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economics as if people
and the planet mattered

UNBURNABLE CARBON
RATIONAL INVESTMENT FOR SUSTAINABILITY

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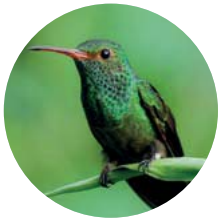

Natural Economies

Social Policy

Valuing What Matters

Well-being

nef (the new economics foundation) is a registered charity founded in 1986 by the leaders of The Other Economic Summit (TOES), which forced issues such as international debt onto the agenda of the G8 summit meetings. It has taken a lead in helping establish new coalitions and organisations such as the Jubilee 2000 debt campaign; the Ethical Trading Initiative; the UK Social Investment Forum; and new ways to measure social and economic well-being.

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FOREWORD

The financial system is in the news. A string of bank bail-outs, mis-selling scandals, billion dollar losses by 'rogue' traders, and most recently the manipulation of LIBOR, a key interest rate, have led to an erosion of trust and to calls for reform.

These are serious episodes, undoubtedly, that require redress. But can we at least rely on financial markets to fulfill their core function: to allocate capital to those investments that will create the most long-term value for humanity? In the light of the unfolding crisis of climate change, described by Lord Stern as "the greatest market failure the world has seen", we must seriously question this assumption.

In July 2011 the Carbon Tracker Initiative published a groundbreaking report "Unburnable Carbon: Are the world's financial markets carrying a carbon bubble?" which introduced the concept of 'unburnable carbon' to a wide audience. The report described how we cannot burn all the fossil fuel reserves currently listed on stock exchanges without breaching a 2 °C rise in global temperature, and set out an agenda for market reforms.

The concept of unburnable carbon is a powerful analytical framework, and in this report we aim to add to the growing debate and literature. By gathering views from a range of different stakeholders, we lay out obstacles and recommendations to overcome them. In particular, we consider the role of policymakers and their impact on investment decisions.

This report calls for unburnable carbon reserves to be clearly identified and removed from the market in an orderly way. It draws on industry experts to discuss how to manage a transition to a rational and sustainable investment market. This is only a starting point; we do not underestimate the geopolitical pressures that will stymie action.

Action is required by government and regulators, from investment managers and professional bodies, and by investors and their fiduciaries. We need sound policy that provides a stable investment framework; an understanding of risk based in scientific evidence; and improved market transparency. Above all, we require leadership.
We must confront the fact that our financial system directs large sums of money into carbon which simply cannot be burnt if we are to stay within safe global temperatures. Policymakers must recognise and accept partial responsibility for this market failure. The stakes are high, but if we allow the logic of unburnable carbon to lead us to a transformative shift in sustainable investment, then perhaps at last we can enjoy a financial good news story.

Tony Greenham Programme Head, Finance and Business
nef (the new economics foundation)

THESE ARE SERIOUS EPISODES, UNDOUBTEDLY, THAT REQUIRE REDRESS. BUT CAN WE AT LEAST RELY ON FINANCIAL MARKETS TO FULFILL THEIR CORE FUNCTION: TO ALLOCATE CAPITAL TO THOSE INVESTMENTS THAT WILL CREATE THE MOST LONG-TERM VALUE FOR HUMANITY?

02
EXECUTIVE SUMMARY

In 2010, governments from around the world gathered at an international climate change conference in Cancun, Mexico and agreed to limit climate change to 2 °C above pre-industrial levels. A year earlier, a group of leading climate scientists concluded that to retain a one-in-five chance of keeping global average surface temperature within this 'safe' limit, global carbon emissions could not exceed 886 billion tonnes of CO_2 between 2000 and 2049. Using the most up-to-date figures we find that in the first 12 years of that period from 2000 to 2012, almost half of this global carbon budget has been used.[2]

Furthermore, potential emissions from proven, unburned reserves of fossil fuels, amount to between four and five times the global carbon budget between now and 2049.[3] In other words, these fossil fuel reserves are unburnable. On that basis, around 80 per cent of the declared proven reserves are unburnable. They are not assets, they are misvalued, and potentially toxic financial liabilities.

The recent banking crisis taught the world a difficult lesson concerning the mispricing of risk. If it turns out that a huge amount of the assumed value represented by reserves of fossil fuels can never be brought to market and realised – something which climate science says indeed must be the case – then without a quick and careful re-evaluation of carbon risk and value, the economy is in danger of a far worse crash than the one orchestrated by the finance industry in 2008.

In spite of this, money still flows into fossil fuel exploration and production. Knowingly or not, investors continue to finance the exploration and development of new fossil fuel reserves which, if we are to prevent potentially irreversible climatic upheaval, can never be used. There is a huge imbalance in the levels of investment going into the fossil fuel industry compared to cleaner, renewable sources. In 2012, the oil and gas sector is expected to spend more than $1 trillion on capital expenditure, much of which will be used for further exploration and development of new sources. In contrast, 2010 global investment in clean energy reached just $243 billion.

Any list of the world's largest companies is dominated by fossil fuel companies and others, like car makers, dependent upon their products.[4] The global economy is, in effect, on a deeply unsustainable path. And, despite the commitment in Cancun, governments are failing to demonstrate the leadership needed to change the economy's course.

Why is this so? In the following report we draw on interviews conducted with industry experts to identify and understand the barriers to the transformation of the economy to a more sustainable footing. We then suggest key actions that could be taken to overcome them.

> "I think it is a good time now (for change) because the stock response of four years ago – which was to say "the market gets it more or less right" and "we've no reason to believe the market isn't getting it right" will run hollow with the current environment. It's much easier to show now that there is irrationality on climate issues than it was 5 years ago, when there was irrationality on housing."
>
> **ECONOMIST**

> "A radical new kind of carbon capture and storage is causing a stir amongst scientists. It is cheap, it is efficient and it can be deployed straight away. It is called...leaving fossil fuels in the ground."[1]
>
> **GEORGE MONBIOT,**
> **CAMPAIGNER AND COLUMNIST**

According to our research, the key barriers include:

The very low level of awareness and concern in financial markets that the value of fossil fuel companies, many of which function as 'anchors' to important financial products such as our pensions, is based on fossil fuel reserves which can never, reasonably, be used.[5]

Uncertainty arising from governments and decision-makers inconsistent application of climate and energy policy in regulation. The fact that fossil fuels do not bear their full social and environmental costs, means that prices are poor indicators of the value of an investment.

Attracting capital into low carbon energy alternatives carries a higher cost due to higher risk premiums, which are partly due to relative inexperience among lenders with renewable energy technologies.

A disconnection between shareholders and those actually making key investment decisions. Shareholders often fail to engage, question or understand long-term risks associated with their investments.

Endemic short–termism within the financial system and lack of appreciation of the issues described above, means investors that have an interest in the long-term returns of their investments are being systematically misled about the value of assets.

RECOMMENDATIONS

Based on our research we make the following policy recommendations.

The role of governments

Acknowledge the category of 'unburnable carbon' for fossil fuel reserves: this is the inevitable and logical consequence of a global political consensus about what constitutes 'safe' levels of climate change. This should be translated into domestic and international policy with legally binding commitments, and political leadership that sends a clear signal to the financial sector about the toxic nature of fossil fuel assets.

Establishing a minimum or 'floor' global carbon price: the combination of low and volatile prices for carbon is one of the greatest barriers to directing investment into new, low carbon energy sectors. It is one of the clearest examples that purely market-led approaches are not capable of producing rational behaviour in terms of essential, long term environmental stewardship.

Fossil fuel subsidy reform: Subsidies toward fossil fuels should be phased out and rebalanced in favour of low-carbon, renewable alternatives. Based on available figures renewable energy technologies attract as little as 6 per cent of the subsidies going to fossil fuels. This is in spite of the fact that, dollar-for-dollar of investment, research and experience has shown energy efficiency and renewable energy technologies generate far greater environmental and social benefits.[6]

Mandating disclosure and transparency of climate change risks: proper assessment of the likely impact of climate policy and the reasonable consequences of adopting the notion of 'unburnable carbon' requires a new wave of disclosure and transparency. Without that it will be impossible for fiduciary duties to be properly performed and risk assessed.

Increasing policy certainty: by creating a long-term, sufficient and consistent incentive structure for renewable energy, employing available and new mechanisms for public sector finance, such as a Green Investment Bank to change investor behaviour in favour of new, low carbon sectors; and introducing new accounting metrics and listing rules to account for unburnable carbon.

Requiring credit rating agencies to consider and report on the implications of unburnable carbon: this is a necessary signal for investors when agencies rate or write credit reports for firms in the extractive industries.

Introduce higher capital adequacy requirements for products from and trades with extractive companies: in light of the extractive industry's high carbon risk, financial activities derived from the sector should be more strongly underpinned. Reflecting the general practice required of other parts of the financial services industry engaged in riskier business.

Regulators key trade bodies should assess and take account of unburnable carbon: The Financial Services Authority (the UK regulator for the financial services industry) and the London Stock Exchange, as principle bodies who have a responsibility for the stable and successful functioning of investment and trading activity related to listed fossil fuel companies, should be required to consider and take account of unburnable carbon.

The role of investors

There is much that investors can do to develop new markets, raise issues, and change the culture and expectations of existing markets. Investors can, for example:

Ask their pension or mutual fund how they invest your money: investors right down to the level of the individual can participate in a cultural shift to move money out of unburnable carbon.

Any financial product that invests in FTSE 100 companies means a significant percentage being invested in extractive firms. Funds also invest in bonds which may have been issued by fossil fuel companies. In holding such bonds, the investor is lending operating capital to such firms.

If investors discover their money has been invested in fossil fuel companies, they can disinvest and **move their money.**[7]

Put pressure on pension fund trustees to offer carbon-free pension schemes: without a wide range of products, even those who actively seek to invest sustainably are restricted by the lack of products available.

Add to calls for a change in International Accounting Standards, so 'unburnable' reserves cannot be claimed as assets and listed to inflate a company's apparent worth.

The role of institutional investors

Institutional investors have a special role to play. They own large blocks of shares and have an incentive to develop specialised expertise in making and monitoring investments. They could play a far more active role in pressurising investors to change their behaviour.

> Institutional investors can become more active in investment decisions, by holding management accountable for actions that do not promote shareholder welfare.

> Their greater access to firms' information, coupled with their concentrated voting power, could enable them to more actively monitor a firm's performance and to make changes in the board's composition when performance lags.

We argue that a key driver of man-made CO_2 is the continued capital investment into fossil fuel extractive industries. This is largely the result of a lack of certainty, leadership and authority in climate change policy from national governments. Without leadership at the domestic and international level, safe renewable energy alternatives will continue to lose out in the battle for investment to fossil fuels. Establishing and introducing the category of 'unburnable carbon' would correct the systemic mispricing of climate risk.

Unburnable carbon is a key issue for complex financial markets. It must be discussed, debated and understood far more widely. The ultimate objective, however, is not complicated at all. It is to leave in the ground those fossil fuel reserves which, if extracted and burned, would lead to the loss of a readily habitable climate for humanity. Society has two options, either to keep carbon emissions within the remaining 'safe' carbon budget, or to face increasing social, environmental and economic upheaval from dangerous climate change.

03
UNBURNABLE CARBON

IN SUMMARY

In this report, based on research and a series of interviews conducted with experts in the finance and energy industries, we explore the concept of unburnable carbon.[9] It has been known for some time that to tackle climate change a large proportion of known fossil fuel reserves will need to be left in the ground. Exploring what this means to economies and financial markets that stand on fossil fuel foundations, however, is at a much earlier stage.

There are mechanisms within the financial system which could, if left unregulated, lead to irreversible global and local environmental change, putting the habitability of the planet for humans and other species at risk. Most pressing is the momentum of investment pushing us passed a critical threshold for climate change.

We conclude the report with a suite of actions and policy recommendations that we argue, need to be implemented urgently in order to divert finance away from fossil fuels in favour of investments which safeguard both our climate and the longer term value of pension fund investments.

un·burn·able car·bon
(noun)
A quantitative estimate of the amount of listed fossil fuel reserves that cannot be burned without risking dangerous climate change[8], expressed as a maximum quantity of carbon that can be released into the atmosphere, less the greenhouse gas emissions related to land-use, and land-use change.

It took over 1500 years, from when the first reported oil well developed using a drill bit made from bamboo in China in 350 AD, for oil to dominate and create a new dependence in economies around the world. In 1859, ex-railroad conductor Colonel Edwin Duke and his driller Uncle Billy Smith opened the first commercial oil well in Titusville, Pennsylvania, just 25 years after the French mathematician and physicist Jean Baptiste Joseph Fourier proposed the existence of a 'greenhouse effect.'

Since that time, the world has experienced a period of rapid economic growth. Over 97 per cent of humanity's financial wealth has been created in just 0.01 per cent of human history.[10] The driver behind this phenomenal expansion is a complex combination of, abundant cheap fossil fuel energy, the spread of transport and communication technologies, knowledge accumulation, science, population increase and rising levels of personal consumption.

Fossil fuels remain the primary driver of the global economy.[11] Yet, there is a heavy price to be paid. For every unit of fossil fuel burned, greenhouse gases, specifically carbon dioxide (CO_2) are released into the atmosphere. As concentrations of greenhouse gases rise in the Earth's atmosphere, they increasingly prevent heat from escaping to space, slowly warming the Earth. Behind the complexities of the science, lies a stark reality. According to leading climate scientist James Hansen based at NASA's Goddard Institute for Space Studies, we are on the cusp of losing the climatic conditions in which civilisation emerged.[12]

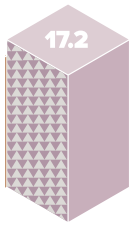
What are fossil fuels?

Fossil fuels are combustible materials formed from organic material that has been transformed below the Earth's surface over millions of years and the products manufactured from them.

Figure 1: Carbon intensity of primary fossil fuels

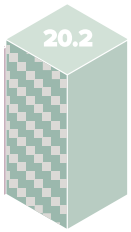
Natural gas
15.3 tCO_2/TJ

Natural gas comprises gases at normal temperature and pressure occurring in underground deposits. In its marketed state it consists mainly of methane. Natural gas is extracted from exclusive gas deposits, crude oil deposits and also methane recovered from coal mines (colliery gas).



Natural Gas Liquids
17.2 tCO_2/TJ

Natural Gas Liquids (NGL) are liquid or liquefied hydrocarbons recovered from natural gas in separation facilities or gas processing plants.

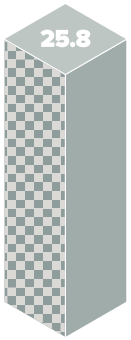


Crude oil
20.2 tCO_2/TJ

Crude oil is a mineral oil found at a range of depths underneath the Earth's surface and consists of a mixture of hydrocarbons and impurities, such as sulphur.

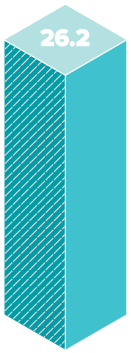
Coking coal
25.8 tCO_2/TJ

Coal of calorific value >23,865 kj/kg and with a quality that allows the production of coke suitable to support a blast furnace.



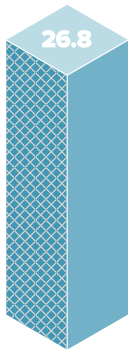
Coal (Other bituminous coal)
25.8 tCO_2/TJ

Coal with a gross calorific value greater than 23 865 kJ/kg and is primarily used in steam-electric generation, manufacturing and to make coke.



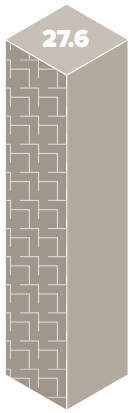
Coal (Sub-bituminous coal)
26.2 tCO_2/TJ

Coals with a gross calorific value between 17,435 kJ/kg and 23,865 kJ/kg and is used primarily as fuel for steam-electric generation and is used in the chemical synthesis industry.



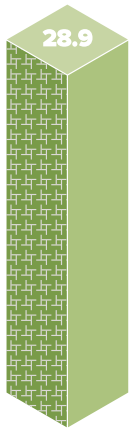
Anthracite
26.8 tCO_2/TJ

A high quality coal with one of the highest energy (<35,300) kj/kg) content of all types of coals. It tends to be used as a domestic fuel in either hand-fired stoves or automatic stoker furnaces. Its high value means that it is rarely used in electricity generation.



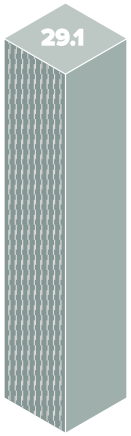
Lignite
27.6 tCO_2/TJ

Also known as brown coal, Lignite is the lowest rank of coal and is used almost exclusively for steam-electric generation. The distinction between Sub-bituminous coal and Lignite is not normally made in Europe.



Peat
28.9 tCO_2/TJ

A precursor of coal, peat is a combustible, soft, porous or compressed sedimentary deposit of plant origin with high water content (up to 90 per cent in its natural state.



Oil shale
29.1 tCO_2/TJ

Oil shale is an inorganic, non-porous rock containing solid organic material that yields hydrocarbons, along with a variety of solid products, when heated to a high temperature. Tar sands refers to sand (or porous carbonate rocks) that are naturally mixed with a viscous form of heavy crude oil sometimes referred to as bitumen. Due to its high viscosity this oil cannot be recovered through conventional recovery methods.

Source: IPCC, Guidelines for National Greenhouse Gas Inventories (2006)
Definition Reference: tonnes of CO2/ terajoule

Although there is no universally agreed definition of what constitutes 'dangerous climate change.' This is partly because 'dangerous' is different for someone living on a South Pacific island whose highest point is only a few metres above sea level, than for someone in the grassy hills of Wales. The most commonly reported threshold is a temperature increase of not more than 2 ˚C above levels as they were in the late nineteenth century. This is approximately 1.2 ˚C above today's global average surface temperature.

The European Union in 2005, and the United Nations Framework Convention on Climate Change Conference (UNFCCC) of the Parties 15 (COP 15) in Copenhagen, Denmark in 2009, after expert testimony and considerable debate, adopted the target of a 2 ˚C temperature rise as an upper limit.[13] At the climate negotiations in 2010 in Mexico, governments from around the world agreed to limit climate change to this level.

There are a number of problems associated with using a temperature threshold as a marker of 'dangerous climate change', and there is increasing debate as to whether the 2˚C threshold is set too high (see Box 1). It remains however the most widely used definition of 'dangerous climate change' with political traction.

BOX 1: THE 2 ˚ C LOTTERY – DEFINING DANGEROUS CLIMATE CHANGE

NASA's James Hansen argued in 2007 that temperatures should not go beyond 1.7 °C (or 1 °C above temperatures in 2000) if we are aiming to avoid probably the irreversible loss of ice sheets and species.[15]

Focusing on average surface temperatures can hide great regional variability. For example, collapse of the Greenland ice sheet is more than likely to be triggered by a local warming of 2.7 °C, yet this could correspond to a global mean temperature increase of just 2 °C or less.[16] The disintegration of the Greenland ice sheet could trigger a sea-level rise of up to 7 metres over the next millennium. That may seem a long period of time, but in the meantime it is likely to kick-start a feedback process accelerating climate change. This is due to changes in how much the land and ocean reflect radiation from the sun. As the ice reveals darker surfaces, it acts to increase localised warming because darker land absorbs more heat. Coral reef, alpine and arctic ecosystems also potentially face irreversible damage at levels of warming below a global average surface rise of 2 °C.[17]

In terms of the social impacts of climate change, what is manageable for some is catastrophic for others. The Alliance of Small Island States (AOSIS) and the Least Developed Country group called for warming to be limited to 1.5 °C at the 2008 climate negotiations in Poland. Norway, South Africa, Switzerland and Iceland, as well as Costa Rica, El Salvador, Honduras, Nicaragua, and Panama have called for climate policy to be based on the assumption that global temperature change should remain below 2 °C. Together, these groups make up 110 countries and represent approximately one in five of the world's population.

'There is nothing special about 2 ˚C that would make warming of less than this magnitude 'safe'. It is more analogous to a speed limit on a road, and is a guide to the scale of the problem.'[14]

GAVIN SCHMIDT
CLIMATE SCIENTIST

In addition to the social and environmental impacts of exceeding 2 °C (see Box 2), the risks to business and the wider economy are substantial. In 2005, Lord Stern published his influential review on the economics of climate change which described the escalating costs of delaying climate change action, and the resulting damaging impact to the economy. In an interview with the Harvard Business Review, Unilever Chief Executive Paul Poleman stated that climate change and other natural catastrophes had cost the company €200 million in 2011 alone. "Some estimate that the total profits of the consumer goods industry could be wiped out in 30 years if no action is taken", said Poleman. [18]

BOX 2: WHAT WILL HAPPEN IF THE 2 °C TEMPERATURE THRESHOLD IS CROSSED?[19]

The likelihood of being able to prevent further warming reduces.

Up to 4 billion people could be experiencing growing water shortages.

Agriculture will cease to be viable in parts of the world and millions will be at risk of hunger.

The rise in temperature could see 40–60 million more people exposed to malaria in Africa.

The threshold for the melting of the Greenland ice sheet is likely to have been passed and sea-level rise will accelerate.

There is greater danger of 'tipping points' for soil carbon release and the collapse of the Amazon rainforest.

Despite social, environmental and economic warnings, and the UK's policies on climate change that recognise these limits, large scale UK investments are still being channelled into the fossil fuel extractive industries – the key driver of greenhouse gas emissions.

In 2012, the oil and gas industry – including national oil companies, integrated and independent oil and gas companies – are expected to register more than $1 trillion in capital expenditure. This is a sum approaching half of the UK's entire GDP.[20] It will dwarf global investments into low-carbon energy alternatives, estimated to be approximately a quarter in 2011 at $260 billion.[21]

2012
Capital expenditure by oil and gas companies: $1 trillion

2011
Global investments into low-carbon energy alternatives: $260billion

These investments are being made even though, it has been known for some time that there are already more proven fossil fuel reserves than can be burned. As one of the experts interviewed for this report told us:

> *"It is clear that we cannot burn all the fossil fuels currently listed on the world's financial markets without seriously impacting the value of other listed assets, which would affect the future pensions on which we all depend."*
> Director of Investment Banking

For these reasons it is clear to us and many of the experts we have spoken to, that the financial markets are mispricing fossil fuel assets as systematically as they did risk in the housing market prior to the crash of 2007 – 2008.

The failure to properly assess the risk of investing in fossil fuels and their related, dependent industries, means that investors are being misled about the true value of the assets they buy. As a result, investors continue to finance the exploration and development of new fossil fuel reserves. What appears on the basis of flawed accounting to be rational behaviour, in reality leads to increasing exposure to potentially toxic carbon liabilities.

To realise the full, apparent value of such carbon assets would require the use of fossil fuels on a scale that would trigger catastrophic climate change. In other words, the current price mechanism encourages the purchase of expensive assets that cannot reasonably be brought into production. A devaluation of these carbon assets to reflect their true value would ricochet through the financial system with major implications for institutional investors and pensions funds.

BOX 3: THE GREAT SHELL SCANDAL

"If you've got a pension pot, the chances are some of it is in Shell, so when the price plunges, then the value of your pension pot, of everybody's pension pot, is reduced accordingly,"
Head of Investment Affairs, Association of British Insurers[22]

Perhaps the most recent experience we have of the turbulent times ahead for pension funds invested in unburnable carbon is the overstating of proven reserves by Royal Dutch Shell group. In January 2004 a company spokesperson told journalists and investors that the company had reviewed its proven oil and gas reserves and had concluded the total value would be reduced by 20 per cent.

Immediately, shares in Shell Transport and Trading fell by 17 per cent, shares in Royal Dutch Petroleum fell by 10 per cent in just a few days, and investors saw around £ 3 billion wiped off the value of their investments.[23]

Shells' re-assessment of their reserves in 2004 gives some indication of the potential impact of a mass write-off of fossil fuel assets (Box 3). A sanguine view of share price volatility holds that, typically, over the long-term markets generally recover and rise. However, the issue of unburnable carbon questions the pricing of up to 80 per cent of presently listed fossil fuel reserves.[24]

A re-adjustment on this scale would affect anyone with a pension, mortgage or savings account. Given this, the continued flow of investment into exploration, and bringing new fossil fuel reserves into production, therefore becomes a concern for every sector in the economy and the population as a whole.

UK fund managers are responsible for approximately £3.2 trillion in financial assets on behalf of UK investors: savings, pensions, life assurance policies and other investments.[25] Approximately two thirds of these represent savings of UK citizens, and over half of all households have investments and pensions that are managed by the fund management industry.[26] Serious questions have already been raised concerning the competence of this industry, with one recent study by the IBM Institute for Business Value estimating that it lost $1.3 trillion in value annually.[27]

UNLESS A CLEAR STRATEGY TO MANAGE CARBON INVESTMENTS IS PUT IN PLACE, EVERYONE FROM THE INDIVIDUAL SAVER, TO LOCAL AUTHORITIES AND CENTRAL GOVERNMENT IS AT RISK.

In 2011 UK pension fund assets were valued at £2.3 trillion, however, a significant proportion of these assets are invested in firms working in the fossil fuel sector of the extractive industries.[28] A 2009 survey of 118 UK equity portfolios by WWF and Trucost showed that, on average, 13 per cent of assets were held in the oil and gas sectors alone.[29]

Pension funds typically target stable quarterly dividend paying stocks,[30] with the top five performers, including BP and Shell accounting for more than 50 per cent of the total dividends paid out in the most recent quarters.[31] As such, according to Capita Registrars Dividend Monitoring Report, investors are driven to select high carbon investments.

To what extent are investors being misled about the value of their investments? The possible scale extends from wilful fraud and illegality, to design flaws in a market, and inappropriate incentive schemes and subtle conflicts that blur lines of responsibility. Which of these views you might tend towards may depend on the view you form of the motivations and relative competence of those working within the investment market.

BOX 4: INTERPRETATIONS OF MISPRICING

The wilful mispricing of carbon assets could be considered a giant Ponzi scheme. A Ponzi scheme is where investors are actively and fraudulently misled about the real value of an asset. Named after Charles Ponzi who defrauded investors of millions of dollars in the early twentieth century by selling International Rely Coupons with the promise of high returns through postage stamps. The scheme relies on an asymmetry of information between the person being duped, and the person doing the duping. Whether or not either party in this instance is informed about the the wrong valuation of carbon assets depends on their willingness to acknowledge as much.

Alternatively, mispricing could represent a speculative bubble, where the price of an asset diverges dramatically from its actual value, and stays in that condition until confidence fails and there is a sudden exit from the market, this is also known as a crash.

A failure of governance and fiduciary duty is another potential explanation.

Following a multi-billion dollar loss from the actions of its trading division, several years after already being one of the large banks embroiled in 2007 – 2008 financial crises, J P Morgan, now has in place plans to deal with what it calls a, "catastrophic, idiosyncratic event."[32]

"It's not that 'we don't care about the future', it's 'we care about the future, but before that arrives, there could be an awful lot of bumps up and down in the road and if enough other people are buying something, even though we think it's a bit of a lemon in the long-run, we'll buy it because everyone buys it'"

ECONOMIST

Recent experience questions profoundly whether financial markets can be self-regulating, or are capable of developing mechanisms to adequately assess the financial risk of carbon assets, let alone a risk of truly global significance such as climate change.

The climate change commitments made at the UK and global level need to be applied to the investment market. This will mean regulatory change which is discussed further below. Unless that happens, investments into what are, in any meaningful sense, carbon liabilities, will continue unchecked by institutional and private investors. The problem is compounded when such investors appear only too willing to transfer responsibility of their fund management to institutions who are driven by short term results. Such short termism, it should be noted, runs counter to the longer term requirements of important financial vehicles such as pensions.

In addition, the continuing flow of investment into fossil fuels also starves innovative, new, and more sustainable technologies of much needed finance. Starved of investment, these new technologies find it harder to reach market and move to scale. This creates a negative, self-reinforcing cycle that locks in an energy market status quo, which favours carbon intensive and increasingly inefficient energy infrastructure. As Fatih Birol, Chief Economist at the International Energy Agency emphasised in 2011:

> *"As each year passes without clear signals to drive investment in clean energy, the lock-in of high-carbon infrastructure is making it harder and more expensive to meet our energy security and climate goals."*[33]

Short–termism in financial markets, and the failure to price the environmental and social impacts of carbon-related assets, leaves society, willingly or not, rushing towards the 2 °C threshold.

04
SIMPLE MATHS

Unburnable carbon at first was simply an idea, the topic of heated debate at UN climate conferences or the occasional newspaper columnist. 'Ladies and gentlemen, I have the answer!' wrote the Guardian's George Monbiot in late 2007, "incredible as it might seem, I have stumbled across the single technology will save us from runaway climate change! From the goodness of my heart, I offer it to you for free. No patents, no small print, no hidden clauses. Already this technology, a radical new kind of carbon capture and storage, is causing a stir among scientists. It is cheap, it is efficient and it can be deployed straight away. It is called...leaving fossil fuels in the ground."[35]

But what began shifting attention from a focus on energy efficiency and cleaner technology, to the need to leave fossil fuels where they are?

In early 2009 two key studies, published by a group of climate scientists and modellers in the leading science journal Nature, translated the abstract notion of unburnable carbon into tangible figures.[36,37] Up until then the focus was on politically negotiated targets for reducing emissions. The studies' authors made calculations that led them to estimate how much of the fossil fuels that remain in the ground should be left there. They linked the total amount of carbon dioxide (CO_2) and equivalent greenhouse gases (CO_2e)[38] that could be released into the atmosphere to the likelihood of the global average surface temperature rising by more than 2 ˚C.[39]

One of the studies led by a German climate modeller, Malte Meinshausen, found that the most reliable way to determine the maximum temperature rise that Earth will experience up to the year 2100 due to climate change was by looking at the total amount of CO_2 emitted to the year 2050.[40] This is in contrast to focusing on the consequences of stabilising greenhouse gas emissions at any specific atmospheric concentration, the basis of most climate policy analyses.

The second study, led by Oxford-based climate modeller Myles Allen, confirmed Meinshausen's analysis.[41] He argued that it is the total concentration of carbon that matters the most and used the term 'the cumulative warming commitment' to illustrate the point. This is the maximum expected global average temperature change linked to a given amount of man-made carbon released into the atmosphere.

The approach of 'total carbon' has attracted some criticism for not providing information on the technical feasibility and cost implications of a particular emission reduction pathway.[42] But others argue equally strongly that by ignoring cumulative emissions, policymakers are wildly out of touch with scientific assessments of dangerous climate change.[43]

> **"Ultimately unburnable carbon is simple maths. We have a fair idea of what our greenhouse gas budget is for the next 50-100 years...we can calculate emissions that would result from the known fossil fuels reserves and to what extent those emissions would go beyond that budget that we have."**
>
> **REMCO FISCHER, UNEP FI[34]**

The notion of 'unburnable carbon' is a logical, indeed inevitable, consequence of this approach. Defining dangerous climate change on the basis of absolute quantities of greenhouse gases gives a clearer view of the absolute limit of how much fossil fuel can be burned.[44]

We note that this assessment of 'unburnable carbon' assumes no carbon capture and storage on the basis that this is not a proven technology (see Box 5).

BOX 5: CARBON CAPTURE AND STORAGE

"Carbon sequestration is irresponsibly portrayed as an imminently useful large-scale option for solving the challenge [of climate change]. But to sequester just 25 per cent of CO_2 emitted in 2005 by large stationary sources of the gas...we would have to create a system whose annual throughput (by volume) would be slightly more than twice that of the world's crude-oil industry, an undertaking that would take many decades to establish"
Professor Vaclav Smil (2008) [45]

Carbon Capture and Storage (CCS) technologies have been widely discussed as a magic bullet to climate change. They intend to capture and store CO_2 produced from the burning of fossil fuels on a large scale, usually underneath the Earth's surface in some manner. It is viewed by some as a key technology to stabilise atmospheric concentrations of CO_2. Policymakers and many engineers are optimistic about its theoretical potential.

Despite this optimism, it is unclear that it will work, or whether it can become commercially viable in time to have a significant impact on the reduction of CO_2 emissions. Based on a target carbon budget at the time of writing, that would allow only a further 452Gt CO_2 to enter the atmosphere.

A recent report published by the UK Energy Research Council (UKERC) suggested that an 'on track' pathway would imply that CCS demonstration projects would need to be under construction by 2015. Commercial-scale plants would need to be developed by 2020-2025, with rapid deployment beyond this point.[46] Since 2000, there have been discussions to build a UK demonstration plant with no firm agreement being reached to fund a specific project. The planned Scottish Power demonstration plant was cancelled last year due to escalating costs.[47]

The scenario above also assumes that the serious uncertainties about this technology can be overcome, including the safety of underground storage in terms of groundwater pollution, managing and monitoring the potential for slow or sudden release of the in situ gas, and the scaling up and speed of development and deployment.[48]

RECENT RESEARCH STRONGLY IMPLIES THAT CCS WILL NOT BE READY IN TIME TO KEEP CO_2 EMISSIONS WITHIN LEVELS THAT WILL PROVIDE A REASONABLE CHANCE OF STAYING BELOW 2°C.

THE TRILLION TONNE WINDOW

Meinshausen's research showed that to be within a three quarters (75 per cent) chance of keeping temperatures below 2 ˚C, the world needs to limit the total amount of greenhouse gases emitted into the Earth's atmosphere between 2000 and 2049 to approximately 1.5 trillion tonnes of CO_2e (which equates to 1 trillion tonnes of CO_2).[49] To reduce the risk by another 5 per cent, bearing in mind this still means there remains a 20 per cent chance of exceeding 2 ˚C, total emissions should be limited to just over 1 trillion tonnes of CO_2e (0.89 trillion tonnes of CO_2).

When these figures are translated into the amount of carbon contained in proven reserves of gas, oil and coal (see Box 6 for definitions), even without accounting for reserves of so-called unconventional fossil-fuel sources such as tar sands and shale gas, it is clear that a significant proportion of proven reserves can never be burned.[50]

BOX 6: PROVEN, PROBABLE, POSSIBLE, UNBURNABLE

The oil industry has developed an internationally used classification system of fossil fuel reserves. It reflects the 'known or estimated' existence of a source. The definitions below are taken from the UK Department of Energy and Climate Change. Unburnable Carbon is as defined by **nef**.

Proven reserves: reserves which on the available evidence are virtually certain to be technically and commercially producible, i.e. have a better than 90 per cent change of being produced

Probable reserves: reserves which are not yet proven, but which are estimated to have a better than 50 per cent chance of being technically and commercially producible.

Possible reserves: reserves which at present cannot be regarded as probable, but which are estimated to have a significant but less than 50 per cent chance of being technically and commercially producible.

Speculative reserves: Estimates of oil which have not been positively identified but which, based on previous geological experience, it is reasonable to expect to discover in the future.

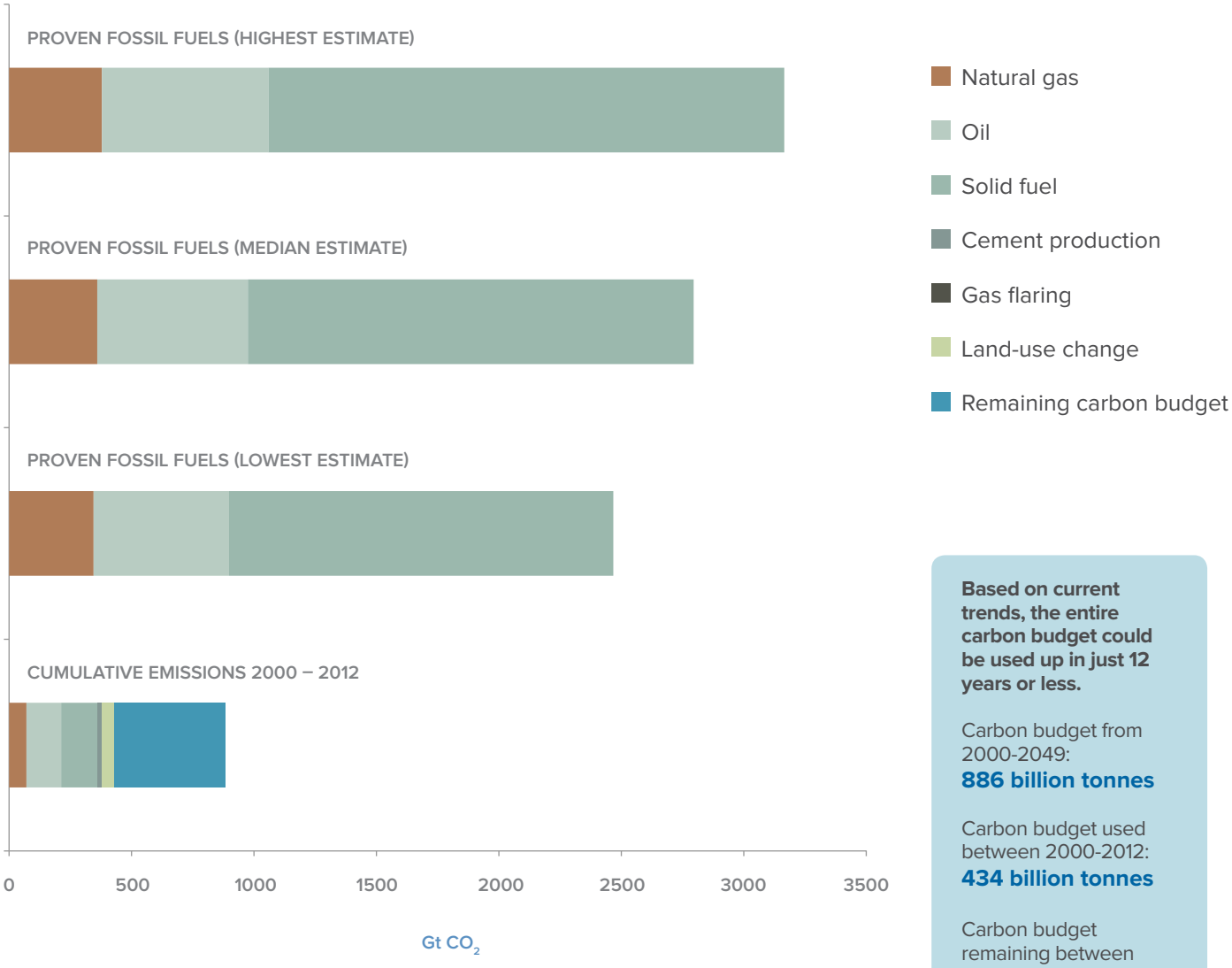
Unburnable carbon: proven, probable and possible reserves that cannot be burned without risking dangerous climate change. This is expressed as a maximum quantity of carbon that can be released into the atmosphere, less greenhouse gas emissions related to land-use, and land-use change (it assumes no carbon capture and storage on the basis that introduction in a necessary timeframe and scale is not demonstrably feasible).

Ultimate recoverable resource: the total quantity of oil that will ever be produced, including the nearly 1 trillion barrels extracted to date.

Using industry figures of proven reserves, Figure 2 shows the range of estimates of potential CO_2 emissions arising from burning all proven and recoverable reserves from fossil fuels.[51] It is clear, across the range of estimates that burning all proven recoverable reserves would vastly exceed the carbon budget defined by Meinshausen's work.

All of the probable and possible reserves currently identified by the fossil fuel industry, and at least 80 per cent of proven reserves currently listed, should all be re-classified as 'unburnable' carbon. These unburnable reserves should be reflected as carbon liabilities in a company's valuation, in the sense that not doing so leads potential investors to dramatically overestimate a company's value.

Figure 2[52] demonstrates that the total cumulative emissions from 2000 to the end of 2012 will be 434 $GtCCO_2$. In just 12 years, almost half of the 886 billion tonne global carbon budget between 2000 and 2049 has been used.



Based on current trends, the entire carbon budget could be used up in just 12 years or less.

Carbon budget from 2000-2049:
886 billion tonnes

Carbon budget used between 2000-2012:
434 billion tonnes

Carbon budget remaining between 2013-2049:
452 billion tonnes

BOX 7: NOT JUST UNBURNABLE CARBON

As fossil fuel firms scramble to increase their proven reserves they are venturing into ever riskier environments, using increasingly experimental technology. The impact of these riskier activities were felt by UK pension holders following the Deepwater Horizon catastrophe in the Gulf of Mexico in 2010.[53]

Development of the Macondo well was a technically demanding endeavour. The source of the spill was below 5000ft of water and a further 3000ft beneath the ocean floor itself. At such depths, direct human intervention is simply not possible.

As the disaster unfolded BP's share price began a steep decline, falling to around a third of its initial value in June 2010.[54] This had the effect of wiping billions from the value of pension schemes. Particularly given that BP's own research estimated that it accounts for 8 per cent of UK pension fund income.

According to the Yorkshire Post, pension funds of Yorkshire public sector workers – council, court and police authority staff - which had substantial sums invested in BP, lost an estimated £80 million of value due to the disaster.[55]

THE IMPACT OF CLASSIFYING CARBON UNBURNABLE

Reclassifying, and thereby effectively removing, unburnable carbon from the tradable market is the logical consequence of this analysis. It is also an essential measure if we are to avoid dangerous climate change. The short-term effect on any given company of specifying carbon liabilities in existing reserves is hard to predict. However, if unburnable assets are not removed from the market in a strategic and systematic manner, there could be a chain of events that far exceed the economic turbulence caused by the banking crisis of 2008.

Events could unfold like this:

> Firstly, the value of the unburnable reserves would collapse. The devaluation of these carbon assets would cause high levels of volatility throughout the financial system with major implications for everyone as they hit pension plans, insurance policies and savings. Investors would lose billions, possibly trillions. A significant reduction in the long-term value of whole sectors would follow, such as in the fossil fuel industries, and those that depend on them. An ensuing economic downturn would see consequential rises in unemployment, rising social inequalities and potentially civil unrest.

> Secondly, without careful management, the value of proven 'burnable' reserves which lie within the 1 trillion tonne window are likely to soar. Most economies are still heavily reliant upon fossil fuels. The UK economy is still 80 per cent dependent on fossil fuels, and a fuel price spike would likely plunge the UK into economic crisis. Oil shocks correlate very closely with recessions. Nine out of ten recessions in the US since World War II were preceded by an oil price shock.[56]

> Thirdly, governments would have to act decisively to prevent a fire sale of remaining assets. They would need to decide carefully and precisely how remaining reserves were to be allocated in order to avoid a race to capture the economic benefits of burning them. In theory, reserves that are least carbon intensive to extract and have the highest energy content for each unit of CO_2 emitted should be the ones utilised first. This would mean utilising, in order of carbon efficiency, first gas, oil and then coal reserves (see Box 8).

Experience from environmental and climate negotiations illustrate the challenges of attempting to agree the fair distribution of resources or emissions rights between nations. Any attempt to agree who had rights to use and benefit from the remaining 20 per cent of assets would likely follow a similar pattern.

In a global economy so dependent on fossil fuels, the fossil fuel lobby and States that sit on large reserves hold enormous power. With the majority of both conventional and unconventional fossil fuel resources held outside the European Union (EU) – this puts the UK and the EU in an especially vulnerable position. With 49.3 per cent of gas reserves held by Russia, Iran and Qatar (21.4, 15.9 and 12 per cent respectively) and 44.7 per cent of oil held by Saudi Arabia, Canada and Venezuela (16.2, 10.6, 17.9 per cent respectively). Whilst almost 60 per cent of the world's coal reserves are held by US, China and Russia (27.6, 13.3 18.2 per cent respectively). The potential is there for a hugely destructive geopolitical dynamic.[57]

The richest and most resourced would apply heavy pressure to burn their specific reserves. The process of allocation would become a flashpoint for international tension. Access to oil and gas resources is already a key driver of conflict around the world. As conflict expert, Michael Klare points out, ruling elites around the world have a conviction that, "the possession of energy assets -- especially oil and gas deposits -- is essential to prop up national wealth, power, and prestige."[58]

Major wars over oil have been fought almost every decade since World War I and smaller conflicts have occurred every few years, in 2012 there are oil-related conflicts occurring involving a dozen or more countries. Klare argues this is an example that we are now entering an era of intensified conflict over energy.

BOX 8: WHICH FOSSIL FUELS ARE BEST LEFT IN THE GROUND?

There is a rational hierarchy of exploitation of the remaining 'burnable' fossil fuels based on the amount of carbon produced per unit of energy and lowest cost in terms of both the finance and energy needed to exploit them. The hierarchy is as follows:

Natural Gas provides relatively high amounts of energy per unit emissions, does not contribute to local air pollution as much as oil, coal and unconventional fossil fuels, and is therefore the most likely candidate to be fully exploited.

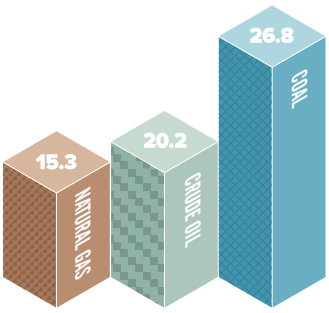
Oil has always been the currency of fossil fuels. The combined storage and energy density qualities of petrol, its main product, make it the primary fuel for transport. It therefore seems logical to exploit conventional oil resources as well.

Coal has a very high emission level per unit of energy, but nonetheless is the main fuel for power plants worldwide. It is a cheap resource, partly because the market understands that it is not as scarce as oil and gas.

Unconventional oil as the processing of tar stands and other unconventional oil types to make petrol and other end-use fuel is in itself very energy intensive. The emissions per final energy supply are thus far above those for gas and conventional oil.

Unconventional gas: The US is experiencing an 'unconventional natural gas revolution' due to advances in drilling technology. Outside the US, the technology is less well developed and several issues create a range of costs. There is potential ground water pollution from hydrofracturing (highly pressurised water and chemical additives are blasted into gas-containing rock formations to fracture them and release the gas – hence the term fracking is used to describe this process), and there are 'fugitive emissions' (gas that escapes from the production process). Monitoring water quality and capturing fugitive emissions are likely to add significantly to operational costs. [59]

Figure 1 details the carbon produced per unit of energy for all the primary fossil fuels.



Carbon intensity of primary fossil fuels (tCO2/TJ)

RATIONALISING THE INVESTMENT MARKET FOR SUSTAINABILITY

Breaking the carbon lock-in

Our physical, man-made environment quickly becomes 'an invisible part of the landscape.' Different choices about infrastructure – to do with transport, buildings and energy generation – lock-in very different outcomes. Like it or not, we often commit ourselves to courses of action over which we subsequently have little choice. Where climate change is concerned, where there is such little room for manoeuvre, making the wrong choices that lock-in the wrong kind of energy use can be disastrous.

A recent study led by the academic Steven Davis from Stanford University estimated the cumulative future emissions, and therefore resulting climate impact, that will stem from our existing transport and energy infrastructure, such as coal-fired power plants. The study concluded that if existing infrastructure was allowed to live-out its normal operational lifespan, we could potentially keep global average temperatures below the 2 °C range.[60] Optimistically, this means that the sources of the most threatening emissions have yet to be built – so a moratorium on carbon-intensive infrastructure could potentially prevent dangerous climate change.

IF EXISTING INFRASTRUCTURE WAS ALLOWED TO LIVE OUT ITS NORMAL OPERATIONAL LIFESPAN, WE COULD POTENTIALLY KEEP GLOBAL AVERAGE TEMPERATURES BELOW THE 2 °C RANGE.

A virtuous circle could be created as new infrastructure was built to exploit clean, renewable sources , fossil fuel demand would be eroded. This would have the effect of breaking the cycle of continued investment in fossil fuels. This would require overcoming substantial inertia and vested interests in the political, financial and technological systems. The 'carbon lock-in' which extends to the considerable lobbying of the fossil fuel industries, would need to be unlocked.[61]

One important reason that explains why carbon becomes locked-in to the economy is that the price mechanism, upon which an efficient market depends, fails to take into account the external consequences of burning carbon – effects that can be felt over a great variety of timescales. Imperfect foresight, uncertainty on future fuel prices, post-2020 climate targets and policies, all of these lead to systematic underinvestment, in low carbon technologies, and research and development of effective carbon abatement.[62]

THE EXISTING POLITICAL AND ECONOMIC FRAMEWORK PUTS FOSSIL FUELS AT AN UNDUE ADVANTAGE OVER ALTERNATIVE ENERGY SOURCES.

The existing political and economic framework puts fossil fuels at an undue advantage over alternative energy sources. The failure to reflect the true cost of CO_2 emissions, volatility of existing pricing mechanisms, and large scale subsidies directed at both the production and consumption of fossil fuels all contribute to this carbon lock-in.

While a number of nations such as Germany, Denmark and China are leading the renewable energy revolution, high upfront capital costs and greater risk premiums means that governments need to show clear long-term commitments to these technologies.[63,64,65] In particular they need to find ways of lowering the cost of capital to them. If this does not happen, fossil fuels – whether gas, oil or coal – will continue to dominate, making any later energy transition more difficult and costly. According to International Energy Agency Chief Economist Fatih Birol, "One dollar not invested now in reducing CO_2 will cost $4.6 in the next decade to achieve the same effect."[66]

Leadership, policy consistency and certainty

Reasonable investor behaviour is currently blocked by structural barriers. The risks stemming from climate change need to be internalised into financial markets to create the conditions in which longer-term sustainable investment strategies can flourish.

Assessment of risk and uncertainty within the market depends on an analysis of, amongst other things, the likelihood of a climate change policy being enforced, not whether that climate change policy should be enforced. To avert global temperature rising beyond 2 °C leadership needs to be demonstrated through strategic action by government, investors, regulators and investment managers. A rational assessment of carbon assets and the climate change risk that they pose could be driven by a number of interventions.

Our interviews with industry experts revealed there is a need to address three key areas to overcome barriers within the investment market. These are necessary if climate change risks are to be acknowledged and exert influence over the direction of investment.

Firstly, there is a need for policy certainty and consistency.

Secondly, market mechanisms need addressing in terms of risk and short–termism.

Thirdly, investors need to be reconnected to the actual process of investment decisions being made.

This section draws on the insights of those interviewed. Comments were made on the basis of anonymity, unless clarified otherwise.

Policy consistency

The absence of political certainty and the lack of a long-term commitment to climate change from individual governments, plus a global, legally binding agreement, were viewed by industry experts as critical obstacles to more rational investment decisions. The market generally seems to be unconvinced that governments would act on their greenhouse gas commitments.

Political leadership is called for, said our interviewees, to provide the policy certainty necessary to influence longer term investment strategies, as these comments demonstrate:

> *"Political leadership is the only way that the externalities can be internalised. Arguably investors who are a sceptical bunch at the best of times are absolutely right to be sceptical about politicians and their prognostications about environmental issues generally and carbon in particular."*
> **Head of research, asset management firm**

> *"One of the reasons why investors aren't convinced that this matters is because they aren't convinced there will be the policy frameworks to make it matter."*
> **Economist**

"Any investment, valuation, financial decision is going to be based partly on what kind of policy and political messages the decision-maker receives, as well as on the perceived likelihood of those messages changing or not being delivered on. We see how investors don't seem to even take notice of the deep emission reduction commitments by 2050. These pledges are simply not taken seriously and I don't blame the investors."
Remco Fischer, UNEP FI

"Unless the private sector knows that regulations are there to last for a long time, are loud enough in that they are convincing enough, financially speaking, and the processes by which they are to be implemented are clear, in general, they will not move."
Françoise Destais, UNEP

Research by the consultancy Trucost also found that, *'Managers do not actively consider climate change factors such as greenhouse gas emissions as part of their investment processes mainly due to the expectation that governments will not achieve emissions reduction targets or establish a global carbon price; short-term pressures to generate returns; and the lack of standardised reporting frameworks needed to deliver comparable, accurate data on company emissions.'*[67]

Environmental regulations related to, for example clean air standards, heavy metals, conservation of land or marine natural habitats, or on improved technological standards, could also have a significant effect. But this requires a belief that they will be rigorously designed, implemented and maintained. For example, Environmental Protection Agency rules in the US have made it virtually impossible for new coal fired power stations to be built under the current presidency. Similar rules exist in the EU, where the Large Combustion Plants Directive means many existing coal plants must shut by 2015, and new ones must be fitted with emissions abatement equipment.

Lack of a carbon price

Fossil fuels do not bear their full social and environmental costs. Where attempts have been made to put a price on carbon, such as in the EU Emissions Trading Scheme, the significant volatility of that price has failed to impact on investor behaviour.[68, 69] With volatility, uncertainty increases and reduces investment profitability of new higher standard facilities and technologies, including those in the renewable energy sector.[70] The adjustment of the limit on emissions (the 'cap') from one period to another aggravates this further as it becomes prey to political bargaining, undermining the positive signals that greater certainty over policy would give.[71]

"The issue at the moment in the European scheme is that... because of what has happened with the economy, the price has become negligible. When this happens, it is very hard for any investor to sit down and say, 'this is going to impact on the share price of the companies I'm investing in over the time horizons that I'm looking at this in.'"
Manager, corporate governance

Other policies favour and encourage fossil fuel exploration, such as exploration subsidies, tax breaks (such as those given in recent years to Britain's North Sea oil operators) and the government support for continuing research and development.[72]

Removing fossil fuel subsidies

Subsidies continue to distort fossil fuel markets, and hence also the consumption and production of coal, oil and gas. According to an OECD study, household consumption of these fuels for heating is subsidised by almost £3 billion.[73] This is because a lower rate of VAT is applied to domestic energy-consumption – set at 5 per cent compared to the standard 20 per cent. Furthermore, a £440 million annual tax write-off is enjoyed by oil and gas production in the UK.[74]

At the global level, the fossil fuel industry is subsided by an estimated $730 billion each year. This support can be so complex however, that the precise influence over continued extractive industry investment is unclear.[75] In early 2012, the UN Secretary General's high level Panel on Global Sustainability (GSP) unequivocally called for the removal of these subsidies in their consensus report, *Resilient People, Resilient Planet: A Future Worth Choosing* which recommended the phasing out of fossil fuel subsidies and the reduction of other trade distorting subsidies by 2020.[76]

In comparison, global subsidies for renewable power were estimated by the International Energy Agency (IEA) to be just $US44 billion, just 6 per cent of those going to fossil fuels.[77] Fossil fuel subsidies in nearly all the countries that pledged fast start finance significantly overshadow pledges for climate finance.[78]

A social justice argument can be made for subsidies targeted at the energy consumption of the poorest and most vulnerable in society. According to the IEA such subsidies benefit the middle classes more than those living in poverty. For example, the poorest 20 per cent of the population typically receive just 5–10 per cent of the benefits of the subsidies.[79] Effective poverty alleviation through consumption-based energy subsidies, therefore, clearly requires policies to be designed better.

The case for removing production subsidies is more clearer cut. Tax write-offs for capital expenditure on new exploration, artificially lowers those costs and encourages exploration. As such they set up a policy conflict with climate change commitments.

REMOVING THE TAX WRITE-OFFS MADE AVAILABLE FOR CAPITAL EXPENDITURE ON NEW EXPLORATION WOULD, BY RAISING COSTS, SEND A CLEAR SIGNAL TO THE SECTOR.

INVESTMENT MARKET MECHANISMS

Perceptions of risk

Carbon assets are not seen as high risk by most investors. And instead they focus their attention on risks that can be controlled, or appear controllable. One pension fund advisor listed the top three risks faced by schemes as: i) interest rates and inflation; ii) equity risk; and iii) longevity risk. With these as the most important apparent risks, fossil fuels remain an attractive investments and the barrier to renewables. Climate change is viewed as an esoteric or uncontrollable risk, and therefore does not sit high on the agenda.

> *"They can do things about interest rate and inflation risk...They can worry about equity risk and they view it as very much the risk of the market and try to control it through diversification, through looking at other sources of investment. But, things that are esoteric and uncontrollable, don't sit high on trustees lists from the simple fact that they don't understand or have the time and governance budget to spend worrying about them."*
> Pension fund advisor

According to research by the credit rating agency, Standard and Poor earlier this year, despite an appetite for pension funds to invest in low-carbon infrastructure through vehicles such as energy or green bonds, investors are still concerned about risks to do with longevity and the stability of climate policies and regulations. [80]

Regulatory risk is seen as particularly high for clean energy markets, because in most cases, they still require public support to be cost-competitive. Surprise regulatory change can seriously undermine the attractiveness of the renewable energy sector for investors. As evidenced by the recent policy change in the UK that severely cut the renewable feed-in-tariff.

Risk premiums required on capital markets for renewable energy projects are usually much higher than those for fossil fuels and their associated technologies. This is due to higher uncertainties associated with relatively immature new technology markets and the perceived variability of renewable sources – to do with, for example, wind speed or sunshine hours. investors require reassurance about the dependability of income streams from renewable energy.

Investment managers will typically also have less experience of renewable energy technology investments, resulting in higher risk premiums due to a lack of understanding about the sector -in terms of technology, operations and regulatory considerations as our interviewees pointed out:

> *"You'll find a lot of institutional inertia and you'll find a lot of what is called 'regret risk' – this means that people are very afraid of doing something outside the norm, because then they could be identified for doing something different and it messed up."*
> **Investment director at a private equity fund**

The impact of this lack of experience, compounded by herding behaviour[81], results in inertia as investors second-guess and copy each other. This is the same behaviour that creates repeated speculative bubbles:

> *"It's not that 'we don't care about the future', it's 'we care about the future, but before that arrives, there could be an awful lot of bumps up and down in the road and if enough other people are buying something, even though we think it's a bit of a lemon in the long-run, we'll buy it because everyone buys it'"*
> **Economist**

Additional barriers exist for large-scale, low-carbon investments which stem from the small size of the secondary debt market, and the absence of liquid, investment grade asset-backed securities.

"You'll find a lot of institutional inertia and you'll find a lot of what is called 'regret risk' – this means that people are very afraid of doing something outside the norm, because then they could be identified for doing something different and it messed up."

PRIVATE EQUITY FUND INVESTMENT DIRECTOR

Short–termism

It is uncontroversial to say that markets are biased towards short–termism. Reporting periods and incentive structures all reinforce this characteristic market tendency. Most of the industry's energy, intellect and computer power is directed as a result toward high frequency trading. This makes consideration of the longer term risks of carbon trading within the 1 trillion window largely irrelevant:

> *"Traders operate over very short-time frames (quarterly reporting, for example), so why should they care about long-term risk? If you think about carbon, for example, they [traders] will have sold those shares years before the risk time-frame."*
> **Analyst**

> *"You sell what you've got to make your short-term gain then move on to the next thing, rather than thinking – 'what is the value of this company, if we're going to own it over 10-years.'"*
> **Analyst**

MOST OF THE INDUSTRY'S ENERGY, INTELLECT AND COMPUTER POWER IS DIRECTED TOWARD HIGH FREQUENCY TRADING. THIS MAKES CONSIDERATION OF THE LONGER TERM RISKS OF CARBON TRADING WITHIN THE 1 TRILLION WINDOW LARGELY IRRELEVANT.

INVESTOR KNOWLEDGE AND ACTION

Investors themselves have a leadership role to play. Institutional and pension fund investors with the opportunity to direct sizeable investments can be 'market makers' in emerging, climate friendly sectors. However, this potential is undermined by a trend toward greater separation, as the influence of investors gets lost in a chain of people making decisions over their investments. This particularly affects institutional investors and pension funds.

> *"They're not picking the stocks themselves [pension fund trustees], someone else is doing it for them...This creates a disconnect; a lack of understanding about what is going on with the investment. The trustees in effect are delegating responsibility for understanding certain risks associated with any of their investments to a third party. I think this is exacerbated by all the other things that investors have got to think about...The fact that there are at least three intermediate steps before you get to the actual decision maker on investments is the key barrier...."*
> **Pension fund advisor**

Furthermore, despite a number of innovative corporations that are considering issues of sustainability, the same level of buy-in from investment managers is rare.

> *"When you talk to leading companies in this area, they really do get it and their CEOs are behind it 100 per cent. There are some hugely impressive companies out there in the field of sustainability. But I think you'd struggle to find the same level of buy-in from the investment managers in general. Of course there are notable exceptions, but they are very much in the minority."*
> **Manager, corporate governance**

Investors appear generally to be too passive, failing to sufficiently interrogate their investment managers, or question the long-term risk associated with their investments.[82] It leaves many exposed, pouring large sums into assets that it may be impossible later to use – what is known as a 'stranded asset.' Imagine, for example, buying costly electrical goods in another country, only to find on returning home that they were incompatible with your local power supply and getting no refund, being forbidden from returning them to the country of origin.

Are investors asking enough questions about why fossil fuels firms are investing billions each year into exploration for new reserves to help production in 7-8 years' time? Are you going to end up with stranded assets? For example, tar sands won't pay back for 20 years. Coal assets invested in now, might never have a market because of emissions restrictions – and not necessarily just carbon. Investors aren't asking, what the business model is going to be in 5-10 years' time when these assets are actually going to be developed."
Carbon Tracker

Large pension funds and organised groups of shareholders have the opportunity, through their combined market power, to drive sustainable investment strategies, yet they remain fragmented, and fail to come to terms with and address the long term risks of their investments.

"Shareholders are so fragmented that the pressure is almost never going to come from them. It might come from groups of big shareholders, but so far we haven't really seen much evidence of that. You have groups like the UNPRI or P8 and other groups claiming to represent trillions of dollars of shareholder funds, and you think – there hasn't really been a lot of movement as a result of this has there?"
Accountant

"I would say it is about shareholders being engaged so they are asking of the business: 'are you creating long-term value for us rather than saying short-term is bad and long-term is good. Short-term may be very good."
Accountant

RECOMMENDATIONS

The following section presents a suite of recommendations drawn from our expert interviews and research that could be applied to change investor behaviour. They operate by increasing the risk, and therefore the cost, of high-carbon investments, or by making alternative investments more attractive. No one intervention will create the scale of change necessary. There does have to be a clear strategic intention, applied consistently over the longer term, through policy and practise to drive the market towards real sustainability. As one interviewee described it:

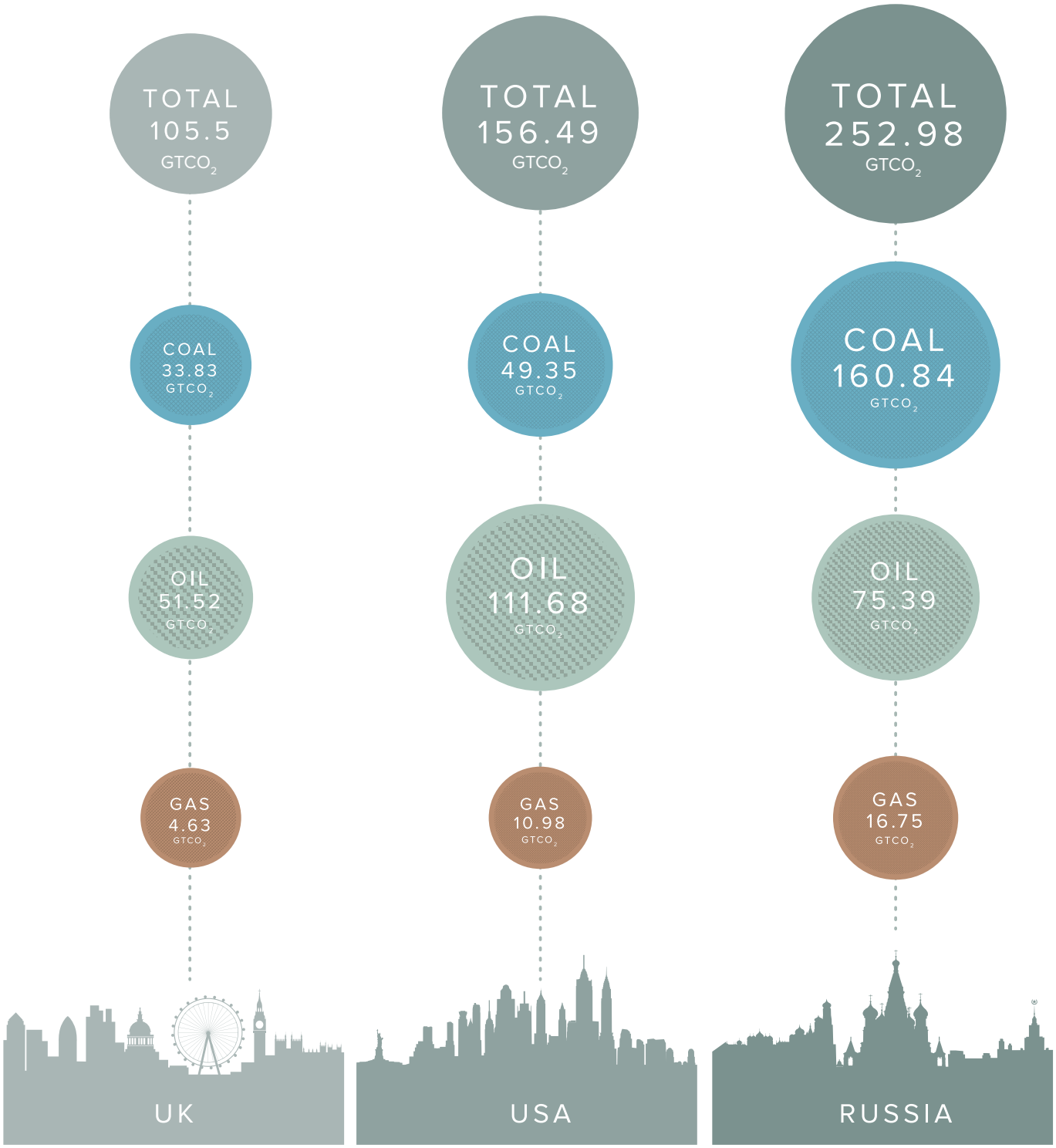
> *"It is a combination of market drivers from corporate strategy to supply chain pressures, to consumer behaviour, to government purchasing, to taxes and subsidies, trading schemes to rating agencies."*
> **Accountant**

Recommendations fall into three key categories:

- Applying the thresholds implied by 'unburnable carbon' to policy in a consistent way.
- Correcting the carbon-and-climate blindness of current risk assessments.
- Increasing the engagement of investors.

> **We know the pricing is wrong. So what can we do and how can we reposition, retool, reskill people? you're not going to retool and reskill them if you keep valuing oil companies as high as they are.**
>
> **ECONOMIST**

Figure 3: Top three Stock Exchanges for listed fossil fuels.



1. Policy clarity

Government and regulators at a national and global level need to translate the new parameters of unburnable carbon into clear regulation. Consistency in policy is needed to shape longer- term investment strategies.

Classifying unburnable fossil fuel reserves

Of currently proven fossil fuel reserves, 80 per cent cannot be utilised if we are to remain within the 1 trillion tonne window at the global level. Information on a company's level of fossil fuel reserves, and when those reserves might be exploited, shapes how a company is valued. Yet, reserves are listed on markets with little or no information on the type of risks discussed in this report.

The market assumes that all proven reserves can and will, sooner or later, be exploited. Re-classifying reserves as unburnable will be the most effective way of removing them from the market, and keeping them in the ground. It would signal to the market the true, realisable assets of a company, set within the limits of a safe global carbon budget.

THE UK CAN DEMONSTRATE ECONOMIC AND ENVIRONMENTAL LEADERSHIP, BY APPLYING THE 'UNBURNABLE' CLASSIFICATION TO FOSSIL FUEL RESERVES LISTED ON THE UK STOCK EXCHANGE.

The UK can demonstrate economic and environmental leadership, by applying the 'unburnable' classification to fossil fuel reserves listed on the UK stock exchange. London is the third largest exchange in the world for fossil fuels following behind Russia and the USA (see figure 3). In 2011, the UK's exposure to fossil fuel carbon emissions was estimated by the Carbon Tracker Initiative to be 105.5 $GtCO_2$, comprising oil 51.52 $GtCO_2$, coal 49.35 $GtCO_2$, Gas 4.63 $GtCO_2$.[83] This could be made operational using an index that reflects the desirable hierarchy of fossil fuel extraction – as discussed in box 8, or by drawing a uniform cut-off line at the 80 per cent mark across all listings.

Obviously, there is likely to be special pleading by different actors in the market and the case will be put for exemptions due to special and particular circumstances. Questions are likely to be raised on a range of technical measures. Consultation on the mechanism will be important, but given the urgency of action to create a stable, forward looking investment market, these should not be used as an excuse for inaction.

If history is a guide, the most common argument against such a measure will be to do with international competitiveness and the UK losing their share of trade to other countries. It should be noted that this argument is consistently raised in the face of practical and moral imperatives to change the way that markets work. It was the case with regard to slavery and measures to improve the safety of shipping. Yet, in each case Britain led and the world ultimately followed. The UK would have to work with other major stock exchanges to achieve application of this policy in as consistent a way as possible. In addition to working in tandem with reformed credit rating agencies.

Setting a carbon floor price

The lack of a carbon price was consistently identified in our research and discussions with industry experts as a key barrier to financial markets recognising unburnable carbon. This has been at the centre of climate policy discussions for a number of decades.

Whilst a carbon price has been set through the European Union Emissions Trading Scheme (ETS), volatility of the price, and its collapse to an currently insignificant value, means that it has not had the desired effect. Setting a floor (minimum) price for carbon is necessary to internalise carbon risk within investment decisions, but remains a huge challenge, as these interviewees emphasise:

> *"If you start pricing carbon effectively and implementing tight caps and standards and regulations and start funding and supporting alternative energies, electric vehicles, the value of your fossil fuels will fall and the amount of rent that you can capture from your stocks will fall. But until that happens, they are still valuable."*
> **Economist**

> *"In an ideal world, a global carbon price floor would be great. But it seems so far away. We can't even get it right in Europe. To get it right globally, I just don't think it is a practical proposition...Carbon trading is even a toxic idea in the US at the moment, because those who benefit from it are the financial community. There have been moves to abandon the ETS in Europe because it was seen as just benefiting fat cat bankers."*
> **Asset manager**

> *"The idea that the steel, aluminium, cement industries are going to allow global carbon prices, without the mother or father of a political battle, I think is not going to happen in anything like the current political context."*
> **Energy policy expert**

A CONCRETE COMMITMENT TO INTRODUCE CARBON PRICING REMAINS NECESSARY TO SEND THE RIGHT AND CONSISTENT SIGNAL TO INVESTORS.

Yet, a concrete commitment to introduce carbon pricing remains necessary to send the right and consistent signal to investors. The price of carbon in existing trading schemes has not to-date delivered the required level of change, because the market does not believe it will be high enough, and maintained. Forces pulling strongly in the other direction are understood to be both powerful and well-funded.

> *"If you look at the emissions trading scheme or the carbon price tax in Ireland and the Netherlands, I don't think the evidence is very strong that it's delivered very much, any more than the fuel tax escalator in the UK has delivered fuel efficiency in cars, because nobody believes it is going to be maintained. As soon as the going gets tough, the political forces that say stop become quite strong..."*
> **Energy policy expert**

Consistent subsidy reform

Possibly the quickest and most effective short-term initiative is the removal of market distorting subsidies. These promote fossil fuel exploration likely to guarantee that the global economy goes beyond the 1 trillion tonne window of carbon emissions. Yet opposition to damaging subsidies is something that can unite people across the political spectrum - the concept that markets should operate on a level playing field.

"Any oil, gas or coal exploration that cumulatively takes you above a 2 degree warming, the best way to disincentivise it is to remove the tax write-off treatment for CAPEX [capital expenditure] spend on new exploration"

MARK CAMPANALE
CARBON TRACKER INITIATIVE

Given the huge imbalance of subsidies to fossil fuels compared to renewable energy, the economic impact of subsidy withdrawal would be reduced, and potentially even reversed, if subsidies were better balanced between the old and new energy sectors. Research by Deutsche Bank in 2010 showed that, per unit of investment, the energy efficiency and renewable energy technology sectors created far more jobs than conventional fossil fuel and nuclear energy generation. Such a new dynamic would reduce risk and uncertainty within the renewable industry, and encourage further research and development.

Capital Adequacy Requirements

'Capital Adequacy Requirements' are regulations relating to how much capital banks have to hold against the assets they have invested in. This capital is held to help cushion the blow of any unexpected collapse in the price of assets. If banks were required to hold more capital against products from, and trades with extractive companies, then this would make investment in the industry more expensive, less profitable and encourage a change in investor behaviour.

IF BANKS WERE REQUIRED TO HOLD MORE CAPITAL ASIDE AGAINST PRODUCTS FROM, AND TRADES WITH EXTRACTIVE COMPANIES, THEN THIS WOULD MAKE INVESTMENT IN THE INDUSTRY MORE EXPENSIVE, LESS PROFITABLE AND ENCOURAGE A CHANGE IN INVESTOR BEHAVIOUR.

Changing Risk Assessment

Assessing risk

Investment banks, credit rating agencies and others who determine the flow of investment already use modelling to assess the likely impact of different government interventions. However, typically they ascribe a very low probability of risk to regulatory action on climate change on the extractive industries. This is why according to one interviewee:

> *"Markets just don't price in that risk [of carbon intensive investments] at the moment...they quite reasonably look at the history we've had with the climate negotiations and what's happened with the carbon price...So the message is quite clear, climate change and carbon emissions are just not seen as important issues, certainly over a period of 1-year. So the risk is not being priced in."*
> **Acturist**

If the risk of unburnable carbon is to be included in models, then the way that investment banks and rating agencies ascribe risk to climate policy needs to change.

> *"The risk isn't being captured in the financial organisations. A mining company, for example, wouldn't carry their reserves on balance sheet, so effectively there is an accounting fault that relates to disclosure. And certainly oil and gas companies don't carry their reserves on balance sheet. There is no formal mechanism which could capture carbon, whether it's embedded or not, on balance sheet..."*
> **Accountant**

Credit rating agencies

The reputations of the major credit rating agencies – Moody's Investor Service, Standard & Poor's and Fitch – suffered enormously because of their failure to spot the risk of the toxic financial products that led to the financial crisis. Credit rating agencies influence where investors put their money, as they provide advice on how likely companies and governments are to repay loans. One way to restore their public standing would be to incorporate the assessment of carbon risk into their rating calculation before something happens to crash the market. If credit rating agencies recognised the unburnable character of the majority of carbon reserves when rating or writing credit reports for extractive firms, it would significantly influence the likely profitability of investments and change investor behaviour.

The scale of the possible impact of credit rating agencies was demonstrated in early 2012 when Moody's threatened to downgrade the major utility firms E.ON and RWE if they continued with a proposed investment in the UK's planned expansion of nuclear power.[85] This action effectively prevented the investment going ahead by inflating the cost of capital. Both firms withdrew from the proposal, at least in the short-term.

Although credit rating agencies have largely been unregulated, wide criticism for failing to recognise the risk posed by the sub-prime crisis, means that action, for example by the European Commission, is now being taken to develop and implement regulatory standards for the industry.[86] As new regulations are designed, credit rating agencies should, at the very least, be compelled to ascribe a high probability to legislation stemming from declared climate policy. These ratings should reflect both the desirability and likelihood of proven fossil fuel reserves being exploited. Our analysis indicates that this would mean taking into account the most logical hierarchy of their use (Box 8). Resulting in effective application of climate change policy, and providing clear signals which will then influence investor behaviour.

New risk metrics

Value-at -risk (VaR) is a standard metric developed for portfolio managers and analysts which quantifies risk in monetary units. This single number provides a common language for investors and management to measures the maximum potential loss in the value of a portfolio (with a given probability) over a defined period.

Developing this tool to encompass environmental value-at-risk would allow a measure already familiar to the investment community to include carbon within the risk calculation.

> *"If you stepped away from carbon for a minute, and thought about ecosystems or biodiversity, it is immensely difficult to put the challenge that is faced in a language that business understands, unless you start to talk about some sort of capital that is not being replenished, and show how it will affect business. As a shareholder, you have to show the environmental value at risk." (EVaR).*
> **Accountant**

Increasing Investor Engagement

Listing rules

Several countries already require the disclosure of environmental and social factors within listing rules, the UK is far behind compared to some emerging economies, such as South Africa, Brazil and Malaysia, who require companies to publish sustainability reports, or explain why these cannot be published.[87,88]

Disclosure of information is at the core of the listing process and is essential for the fair and efficient functioning of markets. Disclosure is governed by extensive regulation, embodied in rules that ensure listing documents contain "all such information as investors and their professional advisers would reasonably require."[89]

Substantial changes in the investment industry in recent years have not included the disclosure of climate risk in prospectuses in the UK. For example, one interviewee said,

> *"Coal India had a big IPO last year (2011), and I got a copy of their prospectus which was around 400 pages long, and CO_2, carbon and climate change weren't mentioned once in the whole thing. It just isn't on people's radar. The sort of people who are going to invest in Coal India, it is just not on their radar at all."*
> **Head of research, asset management firm**

The failure of companies to disclose carbon risks associated with their operations, can not in any meaningful sense by reconciled with a modern understanding of transparency, as it makes attempts to assess a company's long term prospects almost impossible. Some firms understand this and are taking action unilaterally.

> *"It is about shifting corporate reporting away from the quarterly; it is a kind of leadership like Paul Poleman from Unilever has shown. He said "we need to focus on the long-term, if you're not interested in that, you should go and buy someone else's shares." What he's saying is that we'll eventually run out of inputs for the business, and unless we change, the business will effectively die, so we've got to work out how to prevent that. So, the reward for a shareholder there, is trusting that he will deliver an organisation that is future-proof."*
> **Accountant**

A recent study explored the impact of economic, regulatory, social and financial market factors on the motivation of the Global 500 list of companies to voluntarily disclose carbon information. The Carbon Disclosure Project - a consortium of institutional investors with $57 trillion assets – found that economic factors are significantly associated with the decision by a company voluntarily to disclose information about its carbon profile. That is, companies that face a direct economic consequence are more likely to disclose carbon related information. Companies in carbon intensive sectors show the same tendency. The authors also found that large companies have more propensity to disclose carbon information, suggesting social or political pressure plays an important role in such a decision.

Those companies refusing to disclose carbon information appeared to be influenced by the lack of importance ascribed by their investors for this information. The tendency of the Global 500 toward disclosure is therefore likely explained by more general economic and social pressure. Meaning, the major driving force for climate change disclosure comes from the general public and government, rather than other major stakeholders such as shareholders and creditors.[90]

Institutional Investors

Institutional investors have a potentially significant role to play because they have the opportunity to behave differently to individual and more dispersed investors. They own large quantities of shares in a firm, and therefore have an incentive to develop specialised expertise in making and monitoring investments. Given this, institutional investors could play a far more active role in addressing unburnable carbon and hold management accountable for actions that do not promote the welfare of shareholders over the longer term. Their greater access to a company's information, coupled with their concentrated voting power, might enable them to more actively monitor the firm's performance and to make changes in the board's composition when performance lags.

INSTITUTIONAL INVESTORS COULD PLAY A FAR MORE ACTIVE ROLE IN ADDRESSING UNBURNABLE CARBON THAN DISPERSED INDIVIDUAL INVESTORS, BY HOLDING MANAGEMENT ACCOUNTABLE FOR ACTIONS THAT DO NOT PROMOTE THE WELFARE OF SHAREHOLDERS OVER THE LONGER TERM.

In one study that explored the effectiveness of institutional investor activism towards climate change, the authors examined the conditions under which FT 500 companies participated in the Carbon Disclosure Project.[91] By making use of Russia's ratification of the Kyoto Protocol, which caused the Protocol to go into effect, the authors found that companies' participation paid off when the likelihood of climate change regulation rose. A conservative estimate of the total value created was $2.7 billion, about 27 per cent of the size of the carbon market in 2007. This implies that action by institutional investors on climate change can increase shareholder value when the external business environment becomes more climate conscious.

Change incentives in the financial system so that it focuses more on generating long-term value.

A great deal of public and media attention since the banking crisis has focused on the consequences of badly designed incentive and reward structures in the financial sector. They appeared to lack a strong correlation with actual performance and encourage ultimately damaging, high risk behaviour. Well-designed incentives, could however have a positive effect. Loyalty bonuses, where investors who have held shares for 3 years or more, for example, could receive a percentage bonus on their dividends. Some interviewees considered such bonuses to be a positive policy mechanism to encourage more long-termism and a stronger relationship and level of engagement between the shareholder and firm. Others felt that there could be unintended consequences, or questioned whether encouraging long-termism was necessarily good policy.

> *"Measures that in theory are there to incentivise long term share ownership are in reality sometimes misused to insulate and protect the control of founder shareholders and corporate management. Double voting rights in France being the example that springs to mind. That is not to say of course that the benefits might not outweigh the costs, just that there can be unintended consequences."*
> **Manager, corporate governance**

In addition, several interviewees felt that a loyalty bonus would have very little impact on transforming the culture of investing for the short-term:

> *"It wouldn't necessarily stop someone from trading on news flows. And, if someone is trading on news, all they are interested in is the starting price, less the ending price; they aren't interested in the absolute price. So I don't see a loyalty dividend having any effect at all."*
> **Investment director, private equity fund**

Instead of a loyalty bonus, the interviewee considered that a Tobin tax on financial transactions may encourage a longer-term perspective:

> *"...it would make people think twice about short-term trading, it stops people looking to trade on short-term news flows and encourages people to look longer-term and ask questions about the long-term value of the business."*

Public sector Investment

Since the financial crisis of 2008, a number of groups such as the Green New Deal Group have championed the idea of a green investment bank. This was also reflected in the interviews. But, it was argued that the bank needed to be large and powerful.

At the moment the UK's Green Investment Bank is both small and weak. It has been capitalised by just £1 billion – compared to assessments made by the Department of Energy and Climate Change suggesting that £110 billion of investment into green energy infrastructure is needed over the next 7 years. Not all of that sum was expected to come from the Green Investment Bank, but even allowing for successfully leveraging other forms of finance, the bank appears dramatically under-capitalised.

Capitalisation of the UK's Green Investment Bank: **£1 billion**

Department of Energy and Climate Change's assessment of investment in green infrastructure needed in the next 7 years: **£110 billion**

However, if the bank functioned like Germany's government-owned development bank KfW,[92] it would reduce policy risk and send a strong enough signal to change investor sentiment towards renewable energy. Although risk premiums in the sector have been strongly affected by recent energy policy changes, nevertheless, several interviewees identified their future potential:

> *"If done properly...the potential is massive. A Green Investment Bank shows you are serious. Anything that makes the Government look like it is serious about taking on the risk will change investor behaviour."*
> **Economist**

> *"If the UK's Green Investment Bank was large enough and powerful enough to quickly achieve significant reductions in greenhouse gas emissions through up-scaling finance for energy efficiency improvements and low carbon energy in the UK and secondly, all major economies in the world equally created a large and powerful bank. That would be another avenue for reducing greenhouse gas emissions at speed and scale."*
> **Remco Fischer, UNEP FI**

> *"It is important as a way of reducing policy risk perversely. So it's not just to do with money, though of course that helps...It makes it a lower risk set of options if public finance is engaged... others have been doing long-term investment into infrastructure much better than we have. The German KfW for example, it's there, and it works."*
> **Energy policy expert**

A GREEN INVESTMENT BANK SHOWS YOU ARE SERIOUS. ANYTHING THAT MAKES THE GOVERNMENT LOOK LIKE IT IS SERIOUS ABOUT TAKING ON THE RISK WILL CHANGE INVESTOR BEHAVIOUR.

05
CONCLUSION

In just the first 12 years, we have used up almost half the global carbon budget. The potential carbon emissions currently still locked in the proven, unburned reserves of fossil fuels, amount to between four and five times the amount which can be safely emitted. On that basis, around 80 per cent of declared proven reserves are not real assets to the companies that claim them at all, but carbon liabilities that can never realise their apparent value.

The key driver of CO_2 emissions is the continued flow of capital investment into fossil fuel extractive industries, primarily due to the lack of certainty, leadership and authority in climate change policy from national governments. There is a clear case for classifying a significant proportion of the current proven fossil fuel reserves as unburnable.

Without leadership and strategic action being taken by government and investors an unmanaged devaluation of carbon assets would richochet through the financial system with major implications for institutional investors and pension funds. This would affect most of the population with a pension, mortgage or saving account.

Failing to regulate unburnable carbon not only puts the pensions and savings of the British public at risk, significantly damaging their long-term investments, but also the long-term habitability of our planet. Given this, continued investment in fossil fuels should concern the population as a whole, and every sector in the economy. Intentionally or not, unless there is a managed transition away from such investments, all sectors of society, including local authorities and central government will be affected. In this report, based on research and interviews with key experts in the finance and energy sectors, we have explored the concept of unburnable carbon assets, and proposed recommendations that would ensure they remain unburned. For that to happen, the conditions need to be created for investment to flow out of fossil fuel sectors, and into the new generation of low-carbon alternatives.

06
ENDNOTES

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2 Based on the latest data and projecting forward using current trends, cumulative CO_2 emissions from 2000 to the end of this year (2012) from the combustion of fossil fuels, cement production, gas flaring and land-use change will be 434 $GtCO_2$.

3 'Proven reserves' are defined by the UK's Department of Energy and Climate Change as those which on the available evidence are virtually certain to be technically and commercially producible. These were estimated to represent emissions of a scale in the range of between 2,541 $GtCO_2$ and 3,089 $GtCO_2$ in 2010.

4 See for example, FT Global 500 2011. See: http://media.ft.com/cms/33558890-98d4-11e0-bd66-00144feab49a.pdf

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8 Estimates are projected on the basis of existing and proven technologies. Given this, carbon capture and storage technologies are not included in the estimates.

9 We particularly acknowledge Nick Robins (Head of HSBC Climate Centre of Excellence) and Mark Campanale's (Carbon Tracker) work since 2007 on unburnable carbon which has opened up this important debate. See www.carbontracker.org

17 industry experts were interviewed as part of this research including a pension fund advisor, economist, director of investment banking, heads of responsible investment, a renewable energy investment manager, chartered accountants, acturists, experts from UNEP Finance Initiative, energy policy experts and finance-related NGOs.

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49 See note 38.

50 In terms of Myles Allen's team's calculation, their best estimate of the cumulative carbon commitment is 2 ˚C per 1,000 GtC emitted from 1750 to 2500. Given that humans already emitted around 520GtC to the end of 2008, their analysis implies another 480GtC would put global average temperatures 2 ˚C above pre-industrial times with more than 50 per cent likelihood. This is broadly consistent with the 310 GtC estimate from Meinshausen's team which focuses on a much shorter time frame (2000-2049). For comparison, two scenarios with cuts of 80 per cent in emissions by 2050, in developed countries and globally, give an additional 325 GtC and 216 GtC respectively.

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52 Supplementary information on the calculation: Using existing data and projecting forward using current trends, cumulative emissions from 2000 to the end of this year (2012) from the combustion of fossil fuels will be 369 billion tonnes of CO_2. Also over this period: 15 $GtCO_2$ will have been released from cement production - the heating of calcium carbonate to produce cement releases CO_2); 3 $GtCO_2$ from the flaring of gas (gas that cannot be contained or used productively is burned off. In most cases, flaring is associated with natural gas that is released from oil production fields.)". References: Just over 48 $GtCO_2$ from land use change

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