

The Case for Fossil Fuel Divestment

University of Manchester Students' Union

and

Fossil Free Manchester

Overall argument

We believe that the actions and activities of Fossil Fuel companies are unethical and immoral, and that the holding of investments in fossil fuels is incompatible with the University's values and policies.

We call for the University to divest from its assets in fossil fuel companies to demonstrate its commitment to its values, support scientific inquiry and demonstrate positive moral leadership on this issue.

The University's commitment to social responsibility

The University is an organisation created to contribute to society. Its founding charter states its objects are to "advance education, knowledge and wisdom by research, scholarship, learning and teaching, for the benefit of individual and society at large."

The University has also committed, through its 2020 strategic plan, to further advance its contribution to Society by being "an ethical organisation with exemplary policies and procedures which will lead to the highest standards in all our activities". In addition, the strategic plan also commits the University to "environmental sustainability, setting and meeting the highest possible standards across the full range of our activities".

Specifically on investments, the University has committed through its Socially Responsible Investment Policy to "reduce and ideally eliminate, irresponsible corporate behaviour leading to: environmental degradation; armament sales to military regimes; human rights violations; the institutionalisation of poverty through discriminatory market practices; racial or sexual discrimination; tobacco production, cultivation and manufacture; the exploitation of workers; the giving or receiving of bribes."

The University has previously divested itself for this reason from tobacco companies and any companies linked to the defence or aerospace sector.

The University also monitors its investments on the basis of environmental, social and governance (ESG) criteria, produced by external investment research companies. However, while these do detect some issues, often these criteria miss the bigger picture. Firstly, they rely predominantly from data that only the companies can release – meaning those that are less forthcoming about their issues may be ranked lower. Secondly, they focus on ranking the relative compliance of companies within their sector group rather than their absolute impact on society. Thirdly, they tend to also focus on processes rather than outcomes.

Fossil fuel companies compared to our values

The fossil fuel companies in which the University holds investments have a significant record of unethical and immoral behaviour. These companies have, amongst others, committed bribery, human rights abuses and irresponsibly damaged and contaminated areas of significant environmental or scientific importance. In many instances such behaviour has been proved in

court with significant fines imposed upon the companies. Further details are provided in Appendix A of this report.

Furthermore, these fossil fuel companies have a long track record of funding political lobbying groups which seek to distort the scientific consensus on the causes of global warming and climate change, in an attempt to avoid public policy outcomes which would affect their commercial interests. Further details are given in Appendix A of this report.

Many members of the University of Manchester's scientific community have expressed frustration with the lack of public understanding on climate change, most notably when Nobel laureate Professor Mario Molina gave the Foundation Day lecture in October 2013. It is our view that this misunderstanding has been caused by the political activities of these fossil fuel companies.

We believe that the University's position of holding investments in these companies is incompatible with its commitment to independent scientific inquiry through accurate and peer-reviewed research.

The University's chance to show leadership on this issue

The University is a respected thought leader. As the largest single University (apart from the Open University) in the UK and one of the top 5 for research power, its opinion is regarded positively and carries weight well beyond the city boundaries of Manchester. This point is reflected in the University's Socially Responsible Investment Policy which states: "as a high profile national and international University, Manchester is in a position to use its influence as an investor to discourage irresponsible or reprehensible corporate behaviour."

If the University does not take this opportunity to lead on this issue, it may find itself 'caught on the back foot' and at risk of being dragged forward on this issue. This could lead to reputational damage as the issue continues to grow but the University takes no action. Already a number of significant investors including the Norwegian Sovereign Wealth Fund and the insurance conglomerate Axa have committed to divesting from fossil fuels. The number of UK Universities committed to divest from some fossil fuels has reached six and continues to grow.

This issue presents the University the chance to demonstrate its commitment to sustainability by taking proactive leadership of the situation. By divesting in fossil fuels, the University will send a strong moral signal to society that the activities of these fossil fuel companies are unacceptable and that the status quo is both unsustainable and immoral. It will further raise the profile of the issues of climate change and environmental sustainability, and support the efforts of scientists across the globe whose research has been attacked for political purposes.

By divesting fully from fossil fuel companies, the University can make a positive impact upon society at large.

Recommended actions

The continued holding of University investments in fossil fuel companies is unsustainable and unacceptable. Continued engagement with these companies is unlikely to yield any significant changes to their policies. Therefore, we call upon the University of Manchester to take the following actions:

- The University of Manchester should commit to fully divest from fossil fuel companies by 2020.
- The University should take an active role in encouraging and lobbying other universities in the UK to make similar moves to liquidate assets held in fossil fuel companies in a similar timescale.
- The University of Manchester must lobby government and policy makers to enforce further sanctions on polluting firms to curb their environmental degradation in the current parliament (2015-20).
- The University of Manchester must look to more rigorously enforce its Social Responsibility Environmental Sustainability Agenda in its investment portfolio.

Appendix A: Fossil Fuel's unethical practices

Fossil Free Manchester has found evidence of a number of violations to the University's Socially Responsible Investment policy. Evidence has been found of:

- Disregard for the environment
- Climate denial and propagation
- Resistance to energy transition
- Anti-environmental lobbying
- Negative impacts on indigenous peoples

A scientific background to climate change is available in Appendix C of this report. However, the following case studies provide evidence of the above violations:

Royal Dutch Shell

- In the Niger Delta, Shell has a long history of environmental and human rights abuses. In 2012 alone, 198 oil spills took place at Shell facilities in Nigeria, releasing 26,000 barrels of oil.¹ A U.N. report in 2011 determined that cleaning up mangroves contaminated by Shell would take 30 years and cost at least \$1 billion.² Shell is currently in numerous legal disputes as a result of this activity, notably paying out \$80 million in January this year for two spills in 2008 and 2009. In Nigeria, Shell has flouted the Federal High Court of Nigeria's ruling that continued flaring of gas in Nigerian communities is a gross violation of right to life.³
- Since 2005, Shell has refused to comply with the court order to end gas flaring in the Iwherekan community in Nigeria. Shell is also avoiding payment of \$1.5 billion in compensation to the Delta's Ijaw ethnic group for decades of pollution.⁴ It has been estimated that in 2005 flaring of gas amounted to 2.5 billion cubic feet, or 40% of all of Africa's annual gas consumption in 2001, daily. This is estimated to cost the Nigerian economy \$2.5 billion annually and is clearly a waste.⁵
- In subtle ways, fossil fuel companies have sought to influence public debate around climate science as a means of slowing progress. Shell became a principal sponsor of the "Atmosphere, Exploring Climate Science" gallery and the "Climate Changing" programme at the Science Museum in London and expressed concerns at the information presented to visitors. The company discussed with the museum, having issue with one part of the project that "creates an opportunity for NGOs to talk about some of the issues that concern them around Shell's operations". The company also sought to make a particular symposium at the

¹ <http://www.reuters.com/article/2013/01/30/us-shell-nigeria-lawsuit-idUSBRE90S16X20130130> , <http://www.wsj.com/articles/shell-to-pay-80-million-compensation-for-2008-oil-spills-in-nigeria-1420617029>).

² United Nations Environment Programme, *Environmental Assessment of Ogoniland*.

³ <http://www1.chr.up.ac.za/index.php/browse-by-subject/418-nigeria-gbemre-v-shell-petroleum-development-company-nigeria-limited-and-others-2005-ahr1r-151-nghc-2005.html>

⁴ Ukala, "Gas Flaring in Nigeria's Niger Delta: Failed Promises and Reviving Community Voices".

⁵ http://www.foe.co.uk/sites/default/files/downloads/gas_flaring_nigeria.pdf

museum “invite only” – as that would ensure “we do not proactively open up a debate on the topic [of Shell’s operations]”.⁶

- The company recently started exploring oil and gas exploration in Alaska. There has been widespread outcry from local indigenous peoples. There is particular concern over food stocks as the company’s plans are at direct odds with whaling that has taken place for centuries.⁷

Tullow Oil

- In 2010, Wikileaks released cables that appeared to show that Tullow executives had briefed the then US Ambassador to Uganda Jerry Lanier that the company had given bribes to government officials.⁸ A Ugandan MP also presented documents to parliament which accused Tullow of making payments to Uganda’s Minister of Foreign Affairs and Interior Minister.⁹ It was also heard at the High Court that Tullow Oil executives considered paying a bribe to the President of Uganda to help settle a tax dispute against a rival firm. Senior directors at Tullow Oil allegedly discussed making an 'undocumented' \$50m (£33.4m) payment to the Ugandan government and considered funding parts of the re-election campaign of President Museveni¹⁰.
- Tullow Oil consistently explores for and drills oil in highly politically unstable parts of Central Africa and South Asia. Tullow holds oil rights in the Democratic Republic of the Congo, which continues to be in turmoil after years of resource-driven civil war. The region holds 1.4 million internally displaced people, whilst it is the border area which has witnessed some of the fiercest fighting between rival armies and militias¹¹. DRC and Uganda officially ended warfare in 2003 after a decade of conflict involving eight African nations and leaving an estimated four million people dead. Both the Ugandan and Congolese armies were deployed heavily around Lake Albert following the discovery of oil beneath the lake, whilst renewed fighting and militia attacks around the lake was sparked during late summer and autumn of 2007. The discovery of oil within an area of contested land has only exacerbated conflict.

British Petroleum

- In October 2009, BP paid the largest fine in OSHA history, \$87.43 million, for wilful negligence that led to the deaths of 15 workers in a March 2005 refinery explosion in Texas and an additional \$50 million paid to the Department of Justice for the same incident. And just last month, BP paid a \$3 million fine to OSHA for 42 wilful safety violations at one of its refineries in Ohio¹².

⁶ <http://www.api.org/globalitems/globalheaderpages/membership/api-member-companies>

⁷ <http://www.theguardian.com/environment/ng-interactive/2015/jun/16/drilling-oil-gas-arctic-alaska>

⁸ http://www.observer.ug/index.php?option=com_content&view=article&id=11376:wikileaks-throws-ugandas-oil-search-into-more-turmoil&catid=38:business&Itemid=68

⁹ <https://itsapoliticalworld.wordpress.com/2012/11/03/irish-aid-tullow-oil-and-uganda/>

¹⁰ http://courtnesuk.co.uk/online_archive/?name=tullow+oil&sa=Search#results

¹¹ <https://peopleandplanet.org/ditchdirtydevelopment/tulloil>

¹² <http://www.energyvox.org/2010/04/29/the-oil-spill-bps-485-million-in-fines/>

- In 2015, 25,000 Mexican fishermen filed a lawsuit over the environmental disaster caused by BP in the Gulf of Mexico, 2010. The Deepwater Horizon oil spill was the largest in U.S. history and saw nearly 200 million gallons of oil spill into the ocean between April and September of that year. The oil rig explosion killed 11 people and injured 17 others. So far this has incurred fines of \$40bn for BP with an additional \$16bn expected due to the Clean Water Act. Even though the gushing was capped in 2010, oil is still washing up on shores and is expected to cause long term damage to the people and wildlife that live there.¹³
- Despite BP acknowledging climate change was happening first of any fossil fuel company in 1997, it continued to fund the American Legislative Exchange Council (ALEC) until March 2015. This front group was designed to confront the prevailing scientific views on warming, actively opposed ratification of the Kyoto Protocol (including running TV ads against it) and attempted to discredit the IPCC and its reports by attacking climate scientists.¹⁴

Rio Tinto

- The company was recently the subject of significant protests against its environmental record. It was reported: “Among the many bad offenders of workers’ rights in the mining industry, Rio Tinto has been picked out for its anti-worker arrogance, as well as its damage to local communities and the environment”.¹⁵

Glencore Xstrata PLC

- As a recent addition to the ‘world’s worst corporation’ shortlist, Glencore has been cited as one of the worst corporate abusers of human rights. In a recent incident three people were killed and 100 wounded when police tried to stop a protest near a mine¹⁶. In 2012, the organisation was accused of child labour abuses and dumping acid in the Congo. This was said to hurt indigenous peoples greatly.¹⁷

Fossil Fuel firm practices and their effects

The practices outlined in the above case studies are a serious cause for concern. It is clear that by investing in these companies the university is:

- Funding groups which distort the process of impartial scientific inquiry.
- Investing in companies which pressure government to adopt policies with negative social consequences. This often means companies try to ‘have it both ways’ on energy policy.
- Supporting fossil fuel firms that conduct operations in areas of special scientific interest with no regard for any long term environmental impacts.

¹³ <http://www.telesurvtv.net/english/news/25000-Mexican-Fishermen-Sue-BP-over-Environmental-Disaster-20150501-0018.html>, <https://www.dosomething.org/facts/11-facts-about-bp-oil-spill>

¹⁴ <http://www.api.org/globalitems/globalheaderpages/membership/api-member-companies>

¹⁵ <http://www.theguardian.com/business/2015/apr/16/bp-and-rio-tinto-face-protests-over-environmental-record>

¹⁶ <http://newint.org/features/web-exclusive/2013/12/04/glencore-xstrata-worst-corporation-award/>

¹⁷ <http://www.theguardian.com/business/2012/apr/14/glencore-child-labour-acid-dumping-row>

Recent high profile academics to speak out in favour of divestment include former Government Chief Scientific Advisor, Lord May. He states: “if a sufficient number of organisations move away from investments in fossil fuels such action may help achieve the goals we have set but are not approaching as strongly as we should”.

Appendix B: Investment arrangements

Endowment fund

As of April 2014, the University of Manchester owns nearly 850,000 shares in the fossil fuel and mining companies BG Group, BP, Shell, Tullow Oil, Glencore Xstrata and Rio Tinto. These total more than £9.5m of our approximately £165m endowment fund.

The breakdown of these shares is as follows:

Company	Number of shares held	Price of share (GBP, at 30/04/14 close)	Total investment (GBP)
BG Group	107,314	11.98	1,285,621.72
BP PLC	191,729	4.992	957,111.168
Royal Dutch Shell PLC	117,612	25.2	2,963,822.4
Tullow Oil PLC	86,929	8.8	764,975.2
Glencore Xstrata PLC	257,907	3.185	821,433.795
Rio Tinto	84,846	32.245	2,735,859.27
Total	846,337		9,528,823.553

Source: Freedom of Information (FOI) requests, all historic share prices according to the London Stock Exchange

Figure 7 shows the proportional investment (by total value of investment) in each of the six companies. The vast majority of our investment is in Royal Dutch Shell PLC and Rio Tinto which totals around 60%.

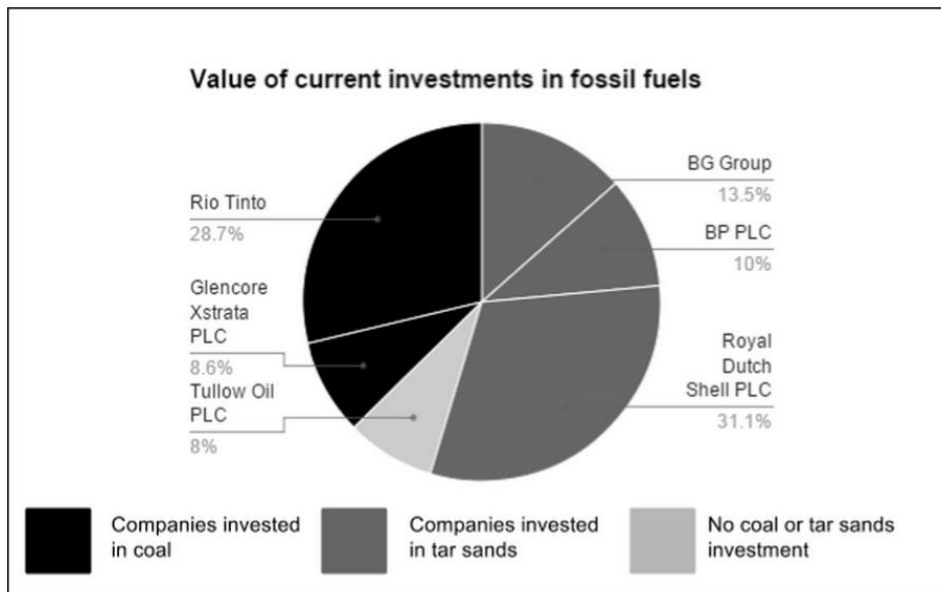


Figure 1: Percentages of investment in six fossil fuel companies. The chart shows five of the six are invested in either coal or tar sands.

Technical Issues and Financial Costs

Investments in the university's portfolio cannot be liquidated and then reinvested overnight from one company to another. All holdings of the university, whether fossil fuel related or not, are subject to a number of transaction costs if they are to be changed, altered or removed in any way. Equally, new investments are often subject to transaction costs which must be factored in to any divestment programme.¹⁸

The liquidation of holdings also means investments need redistributing. Obviously this needs to be a considered decision which makes both financial and ethical sense. As noted by Ansar et al:

Those that commit to divestment should consider re-directing investment to renewable energy alternatives that can trigger 'disruptive innovation' and substitute fossil fuels as a primary source of energy supply¹⁹

Hence, a redistribution of assets to renewable energy companies can certainly have a positive impact. Investments could be moved to support energy companies with more positive ethical records. It would also allow the organisation to maintain a diverse investment portfolio.

Divestment vs. Engagement

Divestment is a more drastic step compared to the more moderate option of verbal engagement with fossil fuel companies. Institutions considering liquidating assets may choose to consult the companies in question. This can help influence top-level management and make changes to corporate decision-making at an earlier stage. However, engagement with firms often produces

¹⁸ <http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/SAP-divestment-report-final.pdf>

¹⁹ *Ibid* 17

limited results and does not yield results at a fast enough pace. Engagement also has minimal effect in the long-run and does not change market norms in the same way divestment can.

Given the relatively small number of fossil fuel investments at the University, a divestment option would yield greater results overall with both significant direct and indirect benefits. Directly, divestment produces uncertainty about future cash flows of fossil fuel companies and permanently affects market norms and investor behaviour. Indirectly, campaigners may “*force the hand*” of policy makers and those in government to become more restrictive on the most polluting firms with new legislation²⁰. Divestment campaigns stigmatise fossil fuel companies and may affect long term income and performance of the target firms.

As the largest single-site higher education institution in the country, the University of Manchester should play a leading role in the divestment movement: stimulating debate, affecting markets, influencing policy makers, accelerating the transition to a low-carbon economy and encouraging similar organisations to follow suit. Divestment is a novel, high-profile and powerful method to make changes to fossil fuel investment. The University is highly influential both nationally and globally and should seize upon the opportunity to become the first and largest English university to liquidate its assets in fossil fuels. It must be seen as a responsible steward.

APPENDIX C

1. The science of climate change

1.1 The greenhouse effect

The ‘greenhouse effect’ is a naturally occurring phenomenon whereby certain gases, known as greenhouse gases (GHGs), trap heat, making the Earth around 33°C warmer than it would be in their absence. These gases absorb infrared radiation reflected from the earth’s surface and emit it in a random direction. The concentration of GHGs in the atmosphere will determine whether too much heat escapes (low GHG concentration), resulting in global cooling; whether just enough heat is trapped (equilibrium GHG concentration), resulting in relative temperature stability or whether too much heat is trapped (high GHG concentration), leading to global warming.

1.2 Human influence on the greenhouse effect

Humankind has altered the concentration of GHGs in the atmosphere by activities such as agriculture and the burning of fossil fuels. For example, the concentration of carbon dioxide has increased by more than 40% since 1750 (indicated by the light blue section of the graph below).

²⁰ *Ibid* 17

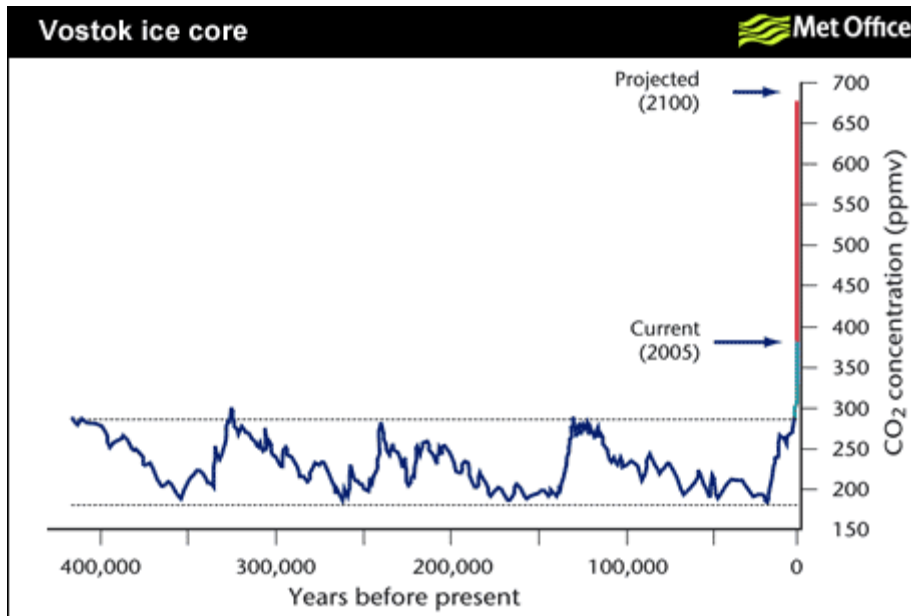


Figure 2: Concentrations of CO₂ in the Vostok ice cores over 400,000 years show a drastic increase in the last few hundred years as a result of the industrial revolution. Source: UK Met Office

Figure 1 shows the sharp rise in CO₂ concentration in the Vostok ice core in the last few hundred years and shows the projected concentrations for the year 2100 if this trend continues.

In addition to carbon dioxide, the concentration of methane (a more potent GHG than carbon dioxide) has increased by 150% since 1750. These levels are, according to the Intergovernmental Panel on Climate Change (IPCC):

“unprecedented in at least the last 800,000 years”.

These changes in concentration have increased the strength of the greenhouse effect. The IPCC states that:

“It is unequivocal that anthropogenic increases in the well-mixed greenhouse gases (WMGHGs) have substantially enhanced the greenhouse effect, and the resulting forcing continues to increase.”

In the above quote, “forcing” refers to the extra energy which is being added to the Earth due to the stronger greenhouse effect.

1.3 Feedback loops and tipping points

There is a risk that an initially small amount of warming caused by man-made greenhouse gas emissions may be considerably amplified by triggering a positive feedback loop, whereby the amount of energy the planet absorbs is greater than that which it emits. For example, large amounts of methane could be released from melting permafrost and warming ocean beds. Since methane is a far stronger greenhouse gas than carbon dioxide, this would exacerbate climate change. The consequences could be extremely serious and irreversible. It is known that sudden methane releases have been implicated in previous abrupt shifts in the Earth’s climate. Reports

suggest that methane plumes are already being released from the Arctic as depicted in the image below:



Figure 3: Ecologists ignite methane being released from a frozen lake in Alaska. Image source: Invalid source specified..

Although the IPCC acknowledges the risk of feedback loops, the models it uses to predict the effects of climate change do not account for them because of the large uncertainties involved. It is therefore difficult to predict where these tipping points lie but the more we increase GHG concentration in the atmosphere, the closer they approach.

However, there are far more immediate dangers of climate change of which there is an ever increasing body of evidence. The imperatives for action on climate change are not based on speculative tipping points of the future but on real environmental, social and economic imbalances of the present.

1.4 Current observed impacts of climate change

Rising global temperature

Many impacts of climate change have already been observed today. For example, average global surface temperatures have risen by 0.85°C between the years 1880 and 2012. However, air temperatures represent only a tiny fraction of the energy accumulated in the climate system because the majority of extra heat (90%) has actually been stored in the ocean..

Global and continental temperature change

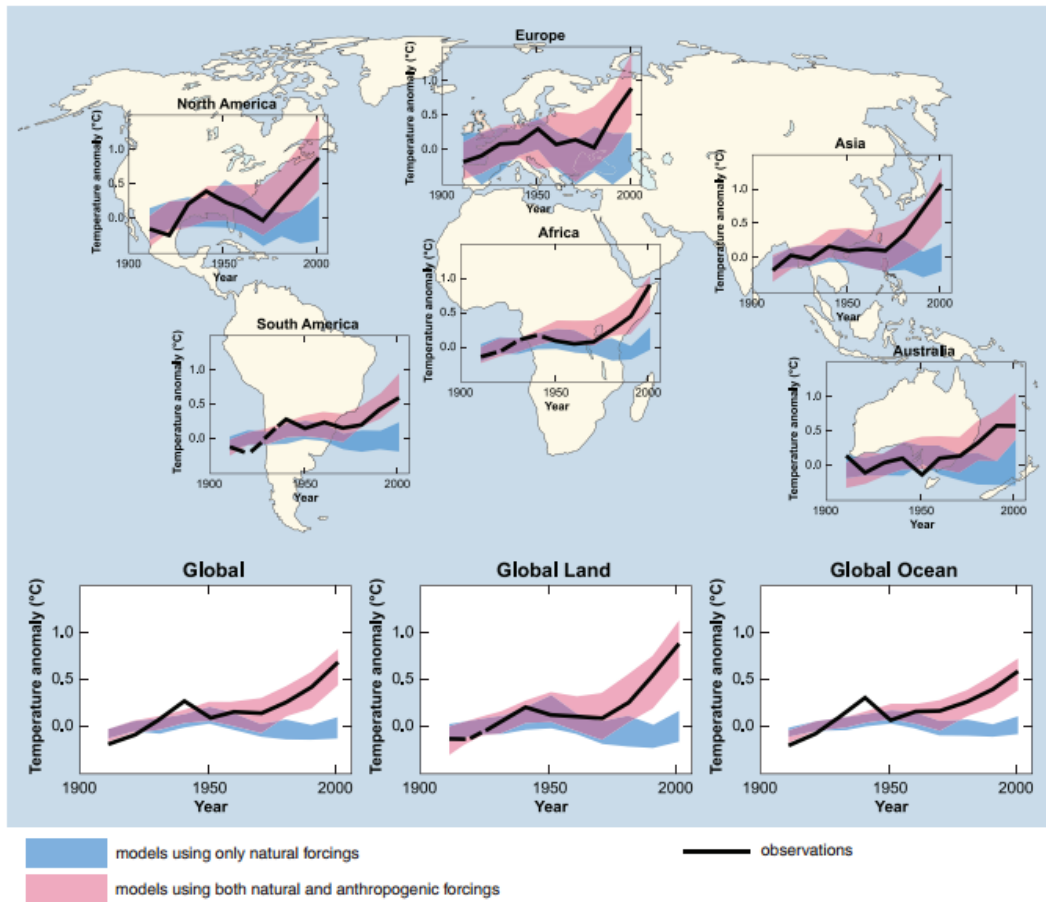


Figure 4: Global and continental temperature change. Source: IPCC 4th Assessment Report, Synthesis Report, p. 40.

Melting glaciers and rising sea levels

As a result of these rises in temperature, glaciers around the world have become significantly depleted. For example, those in the European Alps have lost 30–40% of their surface area and approximately half their volume since the mid-1800s. An additional loss of 10–20% of their remaining volume since 1980 has been reported alongside significant decreases in Arctic sea ice in a similar time period.

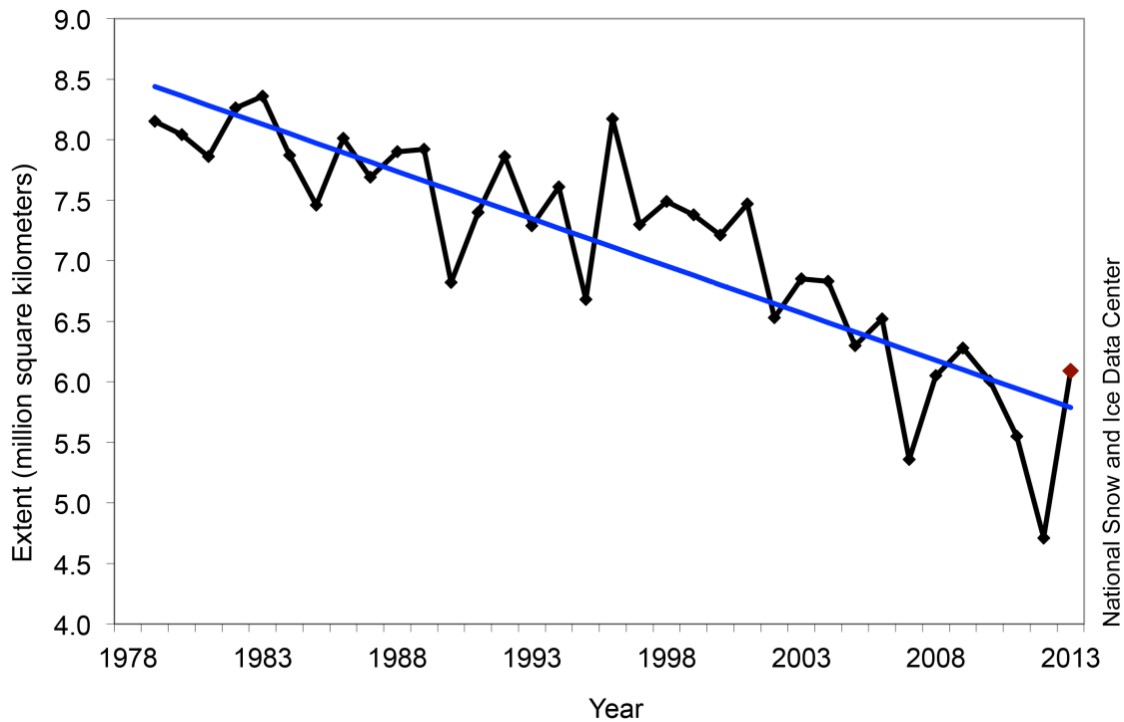


Figure 5: Average monthly (August) arctic sea ice extent for 1979 to 2013 shows a decline of 10.6% per decade. Source: U.S. National Snow and Ice Data Centre.

Meanwhile, global sea levels have risen by 10-25cm over the last 100 years whilst sea water has become 26% more acidic since the start of the industrial era. This acidification has had a range of harmful effects on wildlife and ecosystems including bleaching coral reefs, stunting the formation of shells and skeletons in various marine animals and destabilising food chains leading to reduced biodiversity and potential species extinctions.

Species Extinctions

A recent study led by Stanford, Princeton and Berkeley University reports that the Earth is entering its sixth mass extinction phase, as evidenced by the current rates of vertebrate extinctions being 114 times higher than normal. By analysing fossil records it showed that more than 400 vertebrate species had disappeared since 1900. Such a loss would normally occur over a period of 10,000 years with climate change, pollution and deforestation being cited as the main causes.

Professor Paul Ehrlich of Stanford University said:

"There are examples of species all over the world that are essentially the walking dead... We are sawing off the limb that we are sitting on."

Given the knock-on effects associated with damage to ecosystems, there are concerns that benefits from things such as pollination from bees could be lost within three human generations. The International Union for Conservation of Nature (IUCN) says at least 50 animals are becoming threatened by extinction each year.

Despite the conservative approach taken in attributing these findings to specifically human activity, the report states that:

“Our analysis emphasizes that our global society has started to destroy species of other organisms at an accelerating rate, initiating a mass extinction episode unparalleled for 65 million years.”

It also stressed that rapid alleviations on “habitat loss, exploitation for economic gain and climate change” are necessary to prevent a true mass extinction from happening. “However,” say the scientists, “the window of opportunity is rapidly closing.”

Extreme weather

In recent years there have been many examples of record-breaking extreme weather events. In 2010, Russia saw temperatures reach 40°C – a record high – with 2007 providing three record highs for the months in which they occurred. 18 other countries joined Russia in breaking temperature records in 2010 spanning Africa, South America, Asia and Europe. In 2011 eastern parts of the US and Canada experienced the ‘Groundhog Day Blizzard’ which saw unprecedented levels of snow fall and caused widespread closures of important transport links.²¹

Flooding has been a prominent feature of increasingly extreme weather systems. PreventionWeb analysed the number of flood disasters between 1980 and 2008 and has shown a steady increase.

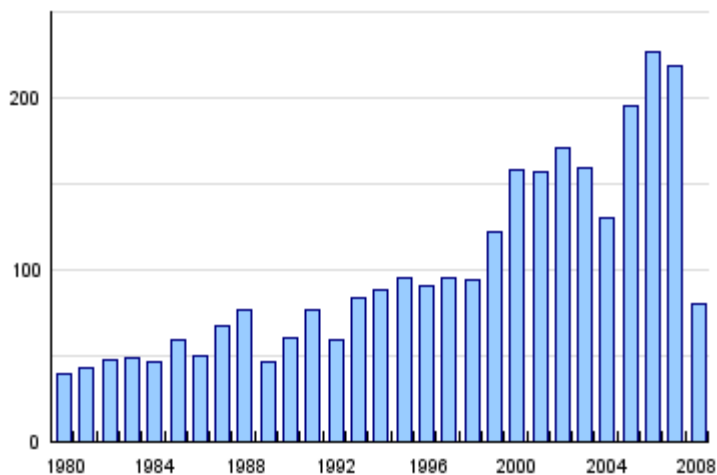


Figure 6: Increased levels of flooding across the world since 1980 are evidence of weather systems becoming more extreme.²²

They found that over this time period, flooding has affected nearly 3 billion people worldwide and has killed almost 200,000.

A paper published in Nature Climate Change reported that 18% of current extreme precipitation sequences can be directly attributed to anthropogenic global warming with non-linearly increases expected if warming continues to increase.

²¹ <http://www.newscientist.com/special/worse-climate> .

²² <http://www.preventionweb.net/english/hazards/statistics/?hid=62>

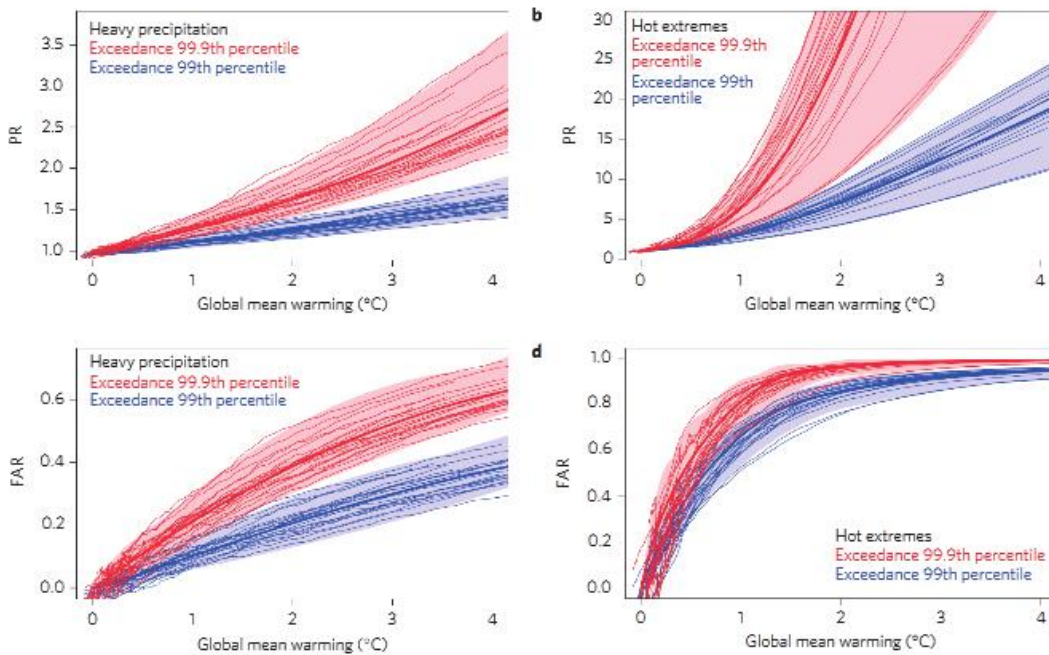


Figure 7: Rapidly increasing global fraction of attributable risk of extremes over land. a,b, Probability ratio of exceeding the (blue) 99th and (red) 99.9th percentile of pre-industrial daily precipitation (**a**) and temperature (**b**) at a given warming level relative to pre-industrial conditions averaged across land. **c,d,** Fraction of attributable risk averaged across land for given levels of global warming and selected percentiles for precipitation (**c**) and temperature (**d**).

Extreme weather affects every aspect of human activity but does not affect every individual equally. In the globalised world in which we live, however, extreme weather in one continent can mean grave instability in another.

Food production

Though rising temperatures associated with climate change may be expected to benefit global food production, the extreme weather that it has brought about has, in fact, significantly harmed it. The New Scientist magazine reported that in 2012, despite record harvests being predicted in the US, droughts and record breaking heat meant that yields fell. In the UK, there was a similar drop in yields but as a result of too much rainfall.²³

The Mekong River Delta in Vietnam, which produces almost half of the country's rice, is suffering year on year as a result of increased water salinity and flooding. It is a low lying region which is requiring greater irrigation in order to retain yields. In addition to flooding, climate change is already showing signs of shifting weather patterns which may delay planting and harvesting and disrupt the continuity of food supply around the world.²⁴

²³ <http://www.newscientist.com/special/worse-climate>

²⁴ <http://www.climatehotmap.org/global-warming-effects/food.html>

1.5 Predicted future impacts

The predicted future impacts of climate change are wide-ranging and cover environmental, social and economic concerns. The IPCC summarised the future impacts as follows:

“Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.”

Examples of the likely impacts include reductions of surface water availability, widespread species extinction and damage to ecosystems, food supply instability due to lower agricultural and fishery yields, destruction of coast lines and reduced inhabitable landmass, increases in human ill-health and proliferation of diseases, negative effects on poverty reduction efforts and increased displacement of people as a result of exposure to extreme weather events. It should be noted that there is evidence that many of these issues are occurring already.

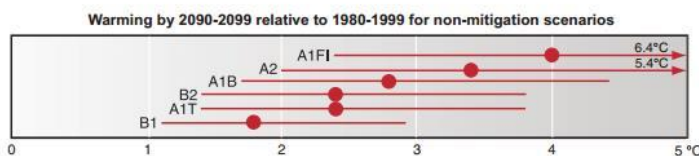
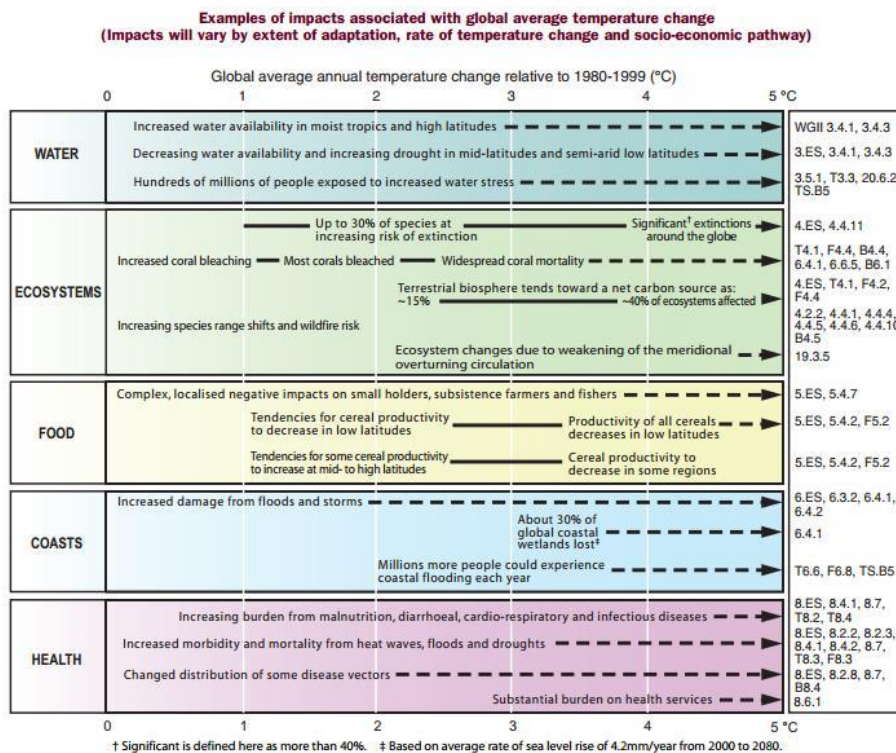


Figure 8: Examples of impacts associated with global average temperature change. Source: IPCC 4th Assessment Report, Synthesis Report, p. 51

This current evidence of environmental degradation is just a snapshot of what will be the case if there is continued emission of such large volumes of greenhouse gases. These environmental

concerns are already and will continue to become directly human concerns which will affect the global population.

Unless action is taken urgently, future progress in human development will be threatened. A 2009 report by the Global Humanitarian Forum concluded that: —every year climate change leaves over 300,000 people dead, 325 million people seriously affected, and economic losses of US\$125 billion.

The threat that climate change poses to future economic stability cannot be ignored. The reparative financial costs that the above issues would incur will far outweigh the costs of averting them in the first place. A report from the German Institute of Economic research said that if active climate protection policy (which would include emissions trading, ecological taxes, clean energy development mechanisms and others) is introduced today then future damages can be significantly reduced. According to the report, future equivalent global costs of implementing such a policy now would be \$3tr USD in 2100 compared to \$20tr USD in damages that would be incurred in the absence of the policy. The report also expressed the economic dangers of delaying action saying that \$12tr USD worth of damages could be saved by 2100 if policy is introduced now compared with introducing it in 2025. This figure amounts to 5% of the projected global GDP for that year (5.5).

More evidence for the economic risks of climate inaction can be found in the Financial Argument section of this report.

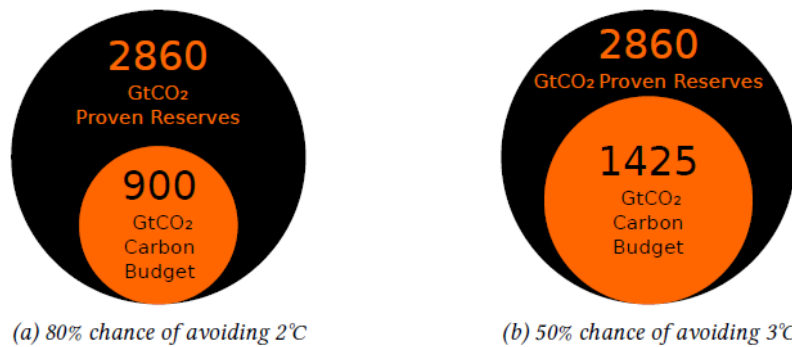
2. The carbon budget

There is a limit to the amount of fossil fuels that can be burned without causing global warming to reach dangerous levels. It has been agreed by governments around the world, including that of the United Kingdom, that a 2°C rise in average global temperature is considered 'dangerous'. The Copenhagen Accord, of which the world leaders present at the United Nations Climate Change Conference in Copenhagen in 2009 pledged their support, outlined the importance of this commitment. Some scientists have suggested that even a 2°C rise could result in harmful effects and that an target of 1-1.5°C would be far more responsible.

Due to uncertainties in modelling the climate response, temperature rises must be addressed in terms of risk levels rather than absolute limits. For example:

1. In order to have an 80% chance of avoiding a 2°C rise, no more than 900 gigatonnes of carbon dioxide can be released to the atmosphere.
2. Burning all proven fossil fuel reserves would release 2860 gigatonnes of carbon dioxide.
3. Hence, to have an 80% chance of avoiding 2°C, 69% of proven fossil fuel reserves must remain in the ground.

The figures depend on the level of risk that society is prepared to take, but the conclusion remains the same: a large fraction of fossil fuel reserves cannot be burnt.



Comparisons of proven and burnable fossil fuel reserves for period to 2050:

(a) Over two-thirds of proven reserves are unburnable under the 2°C-80% budget.

(b) Even under a more reckless 3°C-50% budget half of proven reserves are unburnable.

Figure 9: The fraction of fossil fuel reserves that can be burned depends on the level of risk society is prepared to accept for the planet. Note that the illustrated scenarios are for temperature rises deemed unacceptably dangerous for some scientists.

These stark figures raise the question of why fossil fuel companies are still investing in the exploration of yet more reserves. More alarmingly however, they reveal the fact that the value of fossil fuel shares (which are based on the assumption that all reserves will be burnt) is erroneously high.

3. UK Government Action

The consensus in the scientific community of the risks of anthropogenic climate change has long since been accepted in the political sphere internationally. The UK government have made a series of legislative changes mandating the continued reduction of GHG emissions on the advice of the Committee on Climate Change (CCC) – an independent statutory body set up under the Climate Change Act 2008.

The first report submitted by the CCC in 2008 advised the UK Government to set a target of an 80% reduction of 1990 levels of GHG emissions by 2050. Such a target would not only significantly reduce the UK's contributions to global warming, but would also demonstrate strong political leadership which will influence the decisions made by the international community thereafter. The CCC report emphasises the responsibility that industrially advanced and wealthy nations have in this effort as they are in the best financial and technological positions to develop the means to reduce climate change.

In addition to the target set for 2050, an interim target of a 34% reduction of emissions from 1990 levels is legally required by 2020 according to the April 2009 budget. It can be said, so far, that the UK has performed well when it comes to meeting its targets. It has already surpassed those set by the Kyoto Protocol of a 12.5% reduction by the year 2012. However, this result is largely due to reductions in other GHG emissions such as methane and nitrous oxide with these totalling approximately 60% of overall reductions. Within the same timeframe, reductions of CO₂ (by far the biggest contributor to UK GHG emissions) were comparatively small at just 21%. Increased efficiencies in the industrial sector as well as the rise of renewable energy production are significant

contributors to these reductions. However, future reductions from efficiency increases are limited and are ever harder to achieve. Renewable energy contributions however, show no sign of plateauing – quite the reverse in fact with a 430% increase in capacity between 2003 and 2013 in the UK alone.

In order to meet the interim target by 2020, greater reductions in GHG emissions are required. This means continued investment into renewables, increasing energy efficiencies where possible and reducing the reliance on fossil fuels for energy supply. The trajectory for the UK is clear for the short-term and the long-term and is one that is overseeing the rapid growth in the renewables market and the impending decline in the fossil fuels market.

4. The Price of Inaction

For many years, scientists have been expressing concerns regarding inaction when it comes to climate change. At the World Conference on the Changing Atmosphere held in Toronto in 1988, one scientist advised governments to cut emissions by 20% below 1988 levels by 2005.

“If we choose to take on this challenge it appears that we can slow the rate of change substantially, giving us time to develop mechanisms so that the cost to society and the damage to ecosystems can be minimized. We could alternatively close our eyes, hope for the best, and pay the cost when the bill comes due”.

In fact, over this time period, global carbon emissions increased by 30% with predictions of a peak not arriving until 2020.

As far back as 1965, President Lyndon B. Johnson was given a report by his Science Advisory Committee warning that,

“Through his worldwide industrial civilization, Man is unwittingly conducting a vast geophysical experiment...The climatic changes that may be produced by the increased CO₂ content could be deleterious from the point of view of human beings”.

Later, in 1998, the director of NASA’s Goddard Institute for Space Studies, James Hansen testified at a congressional hearing, and helped to introduce the concept of global warming to a larger public audience. He told them he had “99% confidence” in “a real warming trend” linked to human activity and to The New York Times he added that it’s “time to stop waffling about the science.

More recently, the University of Manchester’s Professor of Energy and Climate Change, Kevin Anderson, has produced persuasive documents regarding the technological and economic challenges that climate change sets us. In publications such as *‘Climate Change: Going Beyond Dangerous... Brutal Numbers and Tenuous Hope’*, he points out that the chances of staying within the safe temperature levels are quickly diminishing. His colleague, Alice Bows-Larkin, an atmospheric physicist and climate change mitigation expert at the Tyndall Centre, agrees with Anderson that we have lost a lot of time to political stalling and weak climate policies – all while emissions have continued to increase.

Expressing frustration with the conflict between the rational prioritisation of climate change mitigation and the irrational, short-term efforts to leave things as they are, Anderson and Bows-Larkin call for society to,

“liberate the science from the economics, finance and astrology, stand by the conclusions however uncomfortable . . . we need to have the audacity to think differently and conceive of alternative futures.”

The undeniable evidence of the link between the burning of fossil fuels and global warming has been the impetus for many governments, businesses, and institutions to aid the shifting of the energy paradigm. Many creative endeavours have resulted in rapidly improving renewable technologies, improved energy storage, smart metering, higher efficiency industrial processes and many others. Every day, new developments are surfacing and the movement to mitigate climate change is growing ever stronger.

The prevalence of fossil fuels in modern day society and the wealth accrued by companies who supply them have given rise to relatively reliable investment opportunities for many organisations and individuals for decades. However, the combined effects of growing governmental pressure, improving renewable energy technologies and increasing costs of fossil fuel extraction mean that the value of shares in these companies will inevitably decline. The uncertainty in when this decline might happen is a cause for investor concern.

Continued investment into these companies exposes shareholders to the risks of the carbon bubble, defers potential funds for renewable companies and other industries but, most importantly, it totally undermines the efforts and revelations of academics and industry experts the world over. That any academic institution would invest in such a flagrant repudiation of its own philosophy is, at best, irrational and, at worst, unforgivable.