

Can the world economy survive without fossil fuels?

Larry Elliott, *Guardian*, 8th April, 2015

The final chapters of [The Bone Clocks](#), David Mitchell's 2014 novel, describe a future in which progress has gone into reverse. In 2043, the fossil fuel age is over: nuclear power stations are melting down, there is no access to the electricity grid and solar panels are so prized that they are looted. Catastrophic climate change has become a reality. Rising sea levels have caused floods on the New York City subway, killing thousands. Internet coverage is patchy, food and consumer goods are scarce, and life-saving drugs such as insulin are hard to come by. It is a dystopian vision that looks like a brutal, dangerous version of the past – one not at all like the future that was promised when the cold war ended with victory for the western capitalist model. If it comes to pass, it will be because, despite all the warnings, climate change has not been taken seriously enough.

Here is one such warning: “For generations, we have assumed that the efforts of mankind would leave the fundamental equilibrium of the world’s systems and atmosphere stable. But it is possible that with all these enormous changes – population, agricultural, use of fossil fuels – concentrated into such a short period of time, we have unwittingly begun a massive experiment with the system of this planet itself.” That was Margaret Thatcher, in a speech to Britain’s scientific elite in 1988. Thatcher was no climate change denier. She told the Royal Society that her government supported the idea of sustainable economic development, and concluded: “Stable prosperity can be achieved throughout the world, provided the environment is nurtured and safeguarded. Protecting this balance of nature is therefore one of the great challenges of the late 20th century.”

It was, though, just one speech at a time of great global upheaval: China was liberalising its economy; apartheid was in its death throes in South Africa; above all, the cold war was coming to an end with defeat for the Soviet Union. “We know what works,” US president George HW Bush said at the time. “Free markets work.” The market model spread quickly to parts of the world that previously it could not touch: to China, where the reforms begun by Deng Xiaoping were accelerated; to India, where the idea that the world’s biggest democracy could go it alone was abandoned; to the Soviet Union and its former satellites, which received a strong dose of economic shock treatment. Within five years, the reach of the market economy had been extended to an additional 3 billion people.

Some places remained off limits. Cuba, subject to a US economic embargo, was one such country. After decades of relying on Moscow for oil, chemical fertilisers, pesticides and a large chunk of its food, Fidel Castro’s government faced a crisis. The economy shrank and strict food rationing was imposed. There was an acute shortage of fuel for tractors. Calorie intake fell by a third. The Cuban government responded by creating urban farms: agriculture went local, small scale and – by necessity – organic. Food production became less oil-intensive, as every possible scrap of land was exploited. If the denouement of Mitchell’s novel presents one frightening future, Cuba provides another sketch of what could be in store if the transition from a fossil fuel world to one running on renewable energy does not go according to plan – less apocalyptic than *The Bone Clocks*, but with considerable drawbacks. The grow-your-own drive has only been partially successful: a quarter of a century later, food is still rationed in Cuba.

Most of the world has gone in a different direction. In the west, there was a long economic boom that lasted from the early 1990s through to the financial crash of 2007. Growth rates in the developed world, however, were dwarfed by those in some of the bigger emerging economies. After the crash, when the developed world was struggling to emerge from the deepest slump since the Great Depression, it was China and India that acted as the engines of growth. In terms of reducing the number of people living below the global poverty line of \$1.25 (84p) a day, the post-cold war model of capitalism has been a success. Fewer people go hungry. More have access to healthcare and education. The size of the global middle class has increased, and consumers in Shanghai and Mumbai have been able to afford cars and fridge-freezers.

Growth based on fossil fuels has had some benefits. Before, incomes had barely risen in the 1,300 years between the sacking of Rome and the mid-18th century

But this process has had two unattractive side effects. The first is that the balance of power in the workplace has tilted decisively in favour of capital over labour: with an abundance of cheap workers to choose from, employers can be mean with pay. The second is that the triumph of the market has put pressure on the planet, just as Thatcher suspected it might. As the west outsourced its manufacturing to low-cost centres in Asia, energy demand in China, India and Indonesia rocketed. Globalisation means that people in the developing world know how we live in the west and they want some of what we have. In addition to higher consumer spending, that also means higher demand for energy, the bulk of which comes from fossil fuels. China currently builds a new coal-fired power station every two weeks. Burning fossil fuels puts carbon into the atmosphere, and the overwhelming view of scientists is that this leads to a buildup of greenhouse gases that results in global warming. To have a realistic prospect of preventing global temperatures from rising by more than the previously recognised danger threshold of 2C, scientists say it is not possible to burn all the proven fossil fuel reserves owned by companies and governments. Between [two-thirds and four-fifths](#) will need to be left in the ground.

The question, therefore, is whether it is possible to marry two seemingly contradictory objectives. Can we imagine a future that is cleaner, greener and sustainable – one that avoids climate armageddon – without abandoning the idea of growth and, thus, forcing living standards into decline? The answer is that it will be hellishly difficult, but it is just about feasible if we make the right choices – and start making them now.

Slowly, those in power are beginning to understand what is at stake: that if we carry on growing the global economy at its current rate, and continue to rely on fossil fuels to power that growth, the planet is going to cook. Not everybody buys into this narrative, of course. One of the challenges faced by those who wish to curtail fossil fuel use is that there is no political consensus on tackling climate change. The business-as-usual camp says that the scientific consensus is wrong about climate change, or that climate scientists have exaggerated the risks, which can be tackled if and when they become apparent. But Barack Obama does not think that way, and nor does China's president, Xi Jinping, which is why they signed a deal in November 2014 setting targets for CO2 emissions up to 2030. Mark Carney, the governor of the Bank of England, does not believe it either, which is why he went public at the 2014 annual meeting of the World Bank with his view that the ["vast majority of fossil fuel reserves are unburnable"](#) if we wish to keep the increase in global temperatures below 2C.

With the world barely recovered from one global recession, policymakers are now concerned about another. The talk at meetings of the International Monetary Fund and the G20 is whether the next financial crash will be caused by [the pricking of the carbon bubble](#) – the idea that the stock-market valuation of fossil fuel companies has been inflated by overestimating the worth of reserves of oil, coal and gas that could only be exploited by putting the climate at risk. In the unlikely event that investors all pulled out of fossil fuels at once, the result would be much worse than what followed the collapse of Lehman Brothers in September 2008 – a colossal stock market crash, followed by an equally epic slump. The Bank of England is sufficiently concerned to have [launched an investigation](#) into the risks of this happening.

The odds are still against such a financial market meltdown. In part, that is because investors will probably move slowly. In part, it is because the reserves of the big western fossil fuel companies make up only a small chunk of the global total, and it is hard to see Vladimir Putin being too troubled by a divestment campaign. But the risk is now out there – and growing – because policymakers have now woken up to the risks of climate change. “There have been two terrible realisations,” says Michael Jacobs, who used to advise Gordon Brown on the issue. “We have started too late, and it doesn’t matter how much solar and wind power there is – you are still burning all the coal, oil and gas. Even if you do so more slowly, it will still go into the atmosphere and cause climate change.” Jacobs adds that, in the past quarter of a century, when countries could have been putting in place the infrastructure for a new green economy, they have been going in the opposite direction. They have invested in fossil fuel-burning power plants and built energy-inefficient buildings in cities designed for cars.

Carney believes climate change is the medium-term issue of our age, but talks about the “tragedy of horizons”. By this he means that central banks and finance ministers are set up to deal with short-term problems, such as whether inflation will hit its target in two or three years’ time, or whether another housing bubble can be prevented before the end of the decade. Governments are thinking about climate change, but they have other more immediate priorities: reducing unemployment, increasing living standards and, in the case of politicians rather than the technocrats running central banks, getting re-elected. To some in the environmental movement – the “deep greens” – it seems pointless to expect politicians to do anything meaningful about climate change: they are obsessed with growth for its own sake, bend the knee to fossil fuel companies when they demand tax breaks and subsidies, and remain reluctant to back the potential of renewables. In order to avoid ecological suicide, in their view, we must first recognise that capitalism is an insuperable obstacle to any reduction in our fossil fuel consumption. All of this may be true, but it leaves unanswered the question of how we get from where we are now to the kind of world the deep greens want to see.

Governments must start to take seriously one of the greatest market failures in history: the failure to take account of the damage caused by burning fossil fuels

Let us begin with one basic idea: 250 years of growth based on the exploitation of fossil fuels has brought real benefits. There are those who might argue otherwise, but life in the world before the industrial revolution really was nasty, brutish and short. Life expectancy was 40 at best, the working week was long, disease was rife and diets were poor. Life for the vast bulk of the population was strictly no-frills, as it had been for more than a millennium. The current coalition government in the UK has come under attack for allowing the

economy to flatline for a couple of years, but incomes per head barely rose in the 1,300 years between the sacking of Rome and the mid-18th century. The acceleration of growth and big increases in living standards only really began with the industrial revolution; they would not have happened without the exploitation of fossil fuels. Over the years, the idea that all growth is good became embedded. Parents expected their children to be better off than they were. Businesses that did not expand were viewed as failures. One four-letter word underpinned economics: more. And this, notwithstanding the corporate sustainability reports and the greenwashing, remains the case for even the most right-on companies. Unilever wants to sell more soap and deodorant. John Lewis commissions expensive ads to encourage us all to spend more at Christmas. Here at the Guardian, we want to sell more newspapers, and more ads to companies selling their own goods and services to readers. But the economics of more, together with a rapidly rising population, have created problems unforeseen at the time of James Watt's steam engine. At the end of the 18th century there were fewer than 1 billion people on the planet. Today there are more than 7 billion. The energy needs of a bigger and richer global population have risen sixfold in the past 50 years. Almost 90% of that energy is provided by fossil fuels – coal, gas and oil. Global temperatures have risen by almost 1C above pre-industrial levels, and the number of weather-related natural disasters has increased. Those who say manmade global warming isn't happening look more and more certain to end up on the wrong side of history – which will harshly judge our failure to act until the threat had become so obvious that we had no other options.

There are more climate change sceptics than we might like to think. But the problem goes much further than figures such as Tony Abbott, the prime minister of Australia, or Nigel Lawson, the former UK chancellor of the exchequer, or about every Republican running to be US president. That problem is us. Dieter Helm, professor of energy studies at Oxford University, says: "It's not clear we're very serious about climate change. We want other people to do stuff, we want to divest from companies – but what about us? We are ultimately the consumers of those carbon-based products, and when we elect politicians, what's worrying is that we're not prepared to say: 'Make us pay for the damage and the pollution we cause.'"

This is an uncomfortable thought. If climate change can simply be blamed on "the Man", on the evils of capitalism, or on a cabal of fossil fuel companies hell-bent on destroying the planet, then the solution is to take on the Man, replace capitalism with something kinder and gentler, and force the fossil fuel companies to shut down. But if the blame lies with "us", the answer is not quite so simple. Fossil fuels are used to make and power mobile phones, tablets and laptops. There is no evidence that we want fewer of them. Nor would there be much support for a return to the days before fridges, gas cookers, washing machines and vacuum cleaners. Smoking in a restaurant or bar is no longer socially acceptable; until the same applies to driving your son or daughter to school in a gas-guzzling 4x4, Helm is right: we are not very serious about climate change.

This is one of the reasons why the deep-green approach to climate change is fraught with difficulty. The fossil fuel companies are in business because we want the products that fossil fuels make and power. It is not just a question of supply, but also a question of demand, which is why many people now have more than one smartphone and lust after the Apple watch. Does this make us any happier? Well, according to Betsey Stevenson and Justin Wolfers, economists at the University of Michigan in the US, the evidence is that wellbeing rises with income, and that the satiation point has yet to be reached, even in the richest

countries. The experience of the past few years would appear to support the Stevenson-Wolfers argument: the theory that, above a certain level of prosperity, there is no link between happiness and income has yet to be tested in a period when living standards have been flatlining. But there is little evidence so far that the public is wildly keen on the idea that they are becoming worse off. The second problem with the deep-green approach is that even assuming rich people in the west could be persuaded to curb their consumption, it would not stop CO2 emissions from rising. That is because the real growth in energy demand from now on is going to come from the developing world.

Countries in sub-Saharan Africa are home to around 630 million people with no electricity. Apart from the impact on households, power shortages are holding back growth and job creation. Firms have to depend on costly generators, which makes goods more expensive. Outside of South Africa, coal is a small part of the power story. Africa is far greener than the UK, the US or Germany, largely because of hydroelectric power in countries such as Ethiopia. Its carbon footprint is tiny. Again leaving South Africa to one side, the average person in sub-Saharan Africa consumes the same amount of energy in a month as the average Briton does in a day, according to Kevin Watkins, director of the UK's Overseas Development Institute.

Without question, Africa's energy consumption is going to rise. It has abundant reserves of coal – the most damaging of the fossil fuels – and nations such as Angola and Nigeria are significant oil exporters. One option would be to skip fossil fuels entirely and move straight to renewables, especially solar energy, but Watkins says that this is too expensive for most countries to contemplate. "Achieving universal access and a tenfold increase in power generation will take huge domestic investments and a big international financing effort." So, there is a choice. The rest of the world can help poor African countries with the cost of developing renewable energy; the rest of the world can provide Africa with expensive carbon capture and storage for coal-fired power stations; or the rest of the world can do nothing and watch Africa's carbon footprint rise rapidly as it burns dirty fossil fuels. There is no status quo option.

India provides another example of the policy choices facing countries in the emerging world. Given the dreadful air quality in Delhi, the government led by Narendra Modi is well aware of the threat of climate change and has announced [ambitious plans to increase solar power](#). But it also wants to ensure that every Indian citizen has access to electricity, and believes that can only be achieved by expanding coal power at the same time as it is expanding solar power. Watkins believes western governments and environmental NGOs would be better off mobilising finance for a programme of carbon capture and storage in India than offering Modi advice about the perils of climate change.

The third difficulty with the anti-growth approach is that growth is part of the solution to climate change. Most growth is the result of innovation – the development of new products, new techniques and new ways of doing things that are an improvement on what went before. Since the middle of the 18th century, there have been successive waves of technical progress: coal and steam, railways and the internal combustion engine at the end of the 19th century; the mid-20th-century age of consumer durables and commercial air travel. The next wave looks like it will be dominated by digital technology, robotics, biotech, lighter materials and renewable energy.

[Nicholas Stern](#), who authored a 2006 report on the economics of climate change commissioned by then-chancellor Gordon Brown, says stopping growth misses the point. The possibilities opened up by this new wave of technology, he believes, provide hope that growth can be decarbonised over the decades to come. “To say that we have to stop growing – that we have to go backwards – I think is factually wrong, and also politically unlikely to be successful.” Even if the world called a halt to economic expansion now, he adds, carbon emissions would continue rising and the world would be looking at an increase in global temperatures of 3-4C. “We absolutely can have growth and protection of the climate at the same time, and in doing so we will construct a much better form of economic activity and growth in terms of clean air, less-congested cities and so on,” Stern says. “If we say the only way to handle this is to stop growing, we will be factually wrong, because if we stopped growing but didn’t break the relationship between activity and emissions, we wouldn’t be tackling climate change.”

In reality, only the deepest greens are opposed to all forms of growth. The Green party in the UK wants to grow the NHS and education; it wants a bigger budget for social care and a higher minimum wage. [Tim Jackson](#) of the University of Surrey, author of [Prosperity Without Growth](#), says we need fewer resource-intensive activities that damage the climate, but more of the services that improve the quality of people’s lives. Like Stern, he is not really talking about replacing the economics of “more” with the economics of “less”; he is suggesting replacing it with the economics of “better”.

There are only three ways of reducing our carbon footprint: reduce the amount each person consumes, reduce the number of people, or make each unit of growth less carbon-intensive. Those who want to cut consumption and restrict population growth have the same question to answer: unless you are prepared to use draconian methods, how do you do it? Historical evidence shows there is a link between income and population: as people become richer, they have fewer children. That is why Japan’s population is ageing and shrinking. So if reducing living standards is a political non-starter and repression is spurned as a way of controlling population growth, that leaves reducing the carbon-intensity of growth. “I think it’s extremely simplistic to be pro-growth or anti-growth”, says Helm. “What matters is the sort of growth we choose. Now the underlying driver of economic growth is technical change, and technical change is accelerating. We want technical change, for example, to build new solar technologies. Do the deep greens say, ‘Tell you what, we want to stop the boat now, we don’t want to bother with any more technical change, let’s go back to a more simple society, a more decentralised society, and one that has a smaller footprint on the planet?’ I think that’s totally naive.”

Even the light green approach is going to be tough, and might not work. The UN is hosting a conference in Paris in late 2015 that will seek commitments to reduce carbon emissions from all the countries attending. As things stand, the offers will fall a long way short of what the experts say is a level consistent with the 2C target – about 12bn tonnes a year short, according to Michael Jacobs. The fossil fuel company BP helpfully provided a ready reckoner in its latest Energy Outlook report for how 2bn tonnes of CO₂ emissions could be saved by 2035. It would involve the share of gas used in power generation rising from just over 20% to more than 35%; coal with carbon capture and storage rising from almost zero to just under 10%; renewables increasing from around 5% to just over 20%; and finally, nuclear power almost doubling from just under 10%. The same 2bn tonnes of CO₂ could be saved through substantial improvements in energy-efficiency over and above those already expected.

Oil, coal and gas currently account for 86% of primary energy, and BP is forecasting only a small decrease, to 81%, by 2035. That is incompatible with the climate change projections made by the [International Energy Agency](#), which thinks fossil fuels should make up no more than two-thirds of the energy mix. BP admits that, on its current projections, emissions will “remain well above the path recommended by scientists”. The IEA also [makes the point](#) that it is time the world got its act together. “Delaying action is a false economy: for every \$1 of investment in cleaner technology that is avoided in the power sector before 2020, an additional \$4.30 would need to be spent after 2020 to compensate for the increased emissions.” Fossil fuels are not going to disappear overnight, but the phasing-out process needs to start immediately, and that process could be hastened if governments used the opportunity provided by the recent halving of global oil prices to remove the [\\$1tn annual subsidies for fossil fuels](#).

It is easy to see why governments, especially those in poorer parts of the world, want to help citizens with their energy bills. But the collapsing cost of crude oil is the equivalent of a tax cut for energy consumers; governments could remove subsidies painlessly in the current climate. The IEA is right: further delay will be costly. Obama could do his bit by making climate change a mission for the US – similar to the way that John F Kennedy vowed to put a man on the moon in the early 1960s. The mission could be to phase out domestic use and export of coal by a fixed date, or to set a deadline for shifting 50% of US energy consumption to renewable sources. Washington could then invite other nations to sign on to the same commitment.

That message would be reinforced by putting a price on carbon. This could be achieved through a carbon tax, [or through a cap-and-trade scheme](#). Either way, it would suggest that governments had started to take seriously what Stern calls one of the greatest market failures in history: the failure to take account of the damage caused by burning fossil fuels. Once shareholders understand that governments are serious about climate change, they will start to look at their investment portfolios. New technologies, particularly those with first-mover advantage, tend to be profitable, and there will be incentives for pension funds and insurance companies to get their money out of the fossil fuel sector and into a sector that has massive growth potential.

On past form, governments will be slow to act. The lesson from the anti-apartheid and debt-relief campaigns is that divestment can be used to put pressure on governments. Politicians move when they know votes are at risk. There are not many votes to be won these days by promising to increase foreign aid, but taxpayers in the west have to realise that poor countries with copious reserves of fossil fuels are going to exploit them, and that one way of mitigating the impact is to transfer the latest technology. The exploitation of fossil fuels in the developing world is only going to be reduced if financial assistance is offered. The amount of money currently allocated by international bodies, such as the UN, for climate change adaptation and mitigation is less than \$1bn a year: it needs to be at least 10 times bigger. Unless it is, there will be little point in saying that someone in sub-Saharan Africa can get all the power he or she needs via a solar panel costing as little as \$200. After all, the average sub-Saharan African does not have \$200 to spare.

Success at the Paris conference would be easier if developing countries saw that the west was serious about providing help for climate change mitigation and adaptation. Jacobs says there is little prospect of countries hardening up their commitments between now and

December, but it would be progress if there were agreements to tackle particularly damaging forms of climate change, such as deforestation, and to cut emissions to zero in the second half of the century. But that does not mean that we can afford to wait until the second half of the century to make the transition to non-fossil-fuel energy. Building up the necessary infrastructure is going to be a long and expensive process, which should be encouraged through public procurement, tax incentives and a big increase in R&D budgets. The stone age did not end because of a shortage of stone. The fossil fuel age will end either when there are newer, better and cleaner ways of providing energy, or when it is too late to prevent irreparable damage to the planet.

Renewable technology is moving on apace. [Investment in clean energy is growing at a double-digit rate](#). That is the good news. The bad news is that renewables will still only meet around 20% of energy demand by 2035, even using optimistic assumptions about future growth rates. That is going to require some tough decisions and some compromises. Coal is by far the dirtiest of the fossil fuels; it needs to be phased out first, and rapidly. But there is going to be a lag, even on the most optimistic assumptions, before renewables can take the place of coal. “We’re seeing very rapid change”, says Nicholas Stern, “but we’re going to have to accelerate the arrival and installation and use of renewables, from hydroelectricity and wave power through to the various types of solar. We’re going to have to look more closely at carbon capture and storage, because that’s a way of using your fossil fuels without emitting. And we’re going to have a period when gas is substituted for coal.” Dieter Helm agrees. “It’s pretty obvious that we can’t both burn fossil fuels and limit the damage from climate change.

There are basically three steps toward getting out of fossil fuels. The first is to make people pay for the consequences of burning fossil fuels, and that’s a carbon tax. The second is the transitional bit: the only serious way in the next 15-20 years to bear down on coal is to switch from coal to gas. Gas is, of course, a fossil fuel, but it has half the emissions of coal, and we could make substantive cuts – as indeed the US has done – by making the switch. And then, further out, what we need are new technologies.”

So what will the world look like in 2043? The future sketched out in *The Bone Clocks* is only fiction. It does not have to be that way. We could be living through the green technological revolution, in which energy has been decarbonised. Atlanta and Barcelona have the same number of people and share the same per-capita incomes, but [Atlanta’s carbon emissions are 10 times those of Barcelona](#). We need more Barcelonas and fewer Atlantas, because that will encourage us to change the way we live: walking more, using public transport, sharing cars, cycling. All of this is important, because ultimately Helm is right. This is not just about carbon taxes. It is not just about R&D. It is not just about divestment. If we really want the fossil fuels to be left in the ground, it is about us.

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