or otherwise hinders the development towards a global strategy on climate change. These companies are acting against the interests of their owners (and using the owners' money to pay for it). We will return to this when discussing engagement strategies in Section 6 below. In this context, we will note that lobbying in principle also could be reason for exclusion under company-based criteria if engagement efforts fail.

5. Asset allocation approaches

The preceding section dealt with some of the ethical aspects of investing and in particular the issue of to what extent the application of ethical norms could guide investors' actions in relation to fossil fuel investments. In its pure form, the norms based approach is about separating oneself as investor from investments that are inconsistent with one's own norms and values. Any effects on investment performance or company behavior are incidental.

We will now look at some of the financial issues related to fossil fuel investments as well as discuss the question of possible ways investors can exert influence on fossil fuel companies indirectly through their investment decisions. We will come back to the issue of direct influence through engagement strategies in section 6 below.

At the heart of this are two separate but related issues:

- What are the possible *effects of climate change and climate policies on investments*, and how should investors take account of that in their approach to investing?
- What are the possible *effects of investor actions on the climate*?

The first question sees investors taking their external environment as given and relates to how they should adapt to maximize the expected value of their investment portfolios. The second question is based on an assumption that investors can *change* their external environment through the decisions they make – in this case, change fossil fuel company behavior in a way that can affect both the climate and the risk and return properties of these companies.

Role of investors

It is first useful to reflect on what a useful and relevant role for investors might be in relation to climate change and fossil fuel investments.

It is obvious that investor action on climate change is not a *necessary* condition for achieving climate policy objectives; Other instruments for achieving climate objectives – such as political agreement on sufficiently high prices on greenhouse gas emissions – are clearly available (the probability that they will be used is a different issue).

A more difficult issue is whether investor action on climate change could be a *sufficient* condition for achieving climate objectives – could investors through their own actions bring about a sufficient reduction in greenhouse gas emission to achieve climate change objectives? The short answer to this must be "No". First, the publicly traded companies investors own hold only a small part of total fossil fuel reserves. [22] The majority of reserves are held by state owned enterprises that are probably not much influenced by investors. Second, there are obviously limits as to how far investors can push companies in one direction if the economic incentives given through price signals in the market pull in another.

In short, it is not reasonable to expect that investors can solve a climate policy problem where the political system – so far – has failed. But this is not to say that they cannot make useful contributions that are also well anchored in their role as investors and consistent with their fiduciary duty. Accepting the role of a financial investor – and not a climate policy instrument – does *not* imply that the actions and policies of the investor cannot or will not have positive effects on climate issues.

A general equilibrium perspective

It is useful to take as a starting point for a discussion of asset allocation two basic facts about asset markets; All existing assets must by definition be owned by someone, and the average investor must by definition own the market portfolio – i.e. a portfolio that represents a scaled-down version of all investable assets.

Since all assets are held by someone in equilibrium, the prices of all assets must be such that supply equals demand for each asset. This in turn determines the expected return for each asset, which reflects the expected future cash flows to the owner of the asset relative to that asset's current price.

It follows that all instances where an investor is underweighted in a particular asset relative to the market portfolio must be matched by a corresponding overweight in the combined portfolios of other investors. And to be specific on the issue of fossil fuels: Any attempt for investors to "decarbonize" their portfolios by divesting from fossil fuel assets must be matched by a corresponding "recarbonization" of other investors' portfolios.[23] Equilibrium prices – and hence expected returns – on these assets must equate supply and demand and thus reflect the compensation for risk that the average investor requires to hold them.

Active management

This leads naturally into a discussion of so-called "active management". By this we mean a management strategy that is based on actively tilting the portfolio away from the market portfolio to achieve better risk-adjusted returns.

At the outset, it should be recognized that successful active management is very difficult. By definition, the average investor holds the market portfolio, so the sum of all deviations from

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[22] http://www.theguardian.com/environment/2015/apr/19/carbon-reserves-held-by-top-fossil-fuel-companies-soar

[23] At least initially. We will later discuss whether divestment can affect the total level of carbon risk in the financial system.

the market portfolio created by active management decisions must be zero. Hence, the sum of all excess returns must also be zero – and negative when management costs are factored in.

However, there can still be rational arguments for active management. Not all investors can be passive – someone has to ensure that market prices of assets have some link to expected future cash flows.[24] So there is a question of what the comparative characteristics of different investors are and how likely it is that they belong to the group of "naturally active" investors.[25] And "active" is usually – and for good reasons – defined relative to a very simple benchmark. There can be benefits to deviating from such a benchmark, and in a system of delegated asset management this can happen through giving the manager some room for discretion in trying to improve the risk and return characteristics of the investment portfolio relative to a simple benchmark set by the owner. [26]

As a general rule, managers operate under a mandate set by the owner (for instance the Ministry of Finance in the case of a Sovereign Wealth Fund) or trustees representing the beneficiaries (in the case of a pension fund). The mandate will normally stipulate the extent to which the fund can deviate from a given benchmark index, which is usually determined by market weights. This reasonably standard system of delegated management ensures that the owner of the fund makes the key decisions regarding the overall risk in the fund, but that operational decisions are left to the manager.

A clear and reasonably simple governance structure is crucial for good long-term management of any fund. Financially motivated divestment built into the mandate is generally not consistent with this. Excluding a whole sector based on an assumption of mispriced risk – especially if markets generally are assumed to be able to price all other types of risk relatively efficiently – is not appropriate as a foundation for the strategic benchmark construction developed or approved by an owner. It is generally not a proper role for an owner to make time-critical investment decisions based on perceptions of mispricing in the market. Such mispricing – to the extent that it exists – could, of course, lead to opportunities for active management for the manager. These opportunities must compete with other opportunities within the given risk budget.

Some investors have linked opportunities for active management to specific beliefs about how expectations are formed in the market. Robert Litterman has argued that while it is well known that emissions markets have not yet priced climate risk appropriately, what is not well understood is that today's equity markets build in expectations that climate risk will not be priced rationally for a very long time. [27] The market expects a slow increase in emissions prices over the next several decades. What the market does not yet realize, according to Litterman, is that this expectation, sometimes referred to as the "*slow policy ramp*," is irrational. Litterman writes that the actual rational expectation for the price path of emissions is a sudden jump of global carbon emissions prices to a level high enough so that incentives are created that will, with extremely high probability, eliminate any threat of catastrophic

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[24] This argument goes back to Grossman and Stieglitz (1980) who argue that perfectly efficient markets are an *impossibility*, for if markets were perfectly efficient, the return to gathering information would be nil, in which case there would be little reason to trade and markets would eventually collapse. So there is an "equilibrium degree of disequilibrium" to allow those who spend resources on processing information compensation for their efforts. Article available at https://www.aeaweb.org/aer/top20/70.3.393-408.pdf

[25] There is, for instance, compelling evidence of herd behavior and lower returns for retail investors, so it is still possible for the sum of all institutional investors to outperform the market.

[26] The academic literature on this issue is summarized eloquently in a report on active management commissioned by the Norwegian Ministry of Finance available at https://www.regjeringen.no/globalassets/upload/fin/statens-pensjonsfond/eksterne-rapporter-og-brev/ags-report.pdf

[27] See http://ensia.com/voices/the-other-reason-for-divestment/

climate change. He also expects this "rational pricing of emissions" to be much higher and to arrive much sooner than the market expects.

More generally, investor short-termism is an argument observers often use in this context.[28] However, the empirical evidence on short-termism in financial markets is mixed. It is true that average turnover in the stock market has increased significantly and that investors can be said to be more short-termist in this sense.[29] This is not the same as saying that investors systematically attach too little weight to future events – such as the possibility of higher carbon prices – that may influence corporate earnings. For instance, there is solid empirical evidence showing that over the long term, investing in companies with above-average growth prospects (as indicated by a high ratio of stock price to book value or dividends) has produced a disappointingly low return. Conversely, investing in companies that have below-average growth prospects has produced a superior long-term return. So, in hindsight, investors have been too *long-termist,* in the sense that they have let assumptions about growth in revenues in the future color their present valuation of assets too much. [30]

If carbon risks have not in the past been fully priced by asset markets, then developments in the last few years may make it less likely that this will still be the case. In 2013, the financial data provider Bloomberg introduced the Carbon Risk Valuation Tool, which allows users to test companies' valuations against various oil price or "decarbonization" scenarios. Recently, the financial services provider MSCI launched a Carbon Emissions and Fossil Fuels Reserves Analytics, designed to support carbon reduction and fossil fuel-free investment strategies and reporting on carbon exposures.[31] As climate risk has been articulated very clearly, markets can be expected to incorporate stranded-asset risk into security prices.

Alternative indices

An alternative option for so-called "decarbonization" of investment portfolios is to invest in a low carbon index.[32] These indices are constructed to lower the allocation to assets that are heavily exposed to carbon risk. In this sense, they represent a more rules-based version of active management designed to lower carbon risk. In operational terms, the investments are "passive", since they track a predefined index, but in economic terms they are "active", since they represent a tilting away from companies and sectors that are heavily exposed to carbon risk. If you expect this to outperform the market portfolio on a risk-adjusted basis, you must believe that carbon risk is mispriced in the markets – i.e. believe that at least for this risk factor, markets are inefficient.

Some indices of this kind are constructed to minimize so-called tracking error against a market benchmark – i.e. mimic the returns of the market portfolio as closely as possible while at the same time reducing exposure to carbon-intensive investments.[33] The underlying

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[28] For example, Caldecott and McDaniels (2014) write that the phenomenon of short-termism in financial markets undermines the ability to invest and manage risk with due consideration for environmental-related risk factors report. They link this short-termism to the practices and regulations that govern financial institutions, such as, for example, benchmarks for performance measurement, decreasing CEO tenure, the application of mark-to-market accounting practices, and liquidity requirements, see Caldecott and McDaniels (2014),Smith School of Enterprise and the Environment Working Paper, Financial Dynamics of the Environment: Risks, Impacts, and Barriers to Resilience, Working Paper for the UNEP Inquiry available at: http://www.smithschool.ox.ac.uk/research/stranded-assets/UNEP-SSEE%20Working%20Paper%20-%20Financial%20Dynamics%20of%20the%20Environment.pdf

[29] One should be a bit careful with this interpretation, however, since much of the increase in turnover is due to the advent of high-frequency trading and thus might not represent an increase in the holding period of the median investor.

[30] Elroy Dimson, Paul Marsh, and Mike Staunton, *Global Investment Returns Sourcebook 2014*, pp. 49–51.

[31] See http://news.msci.com/read/archive?id=8166&e=wm%40fin.dep.no&x=4fc169c3

[32] See for instance https://www.msci.com/msci-low-carbon-indexes

[33] See https://www0.gsb.columbia.edu/faculty/pbolton/papers/Hedgingclimaterisk(v35).pdf

investment idea is that carbon risk is fundamentally mispriced and that this mispricing will sooner or later be corrected. The index is intended to provide a "free option on carbon"; Until the introduction of limits on CO_2 emissions, investors in the index will in theory obtain the same returns as on a benchmark index, but the day when CO_2 emissions are properly priced, the low carbon index will outperform the benchmark.

As with active management generally, these indices do not represent a general equilibrium approach to carbon risk – all investors can obviously not invest in such indices simultaneously. If and when the volumes committed to such indices increase, it should in principle be more and more difficult to track a market-weighted index with one large sector excluded. Moreover, the approach of creating a "synthetic" market portfolio rests on the stability of historically estimated correlations between various assets that may or may not be stable going forward. If you are assuming that carbon risk is a real risk that rational investors in equilibrium would be willing to pay to avoid, and at the same time believe that there is a way of getting that insurance at zero cost by combining a portfolio of assets in a specific way, you are obviously making some implicit assumptions about imperfections in the pricing of these assets. How much these theoretical limitations of the approach will impact the practical implementation of these strategies remains to be seen. In any case, they represent a rules-based low-cost alternative to other active strategies directed at exploiting perceived mispricing of carbon risk.

Risk management tools

Modern financial markets provide a range of tools that effectively separate risk and ownership. For example, investors can mitigate carbon risk through a total return swap — a derivative that creates cash flows to the investor, positive or negative, equal to the total return that would be generated by owning a basket of specified long and short underlying equity exposures. In the case of fossil fuels, such a swap would create the equivalent economic benefit of selling carbon-related assets at current valuations and investing those proceeds in the broad equity market, but without actually doing this.[34] As management of carbon risk comes more to the attention of investors, it is reasonable to assume that there will be a growing market for various forms of financial instruments designed to let investors manage this risk.

This separation of risk and ownership is potentially significant. *It implies that risk concerns are not per se a valid reason for divestment*, as the economic effects of divestment can be easily mimicked through use of derivatives. Moreover, this approach to managing carbon risk will allow investors the opportunity to continue exercising ownership, thus eliminating the perceived trade-off between carbon risk management and engagement strategies. These are in reality separate issues – carbon risk can be managed without selling the underlying assets, giving full opportunity to implement engagement strategies.

An instrumental perspective on divestment

In an asset allocation context – and separate from the ethical issues discussed previously – divestment is just an extreme case of underweighting carbon-related assets in an investment portfolio. As such, this is just a special case of active management, which should be based on the same general investment beliefs and views on comparative characteristics as investor as we have discussed more generally for active management above.

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[34] This example comes from Robert Litterman who has applied this tool as Chair of the Investment Committee of the World Wildlife Fund, see http://ensia.com/voices/the-other-reason-for-divestment/

The public debate on fossil fuel investments has, however, highlighted an alternative perspective on divestment. This is using divestment/exclusion as *an instrument* to achieve change. So far, we have discussed exclusion based on norms or divestment based on financial considerations from the point of view of the investor. The instrumental perspective on divestment takes the opposite approach and asks how divestment might affect the companies one divests from and their investment decisions.

It is immediately clear that this is a qualitatively different approach. At first glance, it seems to directly contradict the obligation to observe fiduciary duty – after all, the focus has now turned to how a fund can be an instrument of climate policy rather than a vehicle for financial saving. But it can still be reasonable for an investor to consider this approach. First, the ethical aspects of fossil investments have been discussed above. If divestment can – somehow – bring about reductions in greenhouse gas emissions, can it be an ethical obligation for an investor to contribute in this way? Second, and looking at this from a financial perspective – if divestment can affect the investment decisions of fossil fuel companies, can it in turn affect the total level of carbon risk in the financial system and not just how it is distributed between investors?

To assess these issues, it is necessary to discuss how divestment from (a growing number of) investors might affect fossil fuel companies and their investment decisions. Generally, the arguments have centered on two main channels of influence that we will discuss in turn – effects through the relevant companies' cost of capital and effects through their so-called "social license" to operate.[35]

Cost of capital

The theory behind this argument is relatively straightforward: If many investors shun investments in a particular sector, these companies have to offer a higher expected return to attract capital. Looking at it from an equity valuation perspective, this is the same as saying that these stocks will have a lower price relative to other stocks with the same expected cash flow. Higher costs of financing should in turn lead to lower investments and lower overall activity from the affected companies.

Does this work in practice? There is research on so called "sin stocks" (tobacco, alcohol and gambling) that indicates that these companies indeed have given higher risk-adjusted returns than other sectors, and that this can be attributed to divestment from (some) institutional investors.[36]

Quantitative studies on this effect have estimated that annual risk-adjusted returns in sin stocks have been around 2 pct. higher per annum.[37] However, the total cost of capital for companies depends not only on the cost of equity, but also on the cost of debt. As the cost of debt for these companies does not seem to be higher than for other companies, we would expect companies that are constrained in the market for equity to rely relatively more on debt finance. Again, this is supported by empirical evidence: Companies in the "sin industries" seem to have significantly higher debt ratios than peers in other sectors.[38] This reduces the

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[35] These effects are claimed not only for divestment, but also for some of the available alternative index products where effects on cost of capital and reputational issues connected with not being included in the relevant index is seen as potential drivers of change in corporate behavior. See for instance http://etindex.com/images/assets/ET_Index_Briefing_Note_01_FTSE_100.pdf

[36] See http://responsiblebusiness.haas.berkeley.edu/documents/Moskowitz_2011_CSR_Cost_of_Capital.pdf

[37] Hong and Kacperczyk (2009), available at http://pages.stern.nyu.edu/~sternfin/mkacperc/public_html/sin.pdf

[38] See above

effect of higher equity costs on total average cost of capital for them.[39] All in all, these findings seem to indicate that total capital costs in the "sin industries" could be around 1- 1½ pct. higher on a risk-adjusted basis.

Is it reasonable to assume that an effect on cost of capital of this magnitude can have an effect on fossil fuel-related investments and hence on greenhouse gas emissions? While it would be unreasonable to completely rule out that there *can* be an effect, it seems unlikely that it can be significant.

It could first be noted that this potential increase in financing costs is marginal compared to the significant reduction in financing costs in recent years due to falling interest rates and well within a reasonable margin for uncertainty in future financing costs. It could also be noted that the effect of (relatively widespread) divestment and higher capital costs on tobacco production seems to have been negligible.[40] This is perhaps not surprising; We would expect a significant effect only if there was concentration of investment opportunities that are marginal, and which would fail to meet required returns if the return hurdle were set slightly higher. For investment opportunities that clear the hurdle by a comfortable margin anyway, a slightly higher hurdle would not be expected to have an impact.

A more careful examination of the cost of capital argument reveals another problem with it; We are assuming that the managers of fossil fuel companies will be observing that their shares are trading at lower prices relative to expected earnings and hence implicitly have a higher expected return than shares in other sectors *and that they will incorporate this information into their investment decisions*. But we have already assumed that there are principal-agent problems in the relationship the owners and managers of these companies, and that managers are *not* necessarily investing to maximize shareholder value. This is one of the central justifications for why investors should be concerned about climate issues in the first place, and not just leave the matter to the managers of the companies they invest in. It is true that *new* capital raised through issuing shares may be more expensive, but this is a minor source of funding compared to retained earnings and various forms of debt financing.[41] [42] And increased cost of new capital will not necessarily giver greater discipline in the spending of retained earnings. This is a proper focus for engagement strategies, to which we will return later.

License to operate

This argument assumes that divestment will stigmatize the fossil fuel sector to a point where they will lose their social license to operate.[43] This, in turn, will lead to lower investments in the sector and gradually lower greenhouse gas emissions.

It seems reasonable to assume that general norms established through an exclusion mechanism could constitute a channel of influence that may exceed the effects of just ceasing to be an owner. Stigma can, for example, lead to restrictions on government purchases from

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[39] It also suggests that more attention should be paid to lenders in relevant sectors. We will return to this when we discuss engagement strategies.

[40] Global tobacco production is at high levels by historical standards, see http://www.statista.com/statistics/261189/global-tobacco-production-since-1980/

[41] In 2014, total financing raised in the global metals and mining sector was USD 230 bn. Equity accounted for USD 21bn, or under 10 pct of the total according to http://www.ey.com/Publication/vwLUAssets/EY-ma-and-capital-raising-in-mining-and-metals/$FILE/EY-ma-and-capital-raising-in-mining-and-metals.pdf

[42] In simple theoretical models, internal and external sources of funding are seen as perfect substitutes, but research focusing on market imperfections show that internal funding can have cost advantages over external. See for instance http://www.brookings.edu/~/media/Projects/BPEA/1988-1/1988a_bpea_fazzari_hubbard_petersen_blinder_poterba.PDF

[43] See for instance http://e360.yale.edu/feature/why_the_fossil_fuel_divestment_movement_may_ultimately_win/2898/

companies, consumer backlash, or more restrictive regulation. There is some anecdotal evidence that exclusion campaigns to a certain degree influenced producers of cluster munitions to stop producing them, due to the increasing political stigma connected to the weapons during the 2000s.[44] There is also some evidence that stigma played a role in influencing previous campaigns against tobacco and investments in apartheid South Africa.[45]

One could, however, question how relevant these historical experiences are for assessing the potential effects on the social license to operate of fossil fuel companies. In the case of cluster munitions, no company had this as their only or even most important product. Tobacco is an economically marginal product with no social value. Fossil fuels, on the other hand, are central to the world's energy system – and will be for quite some time. Nevertheless, there is no doubt that the divestment movement has contributed to raising awareness about the climate issue and the long-term viability of the fossil fuel business in a climate-constrained world.

However, these effects do not necessarily rest on the application of a broad product-based exclusion criterion. For an exclusion criterion targeted at the worst performers within a sector, it is also reasonable to assume that there could be an effect through setting a norm for acceptable standards.[46] The same is true for standards set in expectations documents and promoted through engagement strategies. So while investors can set and promote norms through their actions – and through this also potentially affect investee companies' social license to operate – this is not in itself an argument for product-based exclusions.

Other consequences of divestment

If one does take an instrumental approach to divestment and consider it a legitimate (or necessary) tool for investors to influence investee companies and their investment decisions, one should also look at other possible side effects.

The website gofossilfree.org defines divestment as "the opposite of an investment — it simply means getting rid of stocks, bonds, or investment funds that are unethical or morally ambiguous".[47] But "getting rid of" in this context means *selling the shares to some other investor*. One immediately apparent consequence of divestment is thus the concentration of ownership in the hands of investors who – presumably – care less about the climate than those investors that have divested.[48] Given the principal-agent problems between owners of companies and managers of companies described above, one should consider whether this increases the risk of these companies being subjected to too little scrutiny from their owners and that the disciplinary pressure on new investments in the sector from asset owners will be too weak.

The fossil fuel divestment movement has – at least so far – been particularly centered on coal companies. It seems likely that widespread divestment from coal will lead to the breaking up of both mining and utility companies into pure-coal and non-coal entities.[49] Furthermore, it is

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[44] The Council on Ethics has reported cases of companies, citing reputational concerns, asking what it takes to be either excluded or included in the GPFG.

[45] Ansar, et. al. (2013) "Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets", Stranded Assets Programme, University of Oxford's Smith School of Enterprise and Environment.

[46] A similar norm-setting effect could come through the use of alternative indices based on emissions intensity.

[47] http://gofossilfree.org/frequently-asked-questions/

[48] And to the extent that the "cost of capital"-argument is correct, they are also being rewarded for this through higher expected returns as noted above.

[49] This is the same process the tobacco industry went through, with many tobacco asset being spun off into separate entities.

likely that the ownership structures of the pure-coal and non-coal companies will gradually diverge. In a recent report, the audit and consultancy firm EY points to new players entering the market for coal assets.[50] Private equity and hedge funds seem set to acquire coal assets as a shorter-term financial investment as valuations are pushed lower due to industry restructuring and mining companies selling off coalmines. But low valuation also presents an opportunity for users of coal to secure cheap long-term supplies through buying shares in mining companies and delisting them. The EY report mentions in particular Chinese and Indian state-owned enterprises and steelmakers as likely buyers.

These trends – which may be intensified through the pressures of the divestment movement to dispose of coal assets – are worrying from a climate policy point of view. When integrated mining companies face pressure to reduce their exposure to coal, their rational response is to sell off the coal-related assets to other owners. This presents users of coal with an opportunity to lock in low prices of their coal supply by buying the coalmines and taking them off the market.[51] This is the flip side of the cost of capital argument: If divestment is "successful", it pushes down the value of the assets relative to expected future cash flows. From the perspective of the *buyers* of coal, it pushes down the cost of securing long-term supply of coal today (through simply buying the coalmines themselves) relative to the expected future cost of buying coal in the open market. When long-term coal supplies can be secured at low cost, the incentive to switch to other sources of energy of course becomes much weaker. So there is a potential risk that the current restructuring of ownership of coal-related assets – partly encouraged by the divestment movement – will delay the transition to a low carbon economy.

Impact investing

The mandate for this report asks, "*What meaningful role can a labor market pension fund play in the global transition into a low-carbon economy?*" It is thus natural briefly also to comment on the possible role of so-called impact investing in the context of asset allocation strategies.

Figure 4 below is one way of categorizing different approaches to investing.[52] At the far left is the "traditional" approach to investing – looking only at near-term financial prospects for individual companies and largely ignoring externalities or other factors that may impact longer-term risk and return characteristics of potential investments. At the far right is philanthropy – giving charitable contributions. These two endpoints of the indicated spectrum are both inappropriate for a pension fund. Having no regard for environmental, social and governance (ESG) factors in investing is not consistent with the fiduciary duty to assess factors that may have material impact on risk and long-term returns. On the other hand, pure philanthropy – essentially giving away money belonging to beneficiaries – is also normally inappropriate and inconsistent with the mission of a pension fund.

In addition to possible ethical screens (exclusions) and other forms of ESG integration, impact investing is a tool for investors to align their investment activities with broader societal objectives and the values of their beneficiaries without (necessarily) sacrificing returns.

Within the category of impact investing, a distinction can be made between "themed investments" made on a pure for-profit basis and "impact-first investments" where some

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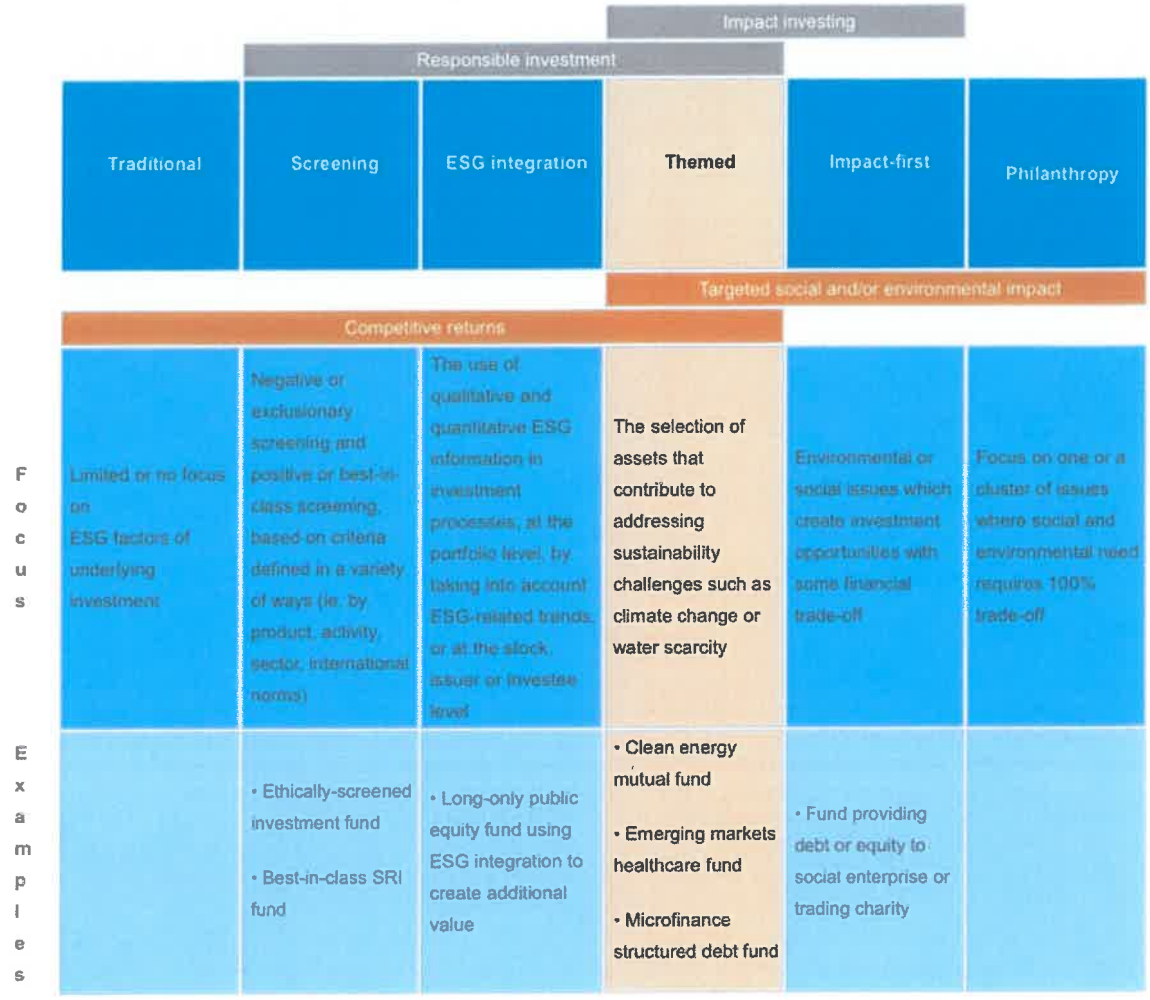
[50] http://www.ey.com/Publication/vwLUAssets/EY-ma-and-capital-raising-in-mining-and-metals/$FILE/EY-ma-and-capital-raising-in-mining-and-metals.pdf

[51] The EY report refers to valuations in mining transactions as low as 40 cents per tonne of coal.

[52] It is taken from http://www.unpri.org/areas-of-work/implementation-support/environmental-and-social-themed/ ,which also has more resources on the topic.

financial trade-off is accepted, for instance in the form of accepting higher risk for a given expected return.



Source: *adapted from Bridges Ventures (2012)*

Traditionally, development finance institutions (DFIs) have been important players in the "impact-first" segment, but we are also seeing increased cooperation between DFIs and pension funds in for profit themed investments as witnessed for instance in the agreement between Norfund and Norwegian pension fund KLP on financing of solar power plants in South Africa.[53] [54]

Dutch pension fund APG states that *"For a long time, APG has actively sought to make high sustainability investments. These are activities that contribute to solutions for climate change, water shortage, a water surplus, pollution, the need for microfinance, and the loss of habitats or species. Here, too, it is essential that they not only contribute to sustainable development but also to a good return.* "[55] These investments total 4-5 pct of the fund's total portfolio. **Many other**

[53] http://www.norfund.no/norfund-news/klp-and-norfund-co-invest-in-solar-energy-article919-322.html

[54] For transparency I should disclose that I am member of Norfund's board.

[55] https://www.apg.nl/en/vvb2013/14.05.46c2-verslag_verantwoord_beleggen_gb.pdf

pension funds have similar investment schemes – the Norwegian GPFG has an environmentally oriented investment program focusing on various forms of clean energy.

The transition to a low-carbon economy will require massive investments. Clearly, a total reorientation of the world's energy system away from fossil fuels is a disruptive event that will provide many investment opportunities. A note of caution is nevertheless in order. These investments will typically be in "growth" companies – companies where a lot of the present value is derived from expected cash flows in the future, as opposed to "value" companies that have positive cash flows now but more limited growth prospects. Perhaps counter to intuition, and as described in the introduction to this section, financial theory and empirical studies show that value companies have outperformed growth companies over long periods of time.[56] While it seems immediately attractive to "invest in a growing business", it is important to properly analyze these aspects of themed investments to make sure that they properly reflect the desired risk and return characteristics of the fund's investments.

6. Engagement strategies

We have established that climate change and climate policy are important and relevant issues for investors – particularly in the context of fossil fuel investments – and discussed pros and cons of various asset allocation strategies, including divestment. It is now time to turn to engagement as a possible tool to address these issues.

It should be noted at the outset that the history of engagement goes back to the establishment of the first modern corporations over 400 years ago. [57] It was immediately recognized that there was an important role for investors in the governance of such corporations – it is not a viable option to delegate all matters to the board of the company. This reflects principal-agent problems that in many ways are hardwired into our economic and financial system.

Modern corporations were established to undertake projects of a scale and complexity that earlier ways of organizing enterprises were not able to accommodate. This in itself creates an issue of asymmetric information between the owners of the company and its managers. Almost by definition, modern corporations are so large and complex that it difficult for outsiders to get a complete picture of them – that is why they were established as corporations in the first place. This issue of asymmetric information is amplified through the financial imperative of divestment. In a modern financial economy, owners hold tiny shares of a large number of individual companies. This is a good way of diversifying risk, but it comes at the cost of reduced control over each individual investment. Moreover, it is difficult to write a contract between owners and managers of a company that completely aligns their interests.

Engagement – and corporate governance work more generally – is a tool to address these inherent principal-agent problems. One important aspect of successful engagement is striking the right balance between appropriate checks and balances on the one hand and sufficient delegation on the other. [58] It is in this context we must consider relevant engagement issues regarding fossil fuel investments and the appropriate tools to address those issues.

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[56] Elroy Dimson, Paul Marsh, and Mike Staunton, *Global Investment Returns Sourcebook 2014*, pp. 49–51. For a broader discussion of the so-called "value premium" see Antti Ilmanen's excellent book *"Expected returns"* (2011)

[57] The Dutch East India Company, established in 1602, is generally regarded as the first such company – characterized by a separate legal personality, limited liability and freely transferable shares.

[58] Consensus on what a good balance is has naturally shifted quite a bit back and forth over time. The adoption of "Stewardship Codes" in several countries in recent years – particularly after the global financial crisis – is perhaps an indication that consensus is now shifting towards a greater role for investors.

Engagement tools

Shareholders have a number of formal rights in the overall governance structure of corporations. While these rights vary a bit from jurisdiction to jurisdiction, they will generally include the right to appoint or approve the board of the company (but not always the right to nominate board members), the right to appoint the auditor, the right to decide or approve dividends and the issuance of new capital and the right to vote on resolutions and other issues put before the annual meeting of shareholders. In addition, legislation and standards set by for instance stock exchanges will normally regulate the timing and minimum contents of reporting from companies to their owners.

These formal tools are complemented by a number of informal tools. Companies will often seek to have an ongoing dialogue with shareholders. Shareholders engage with companies individually or as part of groups, for example through the engagement platform provided by the Principles for Responsible Investment (PRI).[59] This is a way of raising issues of concern with companies outside the formal setting of the annual meeting. Collaborative efforts on engagement reduce the cost of engagement and make engagement a feasible option also for smaller, resource-constrained investors.

Investors with a very diversified portfolio will normally hold shares in several hundred – if not thousands – of companies. For these investors, expectations documents can be a way of communicating views on general corporate governance issues or more specific industry issues in a transparent way to a broad set of companies. A useful starting point for formulating expectations in various areas can be found in the guidance documents developed by the UN Global Compact. [60] The standards developed by the Un Global Compact or investors themselves through expectations documents or other policy documents form a natural basis for engagement.

In addition to engaging with individual companies in the portfolio, it can be relevant to engage with regulators, standard setters, and industry organizations and participate in various investor initiatives. In many cases, these types of engagement can be more effective if the underlying issue implicates broader industry standards rather than individual company conduct. Climate change is not a problem linked primarily to the conduct of individual companies. These more broadly based initiatives are thus an important supplement to ownership strategies at a company level.

Engagement issues

The starting point for prioritization of issues for engagement should be twin challenges of lack of proper carbon pricing and principal-agent problems in the relationship between company owners and company managers. It is this twin challenge that creates the risk that investments in new capacity in the fossil fuel sector in the coming years can be harmful for long-term investor returns as well as lock in use of coal and fossil fuels. Engagement on this issue is thus an area where the financial interests of investors are well aligned with climate policy and broader societal concerns.

The fossil fuel sector is planning substantial investments in the years ahead. This will be needed to meet overall demand for fossil fuels – including under policies consistent with a "2 degree scenario" for global warming. However, there are legitimate concerns about the robustness of the financial analysis behind investments in marginal sources of supply under

[59] For transparency I should disclose that I am Chair of the PRI

[60] These are available at https://www.unglobalcompact.org/library

reasonable assumptions about future climate policies and the degree to which this is adequately reflected in the internal incentive structure of producers.

Transparency and robustness of business models

A constructive engagement on this issue should start by requiring fossil fuel companies to increase transparency on their underlying demand and price assumptions and the robustness of their business models under various climate policy scenarios. For the bigger companies these assumptions are increasingly public.[61] Investor demand for information and various engagement efforts already appear to have achieved some results, with larger oil companies now publishing the long-term assumptions underlying their investment decisions. Shareholder resolutions were recently passed in BP, Shell and Statoil asking for more transparency on these issues, while similar resolutions at ExxonMobile and Chevron were not passed.[62]

As with other investment decisions, in practice one sees different companies using different demand assumptions in their long-term planning. Many companies clearly do not currently plan according to a "2 degree world"[63], presumably partly due to lack of credible political commitments to effective climate policies. This implies that some of the investments these companies currently make will be at risk in a more climate-friendly environment. These concerns are why organizations like CTI (Carbon Tracker Initiative) encourage companies to take seriously the potential for a 2 degree pathway in their long-term energy outlooks.

Systematic work on measuring the carbon footprint of portfolios can support targeted engagement in this area. Due to lack of standardization in data and methodology, it is not straightforward to use carbon footprinting of companies as an absolute measure, but it may still give indications of relative performance that can be a useful input to the overall investment analysis.

At the total portfolio level, footprinting can help identify total exposure to carbon risk relative to a market benchmark. At the level of the individual investment, it can form a basis for engagement, for instance if individual companies seem to have carbon intensities that are significantly higher than relevant peers.

Capital structure and dividend policies

Capital structure and dividend policies are central issues in the relationship between owners and investee companies. They are one of the few areas that are reserved for a direct vote by shareholders in most jurisdictions. Shareholders vote both on the distribution of capital in the form of dividends and on issuing new share capital.

It is *not* the role of an investor to micromanage the companies in which they invest or to second-guess the assumptions underpinning company investment decisions. It is, however, the responsibility of a long-term shareholder to question the robustness of financial analyses behind significant new investments when investors could receive higher dividends instead. It is not an area investors should delegate to the managers of the companies they have invested in.

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[61] The Carbon Disclosure Project's (CDP) 2014 report says that 150 companies that report to CDP are using carbon pricing in their planning. See https://www.cdp.net/CDPResults/global-price-on-carbon-report-2014.pdf

[62] http://insideclimatenews.org/news/28052015/exxon-chevron-reject-shareholder-measures-climate-change-again

[63] In fact, based on the above, they appear to be planning for a four-degree world or thereabouts. This still means, however, that they expect a more rapid transition to a low-carbon economy than a static extrapolation of current trends would indicate.

Investor engagement on dividend policy is thus directly linked to the issue of robustness discussed above. It is an approach that targets the root cause of carbon risk in the financial system through limiting the investment capacity of companies without investment opportunities compatible with reasonable scenarios for climate policies.

The Carbon Tracker Initiative points out that reducing high-cost options may be viewed favorably by the market as a way of cutting investments and maintaining dividends for such companies. Reports such as the ones developed by the Carbon Tracker Initiative enable investors to challenge companies on their underlying demand and price assumptions and should aid in engagements with such companies and in the efficient pricing of these companies.

Fossil fuel companies face the prospect of decline and must adapt to new circumstances to survive. If managed well, this adaptation can enable them to leverage their present strengths in a low-carbon energy system. Since this transition inevitably will take time, these companies will need the engagement and support of large long-term investors. By engaging on climate resilience and transition strategies for fossil fuel companies, investors will be actively managing the climate change related risk exposure to their portfolios and protecting the long-term value of their investments. [64]

Other areas for engagement

Since principal-agent problems in many ways lie at the heart of the carbon risk challenge, it is natural to consider engagement areas directly linked to companies' incentive structures and decision-making processes. This can include areas like compensation policies, the company planning process and the role of the board in risk management and investment planning.[65]

We have noted above the important role of financial institutions as providers of debt capital for fossil fuel companies. These corporations, too, should be challenged to address the issue of climate policy resilience of their business models and how they through their lending practices risk financing an unsustainable accumulation of carbon risk in the financial system.

A global consensus on policies for addressing climate change – including mechanisms for the pricing of emissions – will reduce risk for long-term investors. Thus, long term investors should support and promote efforts to establish such a consensus. Investee companies should be expected to provide information on their position on climate change legislation and regulation and the nature of their interactions with policymakers and regulators. In this context, companies should also be urged to promote the conditions for well-functioning markets and not actively hinder the development towards a global strategy on climate change.

Synergies and the limits of engagement

Engagement and divestment are sometimes portrayed as opposites. In reality, they should be viewed as complementary tools with potential synergies and spillover effects.

A norms-based exclusion mechanism at the individual company level contributes to setting a minimum standard for corporate behavior. This is a natural basis for engagement. The existence of an exclusion mechanism can also make engagement more effective, if the

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[64] But it should be noted that the history of corporate transformations indicates that such transitions are difficult. Disruptive change almost always happens through newcomers attacking the positions of incumbents, and not through change from within large organizations. For investors, this raises the question of how to balance an engagement agenda between reinvesting earnings in new business areas within existing corporations on the one hand and pushing for higher dividends to reinvest in new ventures outside existing corporations on the other.

[65] A very useful overview of possible engagement issues and strategies can be found in Carbon Tracker's "Fossil fuel transition blueprint", available at http://www.carbontracker.org/report/companyblueprint/

company in question attaches a negative stigma effect to being excluded. From the point of view of an investor, the exclusion mechanism represents a "safety valve" and a natural end point for an unsuccessful engagement. The financial risk of investing in companies that are unable or unwilling to respond to well-founded investor concerns may in itself be a reason to divest.

This highlights an important difference between behavior-related exclusion criteria at the company level and product-related exclusions at the sector level. For the former, there is an important link to engagement. For the latter, this link is much weaker. You can engage with a company on dividend policies, labor standards, environmental risk management and a range of other issues – you cannot credibly engage on the line of business itself.

This has given rise to a misconception about the potential role of engagement in the fossil fuel sector. Since one cannot credibly engage with a coal mining company to switch to producing renewable energy, it is easy to conclude that engagement "doesn't work" in the sense that it cannot make fossil fuel companies change their business models. This is true, but it does not imply that engagement cannot play an important role by focusing on the profitability of new investments, capital structure and dividend policy. The transition to a low carbon economy will be delayed if there are investments in new fossil capacity now that will bring new supply with low marginal production costs to the market over the coming years. An engagement strategy focusing on capital expenditures is a direct and targeted approach to addressing this issue.

The growth in engagement activities in recent years, as evidenced also by the growth of companies and organizations facilitating it, proves that engagement *can* work – otherwise it is unlikely that rational, profit-maximizing financial institutions in highly competitive markets would spend resources on it. But this does of course not guarantee that it *will* work everywhere. The efforts to require large oil companies to publish stress tests of their business models against climate policy scenarios took time, and as we have seen, have not so far been successful everywhere.

Research on engagement suggests that successful engagements are followed by positive abnormal returns. [66] Success in engagements is shown to be more probable if the engaged firm has reputational concerns and higher capacity to implement changes.[67] Moreover, collaboration among investors is instrumental in increasing the success rate of engagements. After successful engagements, particularly on environmental and social issues, companies experience improved accounting performance and governance and increased institutional ownership. Clearly, engagement strategies should be a central part of the toolkit of institutional investors.

7. Conclusions

The scientific evidence linking climate change to CO_2 emissions is overwhelming, and the use of fossil fuels is a main component of such emissions. This means, in practice, that we must achieve a large-scale transformation of our energy systems away from fossil fuels. This is a disruptive event that will provide both risks and opportunities to investors.

The current lack of proper pricing of CO_2 emissions represents a significant market failure and can lead to an allocation of investment capital that is unsustainable – locking invested capital

[66] Dimson, Elroy and Karakaş, Oğuzhan and Li, Xi, Active Ownership (August 7, 2015). Review of Financial Studies, Forthcoming . Available at SSRN: http://ssrn.com/abstract=2154724

[67] This supports the argument about synergies between exclusion and engagement made above.

into uses with low or even negative long-term returns. Extracting and burning all available fossil fuels in the world today is not consistent with meeting climate objectives under reasonable assumptions about the rate of technological change. So if we are to be anywhere near a "two degree scenario", some resources will have to stay in the ground, and investments associated with extracting and burning these will become "stranded assets".

The lack of a proper price on CO_2 emissions combined with potential misalignment of interests between owners and managers of fossil fuel companies gives a risk of overinvestments in extraction and use of fossil fuels extraction. This "carbon risk" is *created* by the investment decisions of companies that extract and use fossil fuels and *distributed* among the owners of these companies through the financial system. In a competitive market, prices of assets should generally reflect relevant risk factors – including carbon risk. It is thus important to distinguish between imperfections in the market for greenhouse gas emissions (which are obvious) and possible imperfections in the market for financial assets that are exposed to carbon risk (which are not that obvious) – these are *not* the same.

The phenomenon of "stranded assets" is not new; in a dynamic world investors are constantly at risk of being exposed to assets loosing value because of, e.g., political, regulatory, or technological development, and it is not at all clear that financial markets are incapable of pricing this risk properly. Moreover, in current value terms, the loss may be limited due to discounting reflecting the timing of possible stranding and investor risk appetite.

The fossil fuel sector is large, and projected investments in maintaining and expanding production capacity in the coming years are significant. Even if the market may have *priced* carbon risk correctly and *distributed* it in an optimal way between market participants, the *total level of risk* may be unacceptably high, both from an investment and a broader societal point of view. In that case, the proper focus is on actions that will bring the total level of risk in the financial system down, rather than actions that will only bring about a redistribution of existing risks between investors. Importantly, investors with an active investment strategy can manage their carbon risk exposure, but it will require political intervention to effectively address the market failure that is the root cause of the total level of risk.

This is the proper context for discussing divestment and engagement as tools for investors to address climate issues. Divestment means selling shares to some other investor. While this can reduce carbon risk for the seller, it does this by shifting that risk to the buyer. For the overall carbon risk in the financial system to be reduced, investors must address the source of that risk; They must limit investments made by fossil fuel companies in projects that are not viable under reasonable assumptions about climate policies. We have argued that engagement seems much more likely to achieve this than divestment and have outlined some considerations in formulating an appropriate engagement policy.

Climate change and fossil fuel investments are not just financial issues – they have important ethical aspects investors should consider.

We have argued that it is difficult to establish a norm stating that all production and use of fossil fuels is *per se* unethical – fossil fuels are part of an unsustainable energy system, but that is a shared responsibility for consumers and producers of energy.

But even if it is difficult to state that *all* fossil fuel companies are inherently unethical, it does not mean that *none* of them are. It is reasonable to expect that fossil fuel companies meet certain minimum standards with respect to how their business activities impact climate change. This establishes an important principle of responsibility; Fossil fuel companies are not the *only* ones responsible for our dependence on fossil fuels, but they are *also* responsible,

and they must abide by some minimum standards of corporate responsibility also in respect of climate change.

This means that there is a role for ethically motivated exclusions at the individual company level. The criteria set for such exclusions will help establish norms for acceptable behavior for fossil fuel companies with respect to climate change. These criteria will thus also form an important basis for engagement efforts.

An ethical consideration based on examination of consequences rather than application of norms should also consider the potential effects of exclusions on the ownership structure of investee companies. Fossil fuel companies will exist for a long time still. They need active, engaged owners who can discipline capital spending and address inherent principal-agent problems in the relationship between a company and its owners. It is therefore not obvious that it is better for the climate that ownership is concentrated in the hands of investors who presumably care less about the climate than the investors who are divesting.

Attachment C

Attachment C: Annualized Returns of CU200 Companies as of 9-30-2017	1	3	5	10	15	20	30	1980
Oil and Gas								
Aker BP	26.43	41.43	13.40					
Anadarko Pet	(22.61)	(20.93)	(6.17)	(0.25)	6.18	5.86	7.38	6.82
Antero Resources	(26.16)	(28.67)						
Apache	(27.00)	(19.78)	(10.60)	(5.52)	4.22	5.54	9.20	6.58
ARC RES	(25.25)	(12.91)	(2.30)	3.69	9.92	11.77	9.20	7.37
BASF	28.77	8.96	8.53	8.82	17.03	13.29	10.66	8.52
Bashneft	(33.88)	22.77	8.53					
BHP Billiton	21.87	(5.96)	(5.22)	(2.66)	13.69	10.43	10.20	8.52
Birchcliff Energy	(29.95)	(19.54)	(5.97)	(0.03)				
BP	17.09	2.31	4.16	(0.67)	4.51	3.45	7.27	8.84
Cabot Oil	4.30	(6.08)	3.90	12.11	20.15	14.60	10.84	8.66
California Resources	(16.32)							
Canadian Nat Resources	7.28	(1.82)	4.37	0.49	16.87	13.24	8.64	6.92
Cenovus Energy	(29.26)	(26.10)	(19.81)					
Centrica Plc	(13.00)	(10.98)	(6.13)	(1.16)	6.06	8.34	6.50	5.21
Chesapeake Energy	(31.42)	(42.49)	(24.06)	(17.64)	(1.44)	(3.66)	4.74	3.81
Chevron	18.80	3.76	4.11	6.05	12.37	8.97	11.55	11.63
Cimarex Energy	(15.17)	(3.09)	14.76	12.40	13.85	10.60	6.94	5.57
CNOOC	7.47	(4.73)	(4.45)	1.33	15.05	14.70	9.58	7.66
Concho Resources	(4.10)	1.65	6.81	24.40				
Conoco Phillips	17.80	(10.20)	1.00	0.76	10.76	7.37	8.97	7.68
Consol Energy	(11.77)	(23.27)	(10.26)	(8.87)	7.96	5.74	3.79	3.05
Continental Resources	(25.69)	(16.55)	0.08	15.57				
Cresent Point Energy	(37.26)	(35.94)	(24.44)	(2.71)				
Denbury Res	(58.51)	(54.71)	(38.59)	(24.13)	(3.86)	(6.91)	(0.60)	(0.48)
Devon Energy	(16.25)	(17.41)	(8.17)	(6.73)	3.87	3.44	9.30	7.44
DNO International	34.73	(18.39)						
Ecopetrol	10.12	(30.66)	(27.42)					
Encana	13.14	(16.40)	(9.77)	(7.52)	4.60	4.83	3.20	2.57
Energen	(5.27)	(8.81)	1.27	0.32	11.35	11.19	12.09	14.66
ENGIE	12.18	(4.09)	2.63	(2.72)				
ENI	21.31	(5.77)	0.32	(1.57)	7.37	6.76	6.93	5.56
EOG	0.72	(0.01)	12.28	11.05	17.81	15.98	13.58	10.82
EP Energy	(25.57)	(42.84)						
EQT	(9.99)	(10.51)	2.26	3.42	10.93	13.25	10.68	13.45
Exxon Mobile	(2.53)	(1.09)	0.99	1.54	9.25	7.45	9.98	12.69
Galp Energia	27.67	9.19	6.79	6.20				
Gazprom	6.18	(11.16)	(11.64)	(12.30)	7.08	1.17	1.84	1.48
Great Eastern	34.55	(33.33)	(32.41)	(13.39)				
Gulfport Energy	(49.24)	(35.46)	(14.42)	(4.88)	11.48	(11.11)	(7.55)	(6.14)
Hess	(10.73)	(19.28)	(1.21)	(2.40)	6.22	5.47	6.04	5.80
Husky Energy	(2.80)	(18.30)	(7.29)	(5.94)	8.13	7.58	4.99	4.01
Imperial Oil	3.56	(11.03)	(5.89)	(3.24)	9.51	9.93	8.04	8.26
Inpex	33.55	(6.70)	2.13	(7.41)				
Japex	10.43	(15.76)	(3.81)	(10.85)				

Attachment C: Annualized Returns of CU200

Companies as of 9-30-2017	1	3	5	10	15	20	30	1980
JXTG Holdings	46.61	8.27	9.82					
Kaz Munai Gas	31.41	(15.83)	(6.40)	(3.68)				
Linn								
Lukoil	16.04	7.81	2.74	(0.07)	12.78	7.22	10.04	8.03
Lundin Petro	18.61	15.07	3.05	12.75	27.54	22.86	14.71	11.72
Maersk	26.11	0.54	13.14	1.13	11.03	4.93	8.12	6.51
Marathon Oil	(13.01)	(27.25)	(12.59)	(6.76)	7.25	3.61	3.76	5.00
MEG Energy	(0.88)	(47.36)	(34.74)					
Mitsui Mining	182.83	28.94	31.21	3.54	7.21	2.12	2.13	5.90
MOL	45.46	29.90	9.09	0.69	12.88	11.00	12.22	9.75
Murphy Oil	(9.37)	(19.18)	(6.72)	(5.10)	5.22	6.45	7.36	6.40
National Fuel Gas	7.72	(4.10)	3.64	4.74	10.59	8.38	9.91	12.92
Newfield Exploration	(31.73)	(7.15)	(1.08)	(4.72)	3.86	3.81	6.46	5.18
Noble Energy	(19.67)	(24.35)	(8.25)	(1.00)	9.34	5.60	7.83	5.51
Novatek								
Oando Energy	9.81	(38.24)	(10.06)	(13.80)				
Oasis Petroleum	(20.49)	(39.78)	(20.90)					
Occidental	(7.57)	(7.44)	(1.26)	3.32	13.81	11.88	9.01	9.96
Oil India	44.36	34.39	29.97	15.93				
Oil Search	1.72	(9.91)	(5.45)					
OMV	99.32	27.65	16.87	4.27	16.08	2.27	1.50	1.21
ONGC	3.27	(11.50)	1.46	3.94				
Painted Pony Energy	(58.61)	(35.58)	(20.92)	8.33				
PDC Energy	(26.89)	(0.84)	9.16	1.01	16.27	9.27	11.88	9.08
Petro China	12.18	2.02	0.35					
Petrobras	7.61	(10.88)	(14.40)	(10.51)	12.68	5.57	3.68	2.96
Peyto E&D	(38.62)	(15.97)	(4.16)	5.72				
Pioneer Nat Res	(20.49)	(9.13)	7.21	12.77	13.07	6.71	4.87	3.91
Polish Oil Gas	36.92	11.82	11.97					
Premier Oil	(2.19)	(41.37)	(28.08)	(10.37)	1.56	(1.99)	(1.54)	(1.24)
PTT	25.88	8.30	8.57	5.84	21.28	16.91	10.98	8.77
QEP Resources	(56.12)	(34.56)	(22.82)					
Range Resrouces	(49.34)	(33.67)	(22.24)	(6.76)	13.33	2.47	(4.33)	(3.51)
Repsol	42.52	(2.21)	6.04	(0.42)	8.08	5.60	7.85	6.29
Rice Energy								
Rosneft	3.63	1.35	(0.35)	(1.75)				
Royal Dutch Shell	29.66	(0.80)	3.48	2.64				
RSP Permian	(10.80)	10.60						
Santos	11.36	(28.22)	(13.84)	(7.29)	2.99	3.71	6.82	15.80
Sasol	4.12	(16.64)	(5.07)	(0.51)	10.22	7.58	19.54	15.50
Seven Generation Energy	(34.03)							
Sinopec	9.16	(0.85)	5.51	1.49	17.03	11.81	7.73	6.19
SK Innovation	29.85	38.85	6.08	4.46				
SM Energy Co	(53.86)	(38.76)	(19.80)	(6.51)	2.95	2.63	6.84	5.49
Southwestern Energy	(55.85)	(44.05)	(29.36)	(11.57)	9.81	7.32	7.15	7.16
Statoil	25.72	(4.68)	0.13	(0.38)	11.91	9.11	5.99	4.81

Attachment C: Annualized Returns of CU200

Companies as of 9-30-2017	**1**	**3**	**5**	**10**	**15**	**20**	**30**	**1980**
Suncor Energy	29.95	2.11	4.12	(1.13)	11.50	12.17	12.67	10.11
Tatneft	47.41	11.05	4.65	6.49	19.32	10.51	11.34	9.06
Total	14.87	1.58	9.95					
Tourmaline Oil	(23.59)	(22.36)	(7.70)					
Ultra Petroleum								
Whiting Petrol								
Woodside Petrol	8.31	(8.70)	(2.41)	(2.47)	12.83	8.68	8.88	7.11
WPX Energy	(12.81)	(21.80)	(7.06)					
YPF	22.90	(15.01)	12.44	(0.86)	12.14	3.77	4.77	3.83
Coal Companies								
Adani Enterprises	77.53	8.15	24.51	8.14				
Adaro Energy	55.40	20.11	7.23					
African Rainbow Minerals	31.91	(5.95)	(4.79)	0.64	9.37	9.11	8.71	6.97
AGL Energy	29.21	26.51	16.53	10.63				
Agritrade Resources	32.95	9.91	35.47	11.29	12.78	(1.05)		
ALLETE	33.85	24.70	17.45	10.25	12.08	11.28	11.25	13.77
Alliance Resource Partners	(5.29)	(15.42)	(0.47)	9.21	16.04	14.67	9.55	7.64
Anglo American	42.44	1.88	(2.93)	(6.54)	5.93	5.04	3.33	2.68
ArcelorMittal	33.54	(4.28)	(2.27)	(14.06)	12.76	(3.19)	(2.51)	(2.03)
Arch Coal								
Aspire Mining	(60.78)	(26.30)	(26.29)	(19.53)				
Banpu	15.43	(3.72)	(6.13)	(0.11)	19.26	9.16		
Bayan Resources	(11.76)	(5.00)	(14.58)					
Beijing Haohua Energy Resource								
Beijing Jingneng Thermal Power	1.51	4.42	9.06	(2.94)	13.78			
Berau Coal Energy								
BHP Billiton	21.87	(5.96)	(5.22)	(2.66)	13.69	10.43	10.20	8.52
Black Hills	15.59	16.38	17.74	9.61	10.98	10.82	11.30	14.28
BUMI Resources		1.55	(22.88)	(24.55)				
China Cinda Asset Management	10.37	(1.33)						
China Coal Energy	10.05	9.96	(1.52)					
China Coal Xinji Energy	13.07	(0.07)						
China Shenhua Energy								
Cloud Peak Energy	(32.72)	(33.78)	(27.35)					
CLP Holdings	3.51	12.91	8.10	8.32	10.98	9.18	11.36	11.25
Coal Energy	(10.88)	(6.11)	(10.61)	(15.16)				
Coal India	(10.27)	(0.81)	1.48					
Coal of Africa	(12.13)	(8.46)	(30.33)	(25.25)				
CONSOL Energy Inc.	(11.77)	(23.27)	(10.26)	(8.87)	7.96	5.74	3.79	3.05
Datang International Power Generation	17.71	5.57	2.75	(12.49)				
DaTong Coal Industry	3.88	0.69	(4.75)	(9.10)				
Evraz	111.98	37.91	7.49					
Exxaro Resources	54.31	2.45	(1.80)	7.17	23.06	18.24	11.82	9.44
Feishang Anthracite Resources	(0.76)	5.79						

Attachment C: Annualized Returns of CU200

Companies as of 9-30-2017	**1**	**3**	**5**	**10**	**15**	**20**	**30**	**1980**
FirstEnergy	(2.39)	1.48	(2.50)	(2.50)	4.69	5.68	3.75	3.02
Foresight Energy	12.95	(35.20)						
Glencore	63.90	2.46	2.71					
Golden Eagle Energy	34.02	(58.44)	(33.49)	11.73				
Golden Energy Mines	114.20	15.13	4.40	3.20				
Hallador Energy	(25.98)	(19.76)	(5.09)	8.85	13.61	7.27	(8.78)	(12.45)
Huadian Power International	(8.47)	7.06	8.57	(6.43)				
Idemitsu Australia Resources	55.57	13.47	17.35	2.11				
Inner Mongolia Yitai Coal	68.60	(2.46)	(8.74)	0.37	23.71	20.26	13.57	10.82
ITOCHU	51.11	15.32	22.76	6.36	14.84	10.04	4.78	5.57
JASTRZEBSKA SPOLKA WEGLOWA	82.74	44.11	1.88					
Jindal Steel & Power	77.29	(7.97)	(20.42)	(2.22)				
JSW Energy	1.75	3.20	6.57					
Kangaroo Resources	188.89	42.38	(12.60)	(20.85)				
Kinetic Mines and Energy	85.32	(5.99)	(11.91)					
Kuzbasskaya Toplivnaya	74.71	31.43	1.63					
LG International	(21.11)	2.87	(9.37)	0.42	11.84	10.94	7.31	7.54
Lu'an Environmental Energy	29.44	13.40	(5.81)	(4.73)				
Lubelski Węgiel Bogdanka								
Mechel	67.89	83.04	(7.01)					
Mitsubishi	18.89	8.35	16.61	(0.36)	10.70	6.26	4.00	5.10
Mitsui	23.96	2.69	12.91	(1.87)	9.49	5.23	4.39	5.54
Mongolian Mining	(24.76)	(26.26)	(37.08)					
Monnet Ispat & Energy	35.75	(27.13)	(36.84)	(22.41)				
NACCO Industries	28.12	22.06	20.08	13.50	16.62	6.69	10.04	7.26
National Aluminium	77.59	15.46	13.49	3.20	11.78	13.95		
Nava Bharat Ventures	(5.53)	6.83	10.57	3.73	32.38	26.88		
New Hope	14.83	(4.30)	(9.71)	5.85				
NLC India	39.40	9.46	6.11					
Novolipetsk Steel GDR trades	92.51	25.72	8.46	(0.58)				
NTPC	16.35	8.94	3.07	1.08				
Open Joint-Stock Raspadskaya	51.59	67.53	(0.58)	(0.58)				
Peabody Energy								
PGE	31.03	(11.81)	(2.97)					
Prairie Mining	185.71	11.73	5.00	(4.74)				
Public Power	76.35							
Ramaco Resources								
Raspadskaya OAO	51.59	67.53	(0.58)	(0.58)				
Resource Generation	(44.44)	(26.74)	(29.22)	(13.02)				
Rhino Resource Partners	5.26	(74.02)	(55.46)					
Rio Tinto	22.43	10.96	14.71	4.28	8.01	4.05	2.68	2.16
Sasol	2.00	(11.41)	4.54	6.46	12.18	13.51	15.80	12.57
Severstal	30.72	48.24	28.19	12.44				
Shaanxi Coal Industry	56.62	16.05						
Shanghai Datun Energy Resources	23.87	10.74	(4.52)	(10.08)	6.16	6.36	4.19	3.37
Shanxi Lanhua Sci-Tech	27.15	3.24	(11.69)	(6.37)	9.96			

Attachment C: Annualized Returns of CU200 Companies as of 9-30-2017	**1**	**3**	**5**	**10**	**15**	**20**	**30**	**1980**
Shanxi Meijin Energy	8.52	28.83	23.87	(0.65)	9.98	8.02		
Shanxi Xishan Coal and Electricity	7.76	16.26	(4.96)	(8.66)	12.88	10.72	7.03	5.64
South32	43.07							
Steel Authority of India	15.87	(7.44)	(7.20)	(10.96)				
Tambang Batubara Bukit Asam Aktie	11.08	(4.66)	(4.97)	8.29				
Tata Power	4.93	(0.48)	(4.05)	0.71				
Tata Steel	77.49	15.06	12.89	1.10				
Teck Resources	17.90	5.97	(3.94)	(5.98)	15.33	6.40	3.68	2.96
Tianchi Energy								
United RUSAL	144.91	15.21	8.08					
Up Energy Development	-	(47.83)	(29.23)	(27.52)	(31.95)	(33.84)	(22.46)	(18.56)
Vale	51.18	22.71	25.21	4.75	20.67	14.23	9.76	7.81
Vedanta	97.03	9.54	16.23	11.87				
Vimetco								
Westmoreland Coal	(71.22)	(59.12)	(23.80)	(18.61)	(10.04)	0.92	(6.69)	(5.20)
Whitehaven Coal	50.20	29.08	5.09	5.38				
Wollongong Coal	(34.17)	(37.34)	(48.00)	(36.98)				
Yancoal Australia	(18.80)	(11.75)	(31.43)					
Yang Quan Coal	18.78	4.45	(10.21)	(4.13)				
Yanzhou Coal Mining	5.70	14.08	(6.34)	(4.18)	6.69	6.53	4.31	3.46