Chapter 1
Introduction
A new fossil fuel crisis

In which the growing climate crisis is traced mainly to the mining of coal, oil and gas; the dangers to survival and livelihood are outlined; the political nature and implications of the problem explored; and reasonable and unreasonable solutions sketched.

We've all heard about climate change. But is it really something we need to be worried about?

Yes. The climatic stability that humans have grown used to over the last few centuries may be ending sooner than we think. The results are likely to include intensified droughts and floods, changed weather patterns, agricultural breakdown, ecosystem disruption, rising sea levels, epidemics, and social breakdowns that ultimately threaten the lives or livelihoods of hundreds of millions of people.

What's the cause?

Like many other social problems, climate change is closely tied to the burning of oil, coal and gas. Fossil carbon is being taken out of the ground, run through combustion chambers, and transferred to a more active and rapidly circulating carbon pool in the air, oceans, vegetation and soil. Some of this active carbon builds up in the atmosphere in the form of carbon dioxide, trapping more of the sun's heat, warming the earth and destabilising the climate. The carbon build-up – up to 90 per cent of which has come from the North – has been made worse, especially over the last century, by unchecked land clearance and the spread of industrial agriculture.[1]

The difficulty is that fossil carbon is a lot easier to burn than it is to make. It took millions of years for plants to extract the carbon from the atmosphere that makes up today's coal, oil and gas deposits. It's taking only a few centuries to burn it. Today, the world combusts 400 years' worth of this accumulated, compressed biological matter every year,[2] three to four times more than in 1950. This carbon will not be able to lock itself safely up underground again as coal, oil or gas for many, many millennia.

Aren't there any other ways that the earth can reabsorb this carbon?

Yes, but they take even longer. The weathering of silicate rocks – aided by water and the activity of plants – removes some carbon dioxide from the atmosphere. Carbonates accumulating on the sea floor through weathering, runoff or the accumulation of carbon in the shells of living organisms are eventually pushed under continental plates at ocean edges, finding their way to the atmosphere again in volcanic activity. This process, taking millions of years, isn't going to solve the current crisis.

So the carbon that comes out of the ground stays out of the ground.

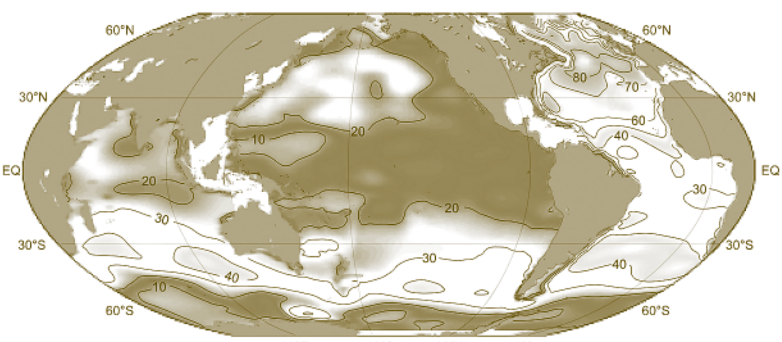
For a very long time. And once it makes its way to the surface in big enough quantities, there's no way of stopping it from building up in the atmosphere. Before the industrial revolution began there were only around 580 billion tonnes of carbon in the atmosphere. Today the figure is closer to 750 billion tonnes – the highest in hundreds of thousands of years.

Why can't trees absorb enough carbon dioxide to keep it out of the air?

Trees can absorb some of it. So can the world's oceans, grass, soil and fresh water. But they can't absorb enough of it, fast enough, to keep it from accumulating in the atmosphere. Nor can they hold onto it for very long. Once above ground, carbon constantly flows back and forth among vegetation, water, soils and air.

The oceans, for instance, can take up just so much of the new carbon pouring up from underground. They have already absorbed a third of their ultimate potential, and the new carbon dioxide dissolving in them is turning them more acid.[3]

Figure 1. Human-caused CO_2 build-up in the oceans is concentrated in the North Atlantic.



Source: US National Oceanic and Atmospheric Administration.

Plants and soil are an even more limited receptacle for fossil carbon than the oceans. Their storage potential is far less than the carbon content of the coal, oil and gas still underground (see Table 1). Living and dead biomass hold on the order of 2,000 billion tonnes of carbon, while fossil fuel companies are still planning to transfer around twice as much fossil carbon to the surface. In addition, plants and soil can only hold onto carbon for a short while before releasing it again to the air, water or soil. Finally, how much carbon land vegetation will absorb or emit in the future is highly uncertain.[4]

Table 1. The Earth's Carbon Pools (billion tonnes)

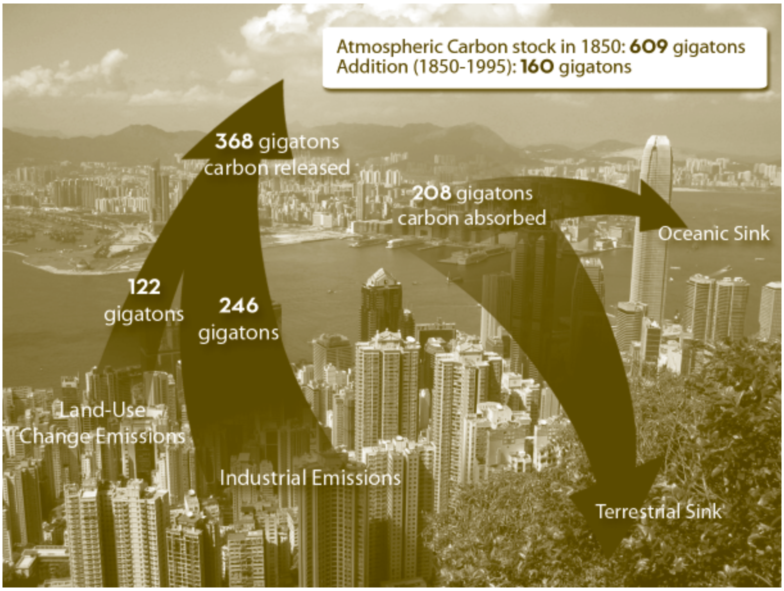
Atmosphere	720-760
Oceans	38,400-40,000
Rock (mainly underground)	75,000,000
Land biosphere	
living biomass	600-1,000
dead biomass	1,200
Fresh water	1-2
Fossil fuels	
coal	3,510
oil	230
gas	140
other	250
Annual transfer of fossil carbon to above ground carbon pools	7+

Sources: P. Falkowski et al., 'The Global Carbon Cycle: A Test of Our Knowledge of Earth as System', *Science* 290, 13 October 2000; US Energy Information Administration. Estimates of the amount of unmined fossil fuels are all highly controversial. Much higher estimates for oil (670 billion tonnes) and gas (503 billion tonnes) are given, for example, by Hans-Holger Rogner.[5] The US Geological Survey estimates about 360 billion tonnes of carbon to lie in 'recoverable' oil.[6]

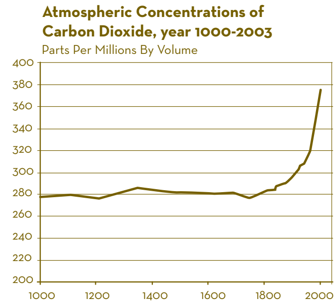
So the above-ground carbon pool in the oceans, vegetation and soil is like a bathtub with the drain plugged. As long as the tap stays on, the water just keeps overflowing.

Yes. Or to make what might be a slightly better comparison, you might look at the earth's above-ground carbon-cycling capacity, minus the atmosphere, as a dumping ground that has the ability to recycle a certain amount of the waste that is put into it, but no more. According to one estimate, between 1850 and 1995, a total of 368 billion tonnes of carbon were released globally into the atmosphere through human activities. Some 208 billion tonnes were absorbed into the oceans and into vegetation and soils, leaving an extra 160 billion tonnes in the atmosphere.[7]

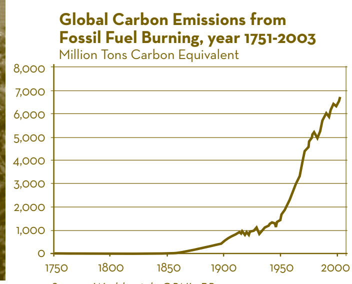
Figure 2. Atmospheric carbon



Source: World Resources Institute



Source: Scripps, ORNL, and IPCC



Source: Worldwatch, ORNL, BP

The current rate of accumulation in the atmosphere is over 1.6 extra billion tonnes of carbon every year. And on current trends, many times more fossil carbon will be added to the atmosphere over this century than has been added since the industrial era began.

What would have to be done to stop the overflow?

Well, there's already far more carbon dioxide in the atmosphere than there has been at any other time in the last half million years – 380 parts per million, as compared to pre-industrial levels of 280 parts per million.[8] So a lot of damage has already been done.

According to the Intergovernmental Panel on Climate Change (IPCC) in 1990, in order to stabilise atmospheric concentrations at a level less than double that of preindustrial times, greenhouse gas emissions would have to be reduced by 60–80 per cent.

So at present we're acting as if we have something like two and a half to five times the amount of carbon dump space than we really have.

Well, it's probably not possible to estimate with any certainty the earth's capacity to recycle transfers of fossil carbon with no remainder. But there's no question that the current rate of overflow is huge.

And this is definitely the main cause of climate change?

The United Nations' Intergovernmental Panel on Climate Change, perhaps the most prestigious body of climate scientists ever assembled, concludes that most of the observed warming of the last 50 years is likely to be due to the increase in greenhouse gas concentrations due to human activities.

But isn't there a lot of controversy about that?

Not much. The IPCC's judgement is now supported by the US's National Academy of Sciences, Brazil's Academia de Ciencias, China's Academy of Sciences, the UK's Royal Society, France's Académie des Sciences, Germany's Akademie der Naturforscher Leopoldina, India's National Science Academy, the Science Council of Japan, the Russian Academy of Sciences, Italy's Accademia Nazionale dei Lincei, the American Meteorological Society, the American Geophysical Union, Canada's Royal Society and the American Association for the Advancement of Science.[9] There's no dissent from it in any of 928 peer-reviewed scientific essays on global climate change published between 1993 and 2003.[10] And the few remaining contrary bits of evidence have been pretty much explained away over the last couple of years. For example, the oceans have warmed in a way that virtually rules out cyclic variations in solar energy as an explanation.[11]

OK, give me the bad news. What happens if the world's above-ground carbon dump goes on overflowing into the atmosphere?

At some point the buildup of carbon dioxide and other greenhouse gases in the atmosphere will change the climate catastrophically. As biologist Tim Flannery notes, 'There is so much carbon buried in the world's coal seams [alone] that, should it find its way back to the surface, it would make the planet hostile to life as we know it'.[12] Combustion of even a substantial fraction of remaining fossil fuels – even a few more hundred billion tonnes – could be disastrous.[13]

How bad is the situation now?

It's hard to tell what the ultimate effects will be, because the extra greenhouse gas already in the air will have long-term effects, not all of which are evident today. Global average temperatures have increased by only 0.7 degrees Centigrade since the mid-1800s. To be sure, some changes often attributed to global warming are already noticeable. For example, rainfall in mid- to high latitudes has increased, Arctic communities are increasingly threatened by coastal erosion and damaged hunting territories, Arctic sea ice and permafrost is dwindling, and stress is growing on plant and animal species ranging from polar bears to butterflies and boreal forest trees.[14] The proportion of the global population affected by weather-related disasters doubled between 1975 and 2001.[15] But such changes are nothing compared to what's on the way. In its Third Assessment report in 2001, the IPCC projected that, on current trends, the planet would warm up by between 1.4 and 5.8 degrees Centigrade by 2100. Many researchers now believe that the warming could be far more severe.[16] Whichever estimates are used, it is likely that by the end of the century the earth will be hotter than at any other time in the last two million years.

Two million years! Will human beings be ready for that?

Little will have prepared them for it. At that point, climatic conditions will probably be not only outside the historical experience of present-day humans, but outside their ancestors' physical and ecological experience as well.[17]

What are the changes that are expected?

Among the likely manifestations of climate change in this century will be:

- Less agricultural productivity, especially in hotter places.[18]
- More frequent heat waves and less frequent cold spells.
- Bigger storms, higher winds and more weather-related damage like that associated with Hurricane Katrina in 2005 and Hurricane Catarina in 2004, the first recorded hurricane in the South Atlantic.[19]
- More intense floods and, in mid-latitude continental interiors, droughts.
- Water crises associated with disappearing glaciers and snowpacks and other events.[20]
- Movement of farming to other regions, especially higher latitudes.
- Faster disease transmission and other health impacts.[21] The World Health Organization estimates that the warming and precipitation trends due to anthropogenic climate change of the past 30 years already claim over 150,000 lives annually.[22]
- Rising sea levels. Melting of the West Antarctic and Greenland ice sheets, once started, would likely become self-reinforcing (such ice masses could not form in today's climate).[23] Combined with the thermal expansion of the warmed oceans, this would ultimately cause a sea-level rise in excess of 10 metres, flooding coastal cities

and prime agricultural areas. Glaciers within the West Antarctic ice sheet are already starting to disappear, and collapse of the sheet within this century cannot be ruled out.[24]

- Species extinction and biodiversity loss.
- Increased numbers of environmental refugees.[25]

How fast is all this happening?

No one can be sure how quickly these problems will unfold, and how severe they will be. One thing scientists are increasingly concerned about is possible feedback reactions that could accelerate global warming. According to the IPCC, such effects are far more likely to make global warming worse than to mediate it.

'Humanity is performing a "great geophysical experiment", not in a laboratory, not in a computer, but on our own planet.'

Roger Revelle and Hans Suess, 1956

For example, melting of ice caps in the Arctic,[26] where the climate is changing faster than elsewhere, could lead to redoubled warming, as a highly reflective white surface gives way to a darker, more heat-absorptive ocean surface.[27] As temperatures rise, more carbon is also being lost from soils due to more rapid decomposition of organic material, creating another feedback effect.[28]

In August 2005, scientists reported that the world's largest expanse of frozen peat bog in western Siberia, spanning a million square kilometres, was undergoing 'unprecedented thawing' that could release into the atmosphere billions of tonnes of methane – a greenhouse gas 20 times more powerful in forcing global warming than carbon dioxide.[29] Some scientists fear that if the oceans are warmed beyond a certain degree, there may also be sudden, catastrophic releases of methane from methane hydrates on the sea floor previously kept quiescent through high pressures and low temperatures.[30]

The geological and ice-core record shows that climatic discontinuities caused by such phenomena have been rife in the past.[31] At times they may have driven up average global temperatures by as much as eight degrees Centigrade in the space of a human lifetime.[32]

Similarly, if dry seasons become long enough, a desiccated Amazon could burn, releasing huge biotic stores of carbon into the atmosphere all at once. If other forests followed suit, that could drive the temperature another two degrees Centigrade higher or more.[33]

Still other abrupt, nonlinear 'flips' of the climate to new equilibria are also possible. For instance, influxes of fresh water from melting ice around the North Atlantic, together with increased flow of Russian rivers into the Arctic Ocean, are capable of slowing or even stopping the 'thermohaline conveyor-belt' of the Gulf Stream. Already, a study

'Tipping Points' and 'Angry Beasts'

The climate doesn't always change gently and gradually. More and more climate scientists are pointing to the possibility that, due to global warming, the earth's climate could suddenly shift to a radically different – and radically less hospitable – state, as has often happened in the past (see main text).

Geophysicist Donald Perovich likens the climate system to a rowing boat that is rocked from side to side more and more violently, until it finally takes in water and suddenly capsizes. 'You can tip and then you'll just go back. You can tip it and just go back. And then you tip it and you get to the other stable state, which is upside down.'[36]

Veteran paleoclimatologist Wallace Broecker of Columbia University uses a different comparison: 'The earth's climate system has proven itself to be an angry beast. When nudged, it is capable of a violent response.'[37]

of ocean circulation in the North Atlantic has found a 30 per cent reduction in the warm currents that carry water north from the Gulf Stream.[34] A shutdown of the Stream would reduce the flow of Caribbean heat northwards, dropping European temperatures drastically while drying out the climate in regions such as Central and Western Asia.[35] When the current stopped about 12,700 years ago – possibly due to a sudden surge of fresh water into the North Atlantic triggered by the melting of glaciers that had dammed up an ancient lake in North America – it was for more than 1,000 years; another event lasting 100 years occurred about 8,200 years ago.

The climate, in other words, is likely to change in nonlinear and nonuniform ways. Yet even if it were possible to predict exactly how it might shift in every region, it would still be virtually impossible to track or estimate in advance the effects on living things and human societies with much confidence.

As ecosystems confront shock after shock, a raft of difficult-to-anticipate effects will radiate through communities of living things as fish, insects, microorganisms and trees shift their ranges or growth patterns or die off.[38]

The unpredictability can only increase as these shocks reverberate through social systems. Water, heating, transport, health care, insurance, legal and policing systems will all have to adapt to changes far outside their historical experience.[39]

Strange weather ahead: global warming will increase storm intensity.

Is climate change already irreversible?

It depends what you mean, and for whom. For many people, for example in some regions of the far north, it is not only irreversible but has already overturned the lives of, for example, hunters who rely on winter ice. For some bird species or coral species it is already too late. In other, broader senses, things can be turned around, even though at this stage they are bound to get worse before they get better, no matter what policies are adopted now.

If everything's so uncertain, why should we do anything? Wouldn't it be better to wait until we're sure what's going to happen?

There will always be uncertainty about the details and the timing. But what is certain is that the world is on course for severe shocks, that these will become more severe the more fossil carbon is transferred to the atmosphere, that they will threaten many millions of people, that there will continue to be surprises, and that these surprises will mostly be unpleasant.[40] That's enough to demand immediate action.

Give me the bottom line. If we don't do anything, what will climate change cost us?

Again, that's a question no one is likely to be able to find a sensible answer to. First, nobody has any idea how to calculate or estimate with any confidence the extent and effects of climate change.[41] Nor can anyone predict very well the future costs of technologies that have yet to be developed or deployed or social changes that are likely to have multiple effects.[42] Second, no one can reasonably assign a cost to improbable but irreversible or catastrophic events when what could trigger them is so poorly understood, and when discount rates are capable of making any future disaster ultimately inconsequential in money terms.[43] Third, those effects may nevertheless be so sweeping that they undermine many of the imagined constants on which cost estimates are based.[44] To take an extreme case, if there are no markets there will be no prices. Fourth, the civilizations and human life and livelihoods that are threatened by climate change are not generally held to be for sale. No one can imagine what markets they would be sold in if they were and what their price would be, and attempts to situate them in imaginary markets are endlessly disputed. The same is true of species extinction, health disasters that affect tens of millions of people, and many other of the possible effects of climate change.[45]

But if we can't assign a price to all the possible future damage, how can we know how serious the threat is? And how will we know what level of action will be appropriate?

As Ruth Greenspan Bell of Resources for the Future has pointed out, when a loved one has a potentially fatal disease, you don't perform a cost-benefit analysis when deciding what to do. Instead, you do what is within your power to help.

We can grasp how serious the threat of climate change is by looking at the trends, looking at the science, looking at the possible effects, and not pretending to possess a knowledge that we can't achieve. The situation is bad, but imagining we can quantify how bad it is interferes with clarity of thought and with good decision-making. Even worse is trying to compare some imaginary figure for future costs of climate change with imaginary numbers for, say, future economic gains or losses associated with a transition to a more sensible energy system.[46]

The climate system is not a statistical sample of champagne bottles.

The effects of possible changes in climate, however horrifying they are, are not, strictly speaking, 'risks'. Risks can be calculated and probabilities assigned to them, allowing them to become the subject of economic calculations. For example, life insurance companies, extrapolating from history, can compile actuarial tables that will tell them the likely lifespans of people fitting various descriptions. Or, to take the classic example of champagne production used in 1921 by Frank Knight, one of the seminal thinkers about risk: 'Since in the operations of any producer a practically constant and known proportion of the bottles burst, it does not especially matter…whether the proportion is large or small. The loss becomes a fixed cost in the industry and is passed on to the consumer, like the outlays for labor or materials.'[47]

Planning for climate change requires a different kind of thinking. The climate system is not a statistical sample of champagne bottles. Climatologists do not extrapolate statistically from past trends, as insurance companies and wine bottlers do, but construct simplified, future-focused computer circulation models that yield various different scenarios.[48] The probabilities of those outcomes that can be anticipated at all can be calculated only relative to some assortment of computer models. These models may or may not incorporate relevant factors,[49] and may or may not define the full range of possible future realities (see box on p. 16: Worlds inside Computers).

So industrialised societies aren't going to be able just to keep on what they're doing, calculate their chances, and take out a little more insurance?

No. Many of the likely outcomes of climate change are going to be uninsurable. Andrew Dlugolecki, an insurance specialist formerly with CGNU (now known as Aviva), the sixth largest insurance firm in the world, speculates that, as early as 2010, abrupt or chaotic climate change could force insurance companies to charge annual rates as high as 12 per cent of insured value, forcing most businesses and individuals to drop their coverage entirely.[55] Insurance losses because of extreme weather, Dlugolecki points out, are increasing by an annual 10 per cent while world economic growth is averaging 3 per cent a year: 'By 2065 the two growth graphs cross, the world economy can no longer sustain the losses, and collapse will follow.'[56]

It's often stressed that the South will suffer most from global warming. Southern countries are estimated to suffer 97 per cent of natural disaster-related deaths occurring each year, and also face much larger economic losses than Northern countries in terms of percentage of gross national product.[57] But it's important to realise that global warming will not spare industrialised societies, as the recent New Orleans disaster suggests.

Indeed, the locked-in dependence of industrialised societies and their militaries on an enormous fossil-oriented technological and institutional system of unparalleled inertia and inflexibility creates its own special global warming vulnerabilities. Michael Northrop of Rockefeller Brothers Fund and David Sassoon of Science First Communications note in a recent business publication that 'climate change is unlike any other "risk factor" that our modern financial system has ever confronted':

> It contains no reciprocal or alternative opportunity... Climate change renders [money managers] impotent. It's a risk that can't be managed around, and the only rational course of action is to minimise its impact.[58]

Worlds inside Computers

General Circulation Models (GCMs) are miniature, closed worlds created inside computers. Consisting of tens of thousands of lines of computer code, each GCM calculates how climate might change in a particular imaginary world over decades or centuries, given certain initial assumptions.

These models – there are dozens of them in use in various places – are based on solid principles of physics. Taken together, they give a feel for how climate might change in the real world. But their usefulness can't be checked by experiment in the ordinary sense, and there are things they cannot tell us.

First, GCMs are highly simplified when compared with the real climate system. Second, all of them are likely to have left out certain mechanisms influencing climate that are not yet known.[50] This difficulty is made more serious by the fact that many models share a common heritage. 'Typically, one modelling group "borrows" another group's model and modifies it, meaning that the "new" models may retain problematic elements of those from which they were created', replicating systematic errors.[51]

Third, the global data that models use have certain limitations – limitations exacerbated by the fact that many of the data are generated by the models themselves, to fill in blanks needed to run global simulations.[52] Fourth, models are characterised by various kinds of uncertainty. For instance, they are extremely sensitive to initial assumptions, meaning that different runs will yield hugely different results. No particular run of a model can be expected to reflect the real climate system, in which, also, small changes at one location and time can lead to large differences at other locations and times.[53] Climate modelling generates what one analyst calls 'mutated' facts full of theories, uncertainties and ambiguities – facts that have to be grasped 'as much with your imagination as with your calculator'.[54] That does not make them any less worthy of attention.

So if conventional types of economic management are out the window, what do we do?

A different kind of precaution is needed, one matched to the particular nature of the climate problem.

This kind of precaution would acknowledge and attempt to remove ignorance and uncertainty. It would try to maximise flexibility, resilience and possibilities for future learning. And in the meantime it would avoid irreversible courses of action that are potentially civilisation-threatening.[59]

Unavoidably, that means taking better care of the world's native biota, which constitute a large and volatile storehouse of carbon. But above all, it means slowing and halting fossil fuel extraction pending more research into gaps and blind spots.

'Humanity has become more and more vulnerable to long- and short-term climate change, as it has become ever more difficult and expensive for us to respond to it… The times require us to learn the vagaries of the global climate, to study its moods, and to keep our skies relatively free of excessive greenhouse gases with the same diligence, and for the same reasons, that Mesopotamian farmers five millennia ago had to learn the moods of the Euphrates and keep their irrigation canals reasonably free of silt.'[60]

Brian Fagan, 2004

What? You mean we have to stop mining coal and drilling for oil and gas?

More or less, yes. Remember the image of the above-ground carbon-cycling system – oceans, atmosphere, vegetation, soil – as a giant global waste dump with limited capacity. Then think of fossil fuel mining and burning as a giant factory that's ceaselessly pumping waste into this dump regardless. The only secure way of stopping the dump from overflowing is to reduce drastically, and ultimately stop, the flow into it – to make sure that most remaining fossil fuels stay in the ground.

That seems so extreme.

It's not. Even Sheikh Zaki Yamani, the former Saudi oil minister, has acknowledged that '[t]he Stone Age did not end for lack of stone, and the oil age will end long before the world runs out of oil.'[61] Most fossil fuels are going to have to be left in the ground, just as most of the world's stone is never going to be transformed into arrowheads or Stonehenges.

Continuing to take fossil carbon out of the ground and putting it in the above-ground dump is a one-way street, because it can't safely be put back. Stopping the flow into the dump, on the other hand, is both possible and prudent. Keeping fossil fuels in the ground – and encouraging any democratic movements that already have this objective – has to be the default, mainstream approach to tackling climate change.

How soon must the flow of fossil fuels from the ground to the surface be cut off, then? Immediately? As soon as possible? How soon is that?

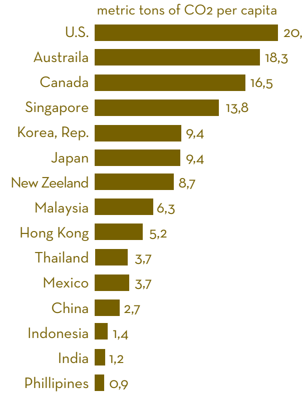
There is no single 'correct' answer to questions like that. But some work has already been done on the scale of actions needed to minimise future damage and keep options open.

In 2001, the IPCC estimated that restricting temperature rise to 1.5–3.9 degrees Centigrade would require CO_2 levels to be stabilised at 450 parts per million (ppm). That would imply cumulative carbon emissions of only 630–650 million tonnes between 1990 and 2100, compared to the 4,000 million tonnes or so that would result if all remaining accessible fossil fuels were exploited.[62]

In 2005, researcher Malte Meinshausen of the Swiss Federal Institute of Technology found that, on some models, a temperature rise of 2 degrees Centigrade or less – identified rather arbitrarily by many climate experts to be the highest 'safe' level of heating – was likely only if levels of greenhouse gases could be stabilised at 400 ppm of CO_2 equivalent, after peaking at 475 ppm.[63] That would entail a 50 per cent cut in emissions by 2050, with a peak emissions level of no more than 120 per cent of 1990 levels at around 2010. A rise of 2 degrees Centigrade or less could actually be guaranteed only if atmospheric concentrations stabilised at 350 ppm. That would imply even steeper cuts, since concentrations already stand at 380 ppm.

Quick action is crucial in order to avoid even more painfully drastic action later. Meinshausen warned that annual reduction rates would have to become 1 per cent steeper for every five years of delay. Delaying cuts by 10 years would nearly double the required reduction rate in 2025. Delaying for 20 years, according to researchers Steffen Kalbekken and Nathan Rive, would mean having to reduce emissions three to seven times faster.[64]

Per capita CO2 emissions 2002: North America and Asia/Pacific



Source: (CDIAC)

But how are these cuts going to be made? And who is going to make them?

These are the questions at the heart of the climate debate. And they are not just questions for experts. By revealing that the world's carbon dump is a very limited good, the science of global warming has revealed a problem that is just as much political as technical.

What do you mean?

The world's carbon-cycling capacity, partly because it's very limited, has also become extremely valuable. For that reason, everybody is going to be interested in getting rights to it (see box, below: The Birth of Atmospheric Rights). Pressures will grow to divide up the global carbon dump among the world's people.

> *'Delaying action for decades, or even just years, is not a serious option.'*
>
> Science, *9 January 2004*

Divide up how?

That's a crucial question, and one that has simmered underneath the surface of international negotiations about climate for many years.

What kind of rights should people or governments have to carbon dump space, given the need to maintain climatic stability for current and future generations? And who will get these rights? Do you divide up the dump space equally among the world's people? Do you give the world's worst-off disproportionate shares in the dump? Do you give the biggest shares to those who haven't yet had a chance to use much of the dump? Do you give the biggest shares to those who can least afford to cut down on their use of the dump? Do you give the most dump space to those who can use it to contribute the most to the global good? Or do you just give the most rights to the dump to those who are using it the most already? There are arguments for all of these ways of distributing the world's carbon-cycling capacity.

> *'If we are to avoid having to make dramatic and economically destructive decisions in the future, we must act soon.'*
>
> Foreign Affairs, *July/August 2004*

The Birth of Atmospheric Rights

Up to now, philosopher Peter Singer writes, it is as if the world's people have been living 'in a village in which everyone puts their wastes down a giant sink'. At first there is no problem:

'No one quite knows what happens to the wastes after they go down the sink, but since they disappear and have no adverse impact on anyone, no one worries about it. Some people consume a lot, and so have a lot of waste, while others, with more limited means, have barely any, but the capacity of the sinks to dispose of our wastes seems so limitless that no one worries about the difference.'[65] No matter how much of the sink one person may use, no problems arise, because there is always enough for everybody else.

But after a while,

'…the sink's capacity to carry away our wastes is used up to the full, and there is already some unpleasant seepage that seems to be the result of the sink's being used too much… When the weather is warm, it smells. A nearby water hole where our children swim now has algae blooms that make it unusable. Several respected figures in the village warn that unless usage of the sink is cut down, all the village water supplies will be polluted.'

Continuing to throw wastes down the sink, in other words, does not leave enough of it for everyone to use without harm to the community.

'What we might have assumed was our *de facto* right to use the sink any way we wanted comes into question. The sink belongs to us all in common. In order to avoid consequences no one wants, everyone who uses it must now accept some limits.' Atmospheric rights, Singer believes, must now be discussed, defined, limited and allocated.[66]

Whew. Sounds complicated.

It is. That's why the second and third chapters of this special report of *Development Dialogue* are reserved partly for a look at how this politics has developed.

OK, I'll wait for that. But right now can't you at least give me some idea of the political status quo? Who has been using the most dump space so far? Who is most responsible for the current climate crisis?

As mentioned at the beginning of this chapter, the North is overwhelmingly responsible. Andrew Simms of the New Economics Foundation perhaps sums up the situation best: 'Economic superpowers have been as successful today in their disproportionate occupation of the atmosphere with carbon emissions as they were in their military occupation of the terrestrial world in colonial times.'[67]

From 1950 to 1986, the US, with less than 5 per cent of the world's population, was responsible for 30 per cent of its cumulative greenhouse gas emissions. India, with 17 per cent of the world's population, was responsible for less than 2 per cent.[68] In 2000, the US was emitting 20.6 tonnes of carbon dioxide per person, Sweden 6.1, Uruguay 1.6 and Mozambique 0.1.

In fact, it's probably not too far off the mark to say that the US alone is currently using all of the 'available' global dumping space for greenhouse gases. To borrow Peter Singer's words, to continue to act in this way and yet to 'ensure community survival would be to deprive others of any use of it at all.'[69]

In short, industrialised societies are not only using more of the world's carbon dumping space than everybody else; they're also using several times more than is available for the use of all.

That's about the size of it. So any attempt to keep fossil fuels in the ground is going to have to tackle industrialised societies' addiction to fossil fuels and the energy-profligate ways of living they have made possible.

So the days of petrol-fuelled cars, coal-fired electricity generation, and oil-based air travel are limited.

These are all now 'sunset' technologies, to be phased out as soon as possible.

Not an easy challenge.

No, but not an impossible one, either.

Where do you start?

There are plenty of places to start, and many of them will be discussed in this special report. But the important thing to remember now is that in the struggle to stem the flow of fossil carbon out of the ground, no one is beginning from zero.

Most human experience and most human achievement has taken place in societies in which very little oil, gas or coal is used. It is the world's rich minority that has grown most dependent on fossil carbon; and only in relatively recent times. And even their addiction can be broken by social and technological innovations that only require powerful enough political movements to be set in motion.[70]

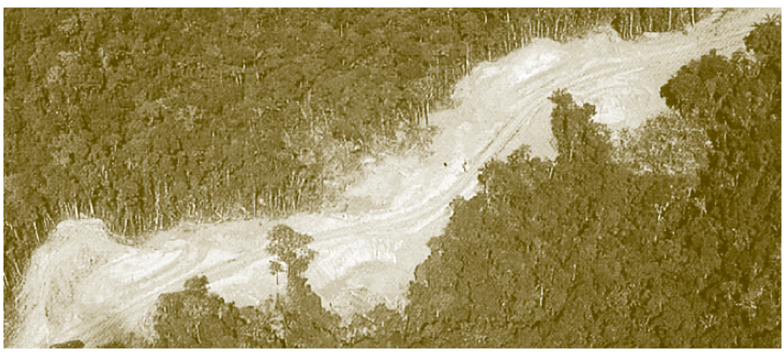
Nor is it only efficiency experts, community planners and developers of solar or wind energy that are providing the materials to enable greater independence from fossil fuels. Just as important are the many social movements with deep experience in resisting fossil fuel extraction or exploitation.

Global warming, after all, isn't the first fossil fuel crisis. Coal, oil and gas have been associated with environmental degradation, damaged lives, debt,[71] social conflict and war for a long time, resulting in sustained campaigns of opposition.

For decades, exploration for new oil and gas fields has gone hand in hand with encroachment on people's land and with preparations to dispossess them.

Extraction has also provoked creative resistance all over the world, as, from Ecuador to the Russian Far East, from Nigeria to Burma, fossil fuel corporations, usually backed by governments, have stolen or contaminated local land, forests and water while massively increasing the debt of countries they work in.[72]

Refining and transport have brought their own legacy of impairment, disease, dispossession and contamination. And pollution from industrial and power plants burning fossil fuels has left a mark of suffering, disease and conflict on affected communities for over 150 years.



Road built through forest in Ecuador to extract oil (top).

Oil spill in the Ecuadorean forest (bottom).

Not least, the militarised quest of industrialised societies for oil has endangered security, poisoned lives and blighted politics around the world. Today, wars costing countless numbers of lives and billions of dollars can be fought for the sake of a few months' or years' worth of oil, and face opposition movements worldwide.

The struggle to stabilise climate – to stop the world's above-ground carbon dump from overflowing – takes its place as one more aspect of this long history of conflict. And it brings out a lesson encoded in that history: the need to find ways of leaving coal, oil and gas in the ground.

That's not a lesson you often see discussed in the newspapers or on television.

No. In fact, most business and political leaders continue to act as if it's a foregone conclusion that all remaining oil, gas and even coal will have to be taken out of the ground, even as they proclaim the urgency of doing something about global warming (see box: Trying to Have It Both Ways).

Women from coastal communities in Songkhla, southern Thailand, protest against a gas pipeline and separation plant project that threatens local fisheries, common land and livelihoods.

Trying to Have It Both Ways: More Fossil Fuels, Less Climate Change

Most business and political leaders speak as if humanity could survive all remaining fossil fuels being taken out of the ground, yet also claim to be committed to action on climate change.

'There is no environment minister on Earth that will stop this oil from being produced,' said Canadian environment minister Stephane Dion in November 2005,[73] referring to a project to mine and process Albertan tar sands that will double Canada's CO_2 emissions in the course of making available billions of additional barrels of oil.[74] Less than two weeks later, Dion told the delegates to the international climate negotiations gathered in Montreal that 'climate change is the single most important environmental issue facing the world today':

'We know that the longer we wait, the larger will be the challenge and the damage from climate change…more action is required now [in pursuit of] our ultimate common objective of stabilising greenhouse gas concentrations.'[75]

Across the Atlantic, British Prime Minister Tony Blair bullied Members of Parliament into acquiescing in an expansion of Britain's aviation industry, the recipient of a GBP 9 billion annual subsidy in waived fuel taxes: 'Hands up around this table… how many politicians facing a potential election at some point in the not-too-distant future would vote to end cheap air travel?'

Blair, who then went on to ditch a policy to require housebuilders to improve the energy efficiency of homes,[76] and whose 'minimal' support for renewable energy has been 'deplored' even by a committee of the House of Lords,[77] had recently identified climate change as 'probably the single most important issue we face as a global community'[78] and emphasised that 'the time to act is now'.[79] Subsequently, he criticised the international climate change debate for a 'reluctance to face up to reality and the practical action needed to tackle problems'.[80] Blair's aviation policy means that his government's target of cutting carbon emissions by 60 per cent by 2050 could only be achieved if every bit of machinery other than aeroplanes and ships stopped producing any emissions at all.[81]

In the same year, the International Energy Agency (IEA), comprising the 26 main oil-consuming nations, recommended that the global oil industry invest USD 20.3 trillion in new facilities by 2030, to avoid higher oil prices. The IEA then went on to warn that unless the world takes action to reduce energy consumption, global greenhouse gas emissions will increase by 52 per cent by 2030. 'These projected trends lead to a future that is not sustainable… We must change these outcomes and get the planet onto a sustainable energy path,' said William C. Ramsay, the IEA's Deputy Executive Director.[82]

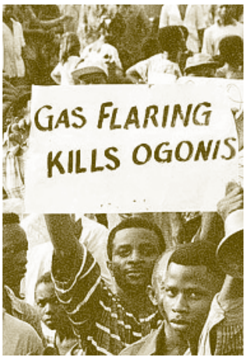
Oil companies such as BP and Shell meanwhile continually boast of increased, not decreased, efforts to find and exploit new sources of fossil fuels. 'My view is that hydrocarbons will be the bulk of the energy supply for the next 30 to 50 years,'[83] said John

Browne, chief executive of BP. Yet Browne, who oversaw a switch of BP's logo to a green and yellow starburst adorned with the slogan 'Beyond Petroleum', proclaims that 'global warming is real and needs to be addressed now'.[84] Ron Oxburgh, head of Shell, conceded in 2004 that climate change made him 'very worried for the planet'.[85]

In a 2005 publication, the World Business Council on Sustainable Development outlines key areas for future action on climate change, including efficiency, nuclear energy, government support for energy research and development, and technology transfer to the South. It neglects to mention any measures for phasing out fossil fuels before they are exhausted.[86]

Finally, the World Bank, which has consistently obeyed the 1981 demand of the US Treasury Department that it play a lead role in the 'expansion and diversification of global energy supplies to enhance security of supplies and reduce OPEC market power over oil prices',[87] scorned the August 2004 recommendation of its own review commission that it halt support for coal extraction projects immediately and phase out support for oil extraction projects by 2008.[88] The commission, chaired by former Indonesian environment minister Emil Salim, had pointed out that such extractive projects did nothing to promote the Bank's stated mission of alleviating global poverty.

From 1992 through late 2004, the World Bank Group approved USD 11 billion in financing for 128 fossil-fuel extraction projects in 45 countries – projects that will ultimately lead to more than 43 billion tonnes of carbon-dioxide emissions, a figure hundreds of times more than the emissions reductions that signatories to the Kyoto Protocol are required to make between 1990 and 2012. Another USD 17 billion has gone for other fossil fuel-related projects. In 2004-2005, the World Bank Group spent USD 7.6 billion in fossil fuel-intensive sectors (37 per-cent of its total lending for the year) with only marginal efforts to address the climate change implications.[89] More than 82 per cent of World Bank financing for oil extraction has gone to projects that export oil back to wealthy Northern countries. Bank financing for fossil fuels outpaces renewable energy financing by 17 to one.[90] Some of the biggest beneficiaries of Bank funding include Halliburton, the oil contractor, Shell, ChevronTexaco, Total, ExxonMobil, and other fossil fuel companies.[91] Yet in 2005, the Bank was assigned a key role in tackling climate change by the G8 group of economic powers. 'Let's work together for a climate-friendly future,' said Bank president, Paul Wolfowitz, one of the architects of the US war on Iraq.[92]



Gas flaring in Delta State, Nigeria (top) and protests (bottom).

They hope to solve the problem of the overflowing above-ground carbon dump not by cutting off the flow of fossil carbon from underground, but by carving out new dumps to put it in.

Solemnly, they propose parking carbon dioxide in holes in the ground, or liquefying it and injecting it into the bottom of the ocean. In all seriousness, they suggest putting the extra carbon in billions of extra trees specially grown for the purpose. Without any sense of absurdity, they advocate 'compensating' for the extraction of remaining fossil fuels by making extra efforts to 'save' them or use them more efficiently; or by cutting down on the use of other greenhouse gases like hydrofluorocarbons or nitrous oxide; or by building more windmills than had been originally planned; or by burning off the methane that coal mining releases rather than just venting it into the atmosphere.

Political and business leaders then go on to propose a market for exchanging all of these supposedly 'equivalent' things for each other. This is a market, they assure the public, in which you will be able to 'pay' the environmental costs of continuing to drill oil by screwing in efficient light bulbs, or for the costs of opening a new coal mine by burning the methane that seeps up out of the same mine.

The message is clear. Industrialised societies can continue to use up fossil fuels until there are none left worth recovering. Subsidies for exploitation of fossil fuel deposits need not be reduced. Nor is there any need to get started right away on a just technological and cultural transition to a society that does not need coal, oil and gas.

The untenability of this attempt to escape from the climate crisis – and the way it extends those classic conflicts over exploration, extraction, refining, pollution, militarisation, debt and insecurity that have been a feature of society's relationship to coal, oil and gas for more than a century – will be the subject of much of the rest of this special report. The next chapter will sketch how carbon trading developed historically.

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